MANED WOLF ACTION PLAN

Population and Habitat Viability Assessment PHVA

Editors

Rogério Cunha de Paula
Patrícia Medici
Ronaldo Gonçalves Morato

Chrysocyon brachyurus

2008

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Population and Habitat Viability Assessment

Ministério do Meio Ambiente
Carlos Minc

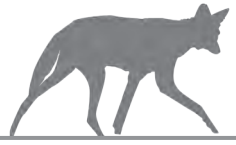
Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis
Roberto Messias Franco

Instituto Chico Mendes de Conservação da Biodiversidade
Rômulo José Fernandes Barreto Mello

Diretoria de Conservação da Biodiversidade
Marcelo Marcelino de Oliveira

Centro Nacional de Pesquisas para a Conservação de Predadores Naturais
Ronaldo Gonçalves Morato

Ministério do Meio Ambiente
Instituto Chico Mendes de Conservação da Biodiversidade
Centro Nacional de Pesquisas para a Conservação de
Predadores Naturais



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Editors
Rogério Cunha de Paula
Patrícia Medici
Ronaldo Gonçalves Morato

Edições Ibama
Coordination
Paulo Luna

Review
Maria José Teixeira
Vitória Rodrigues

Cover
Adriano Gambarini

Graphic Design and layout
Paulo Luna

Bibliographic standardization
Helionidia C. Oliveira

Typeset and Publishing
Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis
Centro Nacional de Informação, Tecnologias Ambientais e Editoração

Edições Ibama
SCEN Trecho 2, Bloco C - Subsolo, Edifício-sede do Ibama
70818-900 - Brasília, DF
Telefone (61) 3316 1065
E-mail:editora.sede@ibama.gov.br

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Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis

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Translation

Anders Gonçalves da Silva
Arnaud Desbiez
Cynthia Widmer
Joares May Junior
Lucía Corral Hurtado
Marcela Orozco

Summary

Foreword

The 'Maned Wolf Action Plan' is a product of the I International Workshop for the Maned Wolf Conservation – Population and Habitat Viability Assessment (PHVA), organized by the National Research Center for Predators Conservation (CENAP) in partnership with the International Union for Conservation of Nature (IUCN) through the Conservation and Breeding Specialist Group (CBSG) – Brazilian Network, and the institutional support of the Pro-Carnívoros Institute and Canid Specialist Group (IUCN/SSC/CSG)

The workshop happened at the Serra da Canastra National Park in October of 2005, has now been considered a mark for the conservation of the Brazilian megabiodiversity. The importance relies in the fact that this is the first document generated by a Research Center of the Chico Mendes Institute for the Biodiversity Conservation (ICMBio) and, overall because is an Action Plan for an endangered species with low information available in science.

This book provides excellence for Brazil for the assembling of specialists from several countries for the first time with objectives of defining shared strategies and proposing actions towards an endangered species conservation. The Brazilian responsibility grows proportional to its biodiversity and this fact necessarily implies on implementation of effective actions to avoid species losses. This action plan was elaborated to attend this urge while recognize the main threats to the maned wolf survivorship besides the identification of socio-economic linkage to its conservation. Additionally, the document presents unpublished information on population estimates (status and distribution) and effective proposals on management of individuals and their habitats.

In spite of not occurring exclusively in Brazil, it is in our territory that the Maned Wolf is widest distributed and it keeps the largest population. This fact itself stresses the importance of this document as a reference to the elaboration of viable and efficient public politics that ensure the direction of financial and human resources towards the species protection and habitat's preservation.

Certain that the information accounted in the Maned Wolf Action Plan will be useful for the maned wolf conservation both *in situ* and *ex situ*, this book is another step of the Brazilian leadership for the biodiversity conservation. I take the opportunity to acknowledge all the participants, partners, and sponsors for the effective collaboration on the global biodiversity conservation, a responsibility of all of us.

Rômulo José Fernandes Barreto Mello
President
Instituto Chico Mendes de Conservação da Biodiversidade

Introduction

The Maned wolf (*Chrysocyon brachyurus*) is the largest of the South American Canid species weighing between 20-30kg. It has long black legs, which give this species its unique appearance. With an elongated snout and large, erect ears, its head is very similar to that of the fox. The coat is long mainly at the neck and shoulders, forming a mane that may become erect. Its coat presents a reddish-golden color pattern, while the snout, inferior part of the legs, and the area from the nape to the back show a dark color (mostly black). Often, the anterior part of the neck, the interior of the ear and the tip of the tail may be light, even white. The species distribution ranges through Central and eastern South America including northern Uruguay and Argentina, south and central Brazil, eastern Bolivia, Paraguay, and southern Peru. Although this species presents a wide distribution area, it has been placed in the majorities of locals red lists of endangered species, and is listed as low risk/near threat at IUCN's 2004 Red List.

Although there is little information on different subjects of the species, there still is a lack of knowledge on Maned Wolves ecology on disturbed areas and even in protected sites. Most of the information is spread among researchers that conduct investigations on the species in each of its distribution range. Nowadays, unplanned cities growth, consequent habitat loss and fragmentation have resulted in an adaptation of many species in order to survive. This can alter the dispersion patterns, what can be harmful to a population or even to an entire community. Among the species that have been showing a certain tolerance to human influence, the Maned Wolf has been recorded as one of those in some regions, although showing behavioral and ecological alterations when in direct and constant contact with human population. The major threat to the Maned Wolf conservation is the drastic reduction of suitable habitats. This reaches the extreme when it is observed that a great portion of the species' distribution range had already been converted in farm and ranch lands.

The I Maned Wolf International Workshop - Population and Habitat Viability Assessment (PHVA) had the intention of grouping researchers with the great expertise on the species and issues involved on its conservation with the objective of gathering, systematizing and discussing all the available data and information on maned wolf ecology, behavior, epidemiology, habitat use, dispersal patterns, and population demographic parameters, such as age structure, birth rates, mortality, dispersal, and other biological data, the species current status and distribution, threats to survival across its range, available habitat etc., and use this information to establish research, management and conservation priorities for the species. The workshop is expected to be an efficient and systematic working process for the species action planning. The PHVA balances the need to integrate information necessary for evaluating alternative species conservation strategies with the need to integrate, or at least connect, individuals from different disciplines and backgrounds that are centrally concerned with the species of interest. This is done with the hope that some realignment of priorities among individual stakeholder groups will take into account the needs, views and

initiatives of other groups. Central to this process is the use of *Vortex*, a computer software simulation model of wildlife population dynamics that performs a risk assessment, and provides a tangible focus for quantitative evaluation of conservation options for a species and a vehicle for integrating diverse biological and human sociological data. Taken together, the risk assessment modeling and focused, stakeholder-driven deliberations are designed to directly address the issues affecting the species so that alternative strategies can be analyzed rationally and systematically. When this occurs, better conservation decisions and specific action steps with targeted responsibilities result.

The expected outcome of this workshop is an updated Action Plan for the species to be applied throughout its entire range, where the same pattern of human occupation and development can be observed, in order to protect the species and preserve the ecosystems it inhabits. It is intended to concentrate on recommendations for the preservation in the wild, but also addressing the captive population, education and capacity building, research priorities, and funding. It is necessary to design a clear Maned Wolf conservation strategy in which, based on scientific information, priority activities are identified in each of the range countries. Finally, a significant outcome of the PHVA will be the creation of a network of professionals and institutions committed to put into practice all the recommendations and necessary actions listed as priorities.

Organization institutions

The main organization undertaking this workshop is 'CENAP/ICMBio' with the support of 'Instituto Pró-Carnívoros'. The National Research Center for Predators Conservation (CENAP) was created in 1994, when IBAMA, which is the federal Agency for the environment in Brazil, realized the need of creation of a specific structure to deal with all matters concerning carnivores such as captive management, issuing of permits for specimens transportation throughout the country, analysis and allowance of research projects, among others, and mainly due to the big amount of complaints that arrives in the Agency about livestock depredation, risks to humans, and other general conflicts. Additionally the center plan and execute priority actions focused on specific species, and also maintain a genome bank which serves researches on carnivores' reproduction and genetics. Overall, CENAP has the responsibility of developing a national policy for the conservation of carnivores in Brazil. The 'Pró-Carnívoros' is a non-governmental organization funded on 1996 and which mission is "to promote conservation of Neotropical carnivores and their habitats" and has been working on carnivore conservation in several states of Brazil, and also conducting research in Peru. Since 1996, the institute has been conducting 34 different projects being 21 still ongoing, in a cooperative work involving the Brazilian government, universities, zoos, other NGOs and land holders. At the present the institute conducts five different projects involving Maned Wolves, being one specifically on the species which aims to gather enough information on several subjects in order to develop an action plan for the species in all its distribution range. The research projects of the partnership have as their main objective to gain knowledge that is directly applicable on conservation strategies. While CENAP detain a technician corporation composed by six professionals, Pró-Carnívoros is composed by 18 researchers and all of them with long-date expertise on wildlife management, carnivore ecology, behavior, reproduction, genetic, epidemiology, among other subjects. The CENAP and Pró-Carnívoros' researchers believe that partnership and gathering of information is essential for the success of efforts towards carnivore conservation. In this way the institute believes that only with cross-country strategies, carnivore conservation is valid. Pró-Carnívoros has a strong formal relationship with ICMBio (the Brazilian Agency responsible for the biodiversity conservation) through a solid partnership with CENAP. Both institutions are growing together sharing the success for predators' conservation.

Additionally, an important partner of this event has been the Conservation Breeding Specialist Group – Brazil Network (CBSG) - International Union for the Conservation of Nature (IUCN), responsible for the design and facilitation of the workshop, as well as the PHVA modeling and production of workshop final reports. The institutional supporters of this

project include the American Zoo and Aquarium Association (AZA) - Maned Wolf Species Survival Plan (MWSSP) and the Canid Specialist Group (IUCN/CSG), besides 16 sponsoring institutions.

Institucional support

The workshop had two fundamental international partners to plan and make this meeting real: the Brazilian Regional Network of the Conservation Breeding Specialist Group (CBSG) and the Canid Specialist Group (CSG), both committed with the Species Survival Commission (SSC) from IUCN (International Union for the Conservation of Nature and Natural Resources).

The Brazilian Regional Network of the Conservation Breeding Specialist Group (CBSG) was responsible for the design and facilitation of the workshop, and also for the modeling process of the PHVA and co-elaboration of the reports. The CBSG has more than 1,000 volunteer members in more than 100 different countries, besides 10 years of experience developing, testing and using scientific processes and tools to evaluate the risks and decisions around management of species. Based on small populations and conservation biology, human demography and social learning dynamics, these tools are used in workshops to solve problems and to find realistic recommendations that can take place to the management of *in-situ* and *ex-situ* populations. The Brazilian Regional Network of CBSG exists since 2003 and at the present time consists in a group of five highly trained professionals that are committed on using these tools in Brazil.

The Canid Specialist Group (CSG) provided institutional support since the real start of the plan, raising funds support and will have an essential role assisting and helping on the implementation of the Action Plan resulted from the workshop. The CSG (WWW.canids.org) is the main global body specialized in scientific and management topics on the status and conservation of all species of canids. The group consists in at about 100 specialists, between field researchers, academics, wildlife related professionals, governmental officers and NGO members. The Canid Specialist Group also possesses a regional web in South America headed for the Neotropical species. The CSG members are effective involved on research and conservation of canids, and work as honorary consultants, bringing their experience and expertise of their whole professional lives into the group.

The workshop had also the institutional and raising funds support from American Zoo and Aquarium Association (AZA) by the Maned Wolf Species Survival Plan (MWSSP), that focused the resources of many institutions to the workshop and had a fundamental importance taking part on the implementation on topics related to captivity from the Action Plan resulted from this event.

Financial support

Methodology

The methodology used for the Action Plan elaboration was the PHVA – Population and Habitat Viability Assessment. The working process was developed and widely utilized by the IUCN/SSC Conservation Breeding Specialist Group (CBSG).

The PHVA's workshop is an efficient systematic process employed in strategic recovery and conservation plans for endangered species and its habitats. In the course of the PHVA, or even before, information on population demography, genetics, and ecology are compiled and associated to data on human impacts such as present and future development linked to land use. The main tool within the PHVA is the use of the Vortex software, a computer model for population dynamics. The system evaluates risks of population decreasing for the present and future through simulations based on specific threats to local population and under several management scenarios. The models integrate species biological and social data and are used as an excellent tool for the generation of new information. Additionally, the method allows the refinement of hypotheses in order to provide tangible objectives for a quantitative evaluation of management alternatives. The participants propose specific management recommendations based on several analyses in a way that the success of a PHVA workshop is related to the involvement of professionals with different expertise resulting in an exchange of knowledge and technologies, the built of general opinion on threats and its solutions, as well as the direction of resources. The PHVA process is based on contributions from different groups, aiming the connections between individuals from several different backgrounds but all interested on the target species in a multidisciplinary approach. The population modeling strength the decisions to be taken towards the species conservation, due to the intensive resolutions among the interested groups on viable solutions for the species threats and problems.

The CBSG professionals, responsible for the design and facilitation are listed bellow:

Facilitation

Philip Miller
IUCN/SSC Conservation Breeding Specialist Group (CBSG) Headquarters

Patrícia Medici
IPÊ – Instituto de Pesquisas Ecológicas, Brasil
IUCN/SSC Tapir Specialist Group (TSG)
IUCN/SSC Conservation Breeding Specialist Group (CBSG) – Rede Brasil
Durrell Institute of Conservation and Ecology (DIce), University of Kent

Leandro Jerusalinsky
Centro de Proteção dos Primatas Brasileiros/ICMBio, Brasil
Universidade Federal do Estado da Paraíba (UFPB)
IUCN/SSC Conservation Breeding Specialist Group (CBSG) – Rede Brasil

Modelling Vortex

Kathy Traylor-Holzer
IUCN/SSC Conservation Breeding Specialist Group (CBSG) – Headquarters

Arnaud Desbiez
Royal Zoological Society of Scotland (RZSS), Escócia
Embrapa - Pantanal, Brasil
IUCN/SSC Conservation Breeding Specialist Group (CBSG) – Rede Brasil

Anders Gonçalves da Silva
IPÊ – Instituto de Pesquisas Ecológicas, Brasil
University of British Columbia, Canadá
IUCN/SSC Tapir Specialist Group (TSG)
IUCN/SSC Conservation Breeding Specialist Group (CBSG) – Rede Brasil

In the workshop the participants are gathered in smaller working groups, discussing pre-identified topics essential to the target-species conservation. All the available information on maned wolf (specially its demographic parameters, birth and mortality rates age structure, dispersal, geographic distribution, habitat availability, and current threats along the distribution range) was compiled, systemized, and discussed among the participants. Subsequently all the information generated from the gathering was used to establish priorities on maned wolf research, management, and conservation throughout the entire distribution range.

During the first plenary session, all the participants were invited to a personal introduction, when they could express their opinions on the main challenges and priority problems of maned wolf conservation. The impressions commented by all the participants were recorded in a panel and used later to define the main themes to be processed and worked during the entire meeting by the working groups. They are:

1. Threats and habitat management;
2. Distribution and status;
3. Environmental education, social aspects and economic alternatives;
4. *Ex situ* conservation*;*
5. Population dynamics and modeling.

The working groups were established and the participants start to share their knowledge through a “Brain Storm” where general problems related to their specific themes were presented and listed. Afterwards, the groups refined and prioritized the discussed PROBLEMS. Subsequently, GOALS were elaborated based on each priority problems, from which specific ACTIONS were created to its resolution. The ‘goals’ were also prioritized and the main items for the species conservation during the next 5 years were outstanded.

The steps taken by each working group were the following:

- To discuss and refine the important problems/threats for the maned wolf;
- To prioritize the defined PROBLEMS;
- To elaborate a list of short term goals for each defined problem
- To prioritize the GOALS;
- To elaborate and a list of detailed ACTIONS for each of the previous ‘goals’ and prioritize them (overall the high priority ones);
- To identify the different resources needed to implement the ‘actions’

Along the entire meeting, general plenary sessions were realized to each working group present partial results deliberated on their specific assemblage. This procedure was made to ensure that all participants contributed and agreed to the information generated by other groups though new suggestions and proposals, during the general assembly.

Chalenges presented by participants in plenary:

Main Topics	
1. Social and political articulation	3
2. Protected areas complex	1
3. Captivity reproduction	4
4. Research for Conservation and Maintenance of Habitat	*
5. Conservationist Education	3
6. Road mortality	1
7. Creation of biologic samples collection	4
8. Information deficiency	*
9. Agriculture development policy	1,3
10. Changes in the way of thinking	3
11. Projects implementation in Paraguay	*
12. Society's awareness building	3
13. Sanitary aspects	4
14. Development of protocols	1,4
15. Governmental organizations commitment (Argentina)	*
16. Regional aids	3
17. Community involvement in conservation	3
18. Increase knowledge about the species (Argentina)	*
19. Monitoring the regional status	2
20. Creation/Implementation of Conservation Units	1
21. Ex-Situ Action Plan elaboration	4
22. Collectively Global Action Plan elaboration	4
23. Increase knowledge about the species in human altered areas	1,2,3
24. Conflict management	3
25. Turn viable the coexistance between human X maned wolf	3
26. Animals taken away from nature. What should be done?	3,4
27. Diseases from contact between humans and related animals	1
28. Captivity nutrition	4
29. Researchers approach to communities	3
30. Maned wolves population map	2
31. Integration of knowledge*	3
32. Establishment of priority areas to be protected	1,2
33. Preservation of cerrado areas	1
34. Preservation of grassland areas	1
35. Environmental education in zoos	3
36. Maintenance of projects	*
37. Maintenance of funding	*
38. Involvement of politics	*
39. Implementation of all actions and improvement of the plan of management	*
40. Improvement of environment education programs	3
41. Maned wolf populations diagnosis in human altered areas	1,2

Continue

Main Topics	
42. Monitoring populations in regions recently occupied by humans	1,2
43. Mapping and protection of maned wolf populations in Uruguay	2
44. Creation of Private Reserves	1
45. Make use of the “flagship” status	3
46. Implement actions out of protected areas	1
47. Implementation of financial mechanisms to promote areas and populations protection	3
48. Establish patterns to obtain samples	1,4
49. Information exchange (between institutions, *ex-situ* etc.)	*
50. Conciliate tourism (public use) and conservation	3
51. Turn the knowledge available to the communities	3
52. Inform the communities about the researches at the moment	3
53. Integration of i*n-situ* x *ex-situ* actions	*
54. Impact of exotic species	1
55. Impact of domestic dogs	1
56. Impact of tourism	1
57. Connectivity between protected areas	1,2
58. Understand translocation (how? effectiveness? necessity?)	1
59. Determine the minimum viable population size to the maned wolf	5
60. Determine the minimum size of area to sustain a minimum viable population of maned wolves	5
61. Determine the size of populations in protected and unprotected areas	1,2,5
62. Explore massive communication alternatives	3

* Subjects proposed in plenary session to be discussed for all the working groups

Action Plan

WORK GROUP
Threats and habitat managent

Members

Carlyle Mendes Coelho (Fundação Zoo-Botânica de Belo Horizonte), Brazil
Diego Queirolo (USP - Universidade de São Paulo), Brazil
Fernando Bonillo (IBAMA - Pouso Alegre), Brazil
Jean Carlos Ramos (Tríade), Brazil
Maria Luisa Ortiz (Guyra Paraguay), Paraguay
Marcela Orozco (Universidad de Buenos Aires & G.A.A.G.), Argentina
Otávio Borges Maia (DIBIO/ICMBio), Brazil
Paulo Sérgio Mattos (UFSCAR - Universidade Federal de São Carlos), Brazil
Rodrigo Silva Pinto Jorge (CENAP/ICMBio), Brazil
Ronaldo Gonçalves Morato (CENAP/ICMBio), Brazil

PROBLEMS: Brainstorm

1.	Make clear differences between threats and habitat management: road kills, predation, habitat quality.
2.	Animal Health, genetic diversity, mortality, expansion in area of occurrence.
3.	Policies and proposals execution.
4.	Illegal market and use of wild animals as pets.
5.	Hunting due to predation of domestic species.
6.	Climate changes.
7.	Distribution / knowledge about occurrence area.
8.	Local community knowledge about the species.
9.	Overlap of used areas with domestic dogs.
10.	Inexistence of an action protocol.
11.	Lack of preys or of food and water.
12.	Expansion of agriculture activities.
13.	Lack of mobilization.
14.	Lack of popular commitment.
15.	Low genetic diversity.
16.	Disordered urban growth.
17.	Hunting due to beliefs (myths and fears).
18.	Lack of environmental policies.
19.	Lack of development policies.
20.	Lack of conservation strategies.
21.	Specific projects, funds handling, execution and monitoring.

22. Deficient fiscalization.
23. Expansion of distribution to urban areas, human approach to natural environment.
24. Habitat fragmentation.
25. Ventures' impact.
26. Captures by landowners.
27. Lack of knowledge and training by the authorities in charge.
28. Translocations without the adequate criteria.
29. Fires.
30. Lack of connectivity between natural areas.

PROBLEMS: Definition and Categorization

1. Public Policies
The deficiency in public policies focused in conservation of the biomes where the maned wolf occurs has been resulting in their destruction and fragmentation. This scenery and the deficient support to projects (on research and environmental education) directed to the species conservation, added to deficient fiscalization contribute to make the threats critical to the maned wolf:
• Significant difference in politics and legislation between the different countries;
• Deficient politics directed to conservation of the species and habitat;
• Deficient politics to protected fauna;
• Inexistent fund sources, insufficient or inadequately stored;
• Deficient Fiscalization.
2. Alteration of Habitat
The destruction and/or fragmentation of habitat, due to expansion of agriculture and urban areas, can change the environmental quality, reducing the availability of water, food and refuges. Besides that, the inexistence of connectivity might isolate populations and reduce the gene flow.
• Destruction/Fragmentation of habitat;
• Agriculture expansion (deforestation, fires, monocultures);
• Accidental fires (ex.: roads);
• Expansion of urban areas;
• Climate changes;
• Habitat quality;
• Availability of water and food;
• Expansion in occurrence area;
• Genetic diversity loss.
3. Health and epidemiology
The increase of contact between maned wolf, human populations and their domestic animals represent a, so far, little evaluated potential of bilateral transmission of pathogens, as well as wild animals intoxication by the use of agricultural defensives and heavy metals.

3.	**Health and epidemiology**
•	Lack of knowledge about the diseases (diseases prevalence, maned wolf's participation in the epidemiological chains), lack of knowledge about maned wolf's and other species' health;
•	Interaction/contact with domestic animals, mainly domestic dogs;
•	Interaction/approach men X animal and men X natural habitat (ex.: tourism);
•	Destination of individuals of other species to maned wolf's area of occurrence;
•	Environmental pollution, mainly by heavy metals, organochlorines (pesticides, fertilizers, etc).
4.	**Inadequate destination**
The inexistence of clear rules and criteria (protocols) for destination of confiscated specimens, as much as the need of wildlife selection and rehabilitation centers, makes more difficult release actions, translocations and re-introductions.	
•	Inadequate translocations, re-introductions and releases;
•	Inexistence of regulations about destination of captured or confiscated animals;
•	Need of wildlife selection or rehabilitation centers.
5.	**Loss (negative impacts on *in-situ* population)**
Loss (negative impacts on *in-situ* populations): road kills, hunting, illegal trade and use of maned wolf as pet represent significant unnatural losses of still not known proportions.	
•	Road kills;
•	Illegal trade for domestic usage, pet;
•	Hunting (for sport, due to predation, beliefs, etc.).

PROBLEMS: **Setting Priorities** (Paired Ranking)

CRITERIA: Threaten importance to the species survival.

1. Public policies **(40 POINTS)**
2. Alteration of habitat **(36 POINTS)**
3. Health and epidemiology **(15 POINTS)**
4. Inadequate destination **(11 POINTS)**
5. Loss (negative impacts on *in-situ* populations) **(8 POINTS)**

Compilation and data analysis

Main threats	Identification of problems	Compilation of data
1. PUBLIC POLICIES: The deficiency in public policies focused in conservation of the biomes where the maned wolf occurs, has been resulting in their destruction and fragmentation. This scenery and the deficient support to projects (on research and environmental education) directed to the species conservation, added to deficient fiscalization contribute to make the threats critical to the maned wolf.	Significant difference in politics and legislation between the different countries. Deficient politics directed to conservation of the species and habitat. Deficient politics to protected fauna.	Brazil: Deficient implementation of the law and politics, lack of articulation of the government and the different politics (agriculture, energetic department, transport, etc.; deficient transversality. Argentina, Uruguay: Environmental law is deficient; actualization and adaptations to the local problems are needed. Paraguay: Implementation is deficient. Brazil: Specific politics to the species inside the official list of threatened species. Argentina: Elaboration of the list of threatened species in each Province.
	Inexistent fund sources, insufficient or inadequately stored.	Brazil: Insufficient funds for fiscalization actions, implementation and regularization of the Conservation Units. Insufficient and inadequately stored funds to scientific research. Argentina: Insufficient funds for fiscalization, implementation of Conservation Units and for scientific research. Paraguay: Scarce resources. Uruguay: Scarce economic and human resources for fiscalization, little expressive Conservation Units, insufficient and inadequately stored funds to scientific research.
	Deficient fiscalization.	Low effectiveness in all region environmental fiscalization.

continue

Main threats	Identification of problems	Compilation of data
2. ALTERATION OF HABITAT: The destruction and/or fragmentation of habitat, due to expansion of agriculture and urban areas, can change the environment quality, reducing the availability of water, food and refuges. Besides that, the inexistence of connectivity might isolate populations and reduce the gene flow.	Destruction/Fragmentation of habitat. Agriculture expansion (deforestation, fires, monocultures). Forest fires (ex.: roads). Expansion of urban areas.	Monitoring by satellite images (SIG – Geographic Information System. SISCOM/IBAMA; Embrapa; INPE – Brazilian National Institute of Spatial Research).
	Climate changes.	Supposition: A possible alteration in habitat and rain cycles. Studies are necessary to verify the impact of the climate changes.
	Habitat quality. Availability of water and food.	Brazil: Rogério Cunha de Paula (personal comment) Argentina: Soria, 1994.
	Expansion in occurrence area.	Brazil: Courtnay, 1994, Moreira *et al.* (personal comment) Argentina: Galliari, 2004; Orozco, 2005 (personal comment).
	Genetic diversity loss.	The species apparently has natural low genetic variability rates. The important genetic variability to adaptation and immune answers has not been evaluated. The genetic diversity loss due to the human influence might be a threat, but it has not been documented until this moment. Detailed studies are needed. Species is adapted to altered areas.

continue

Main threats	Identification of problems	Compilation of data
3. HEALTH AND EPIDEMIOLOGY: The increase of contact between maned wolf, human populations and their domestic animals represent a, so far, little evaluated potential of bilateral transmission of pathogens, as well as wild animals intoxication by the use of pesticides and heavy metals.	Lack of knowledge about the diseases (diseases' prevalence, maned wolf's participation in the epidemiological chains), lack of knowledge about maned wolf's and other species' health.	Case studies, but without reference about incidence, prevalence, participation of the maned wolf in diseases' epidemiological chains, impact of diseases in *In-Situ* populations.
	Interaction/contact with domestic animals, mainly domestic dogs.	Brazil: Curi, 2005; Lacerda, 2003; Jorge, 2003; Serra da Canastra National Park Project (personal comment); Emas National Park Project (personal comment); Fundação Zoobotânica Project in the city of Belo Horizonte (personal comment). Paraguay: Cartes, 2005 (personal comment). Uruguay: w.i. Bolivia: Emmons, 2005. Argentina: Orozco, 2005 Proyecto Ñangareko Aguará guazú (personal comment).
	Interaction/approach men X animal and men X natural habitat (ex.: tourism).	Interaction between men x maned wolf (consensus) and CENAP/ICMBio (personal comment). Positive results in serological exams for some diseases. Until the present, there is no reference about incidence, prevalence, maned wolf's participation in the diseases' epidemiological chains (Suppositions: Chagas' disease, *Neospora*, *Leishmania, Brucella, Erlichia, Leptospira,* PCR for *Brucella canis*). Elucidate maned wolf's participation in diseases' cycles.
	Destination of individuals of other species to maned wolf's area of occurrence.	Release of recent apprehended animals, without technical criteria.
	Environmental pollution, mainly by heavy metals, organochlorines (pesticides, fertilizers, etc).	Supposition due to the usage of polluting substances, many of them illegal. Necessity of toxicological studies.

continue

Main threats	Identification of problems	Compilation of data
4. INADEQUATED DESTINATION OF CAPTURED ANIMALS The inexistence of clear rules and criteria (protocols) for destination of confiscated specimens, as much as the need of wildlife selection and rehabilitation centers, makes more difficult release actions, translocations and re-introductions.	Inadequate translocations, re-introductions and releases.	Release of recent apprehended animals, without technical criteria. Brazil: Mattos, 2003; Rodrigues, 2002; environment authorities' registers, personal communications. Argentina, Paraguay, Uruguay: w.i.
	Inexistence of regulations about destination of captured or confiscated animals.	Brazil: IBAMA's regulation getting done (personal comment). Argentina: regulation getting done, Orozco, 2005 (personal comment). Paraguay, Uruguay: Inexistence of regulations (personal comment).
	Need of wildlife selection or rehabilitation centers.	Brazil: Few centers; Project CETAS/IBAMA. Paraguay, Uruguay, Argentina: don't have official wildlife selection centers, specific for the species.

continue

Main threats	Identification of problems	Compilation of data
5. LOSS (negative impacts on *in-situ* populations): Road kills, hunting, illegal trade and use of maned wolf as pet represent significant unnatural loss of still not known proportions.	Road kills.	Verified as a problem in the studied areas: Brazil: Rodrigues, 2002; Motta-Júnior *et al.*, 1996; Prada, 2003; Jacomo, 1999; Silveira, 1999. Argentina: Orozco, 2004 (Sarem, 2005). Paraguay: Cartes, 2004 (personal comment). Uruguay: w.i.
	Illegal trade for domestic usage, pet.	Use as pet --- Brazil: Coelho, 2000 (MG); Rodrigues, 2005 (GO) / Argentina: Soler (Cornientes); Orozco, 2004 (Santiago del Estero) / Paraguay: fed by Indians (supposition). Illegal trade --- Argentina: Orozco, 2004 (Santiago del Estero) / Paraguay: w.i. / Brazil: w.i. / Bolivia: Emmons, 2005 (supposition) / Uruguay: w.i.
	Hunting (for sport, due to predation, beliefs).	Sportive hunting --- Argentina: Orozco, 2005 / Brazil: w.i. / Paraguay: w.i. / Uruguay: w.i. Retaliation due to predation --- Brazil: CENAP/ICMBio (database); Dietz, 1984; many personal communications; Rodrigues, 2002; Motta-Júnior, 1996; Figueira, 1995 / Paraguay: Cartes, 2005 (personal comment) / Argentina: Orozco, 2004; Soler, 2005 (personal comment). Beliefs --- Brazil: Mattos, 2003; Dietz, 1984; many personal comments / Argentina: Soler, 2005 (personal comment) / Paraguay: Neris, 2002 / Bolivia: Emmons, 2005.

P.S.: w.i. = without information

GOALS

***PROBLEM 1**: Public Policies*

GOAL 1.1 Promote integration between research institutions, fomentation agencies, government and non-governmental organizations to optimize conservation actions directed to maned wolf and its habitat. **(20 Points)**

GOAL 1.2 Sensitize government and financial agencies about the necessity of funds and enforces to the conservation of the maned wolf and its habitat. **(16 Points)**

GOAL 1.3 Generate research demands to diminish the lacks of knowledge about the maned wolf. **(14 Points)**

GOAL 1.4 Request from the government the improvement and compliance of the environmental legislation. **(16 Points)**

***PROBLEM 2**: Alteration of habitat*

GOAL 2.1 Characterize the environment alterations in the species' distribution area. **(16 Points)**

GOAL 2.2 Evaluate the impact of environment alterations over maned wolf's populations. **(13 Points)**

GOAL 2.3 List, in order of importance, the impacts to be mitigated considering regional particularities. **(4 Points)**

***PROBLEM 3** Health and epidemiology*

GOAL 3.1 Decrease risk of disease infection considering interaction between domestic and wild animals **(13 Points)**

GOAL 3.2 Increase studies on epidemiology of the species' diseases. **(13 Points)**

GOAL 3.3 Raise basic information about maned wolf's exposition to toxic agents. **(7 Points)**

***PROBLEM 4**: Inadequate destination*

GOAL 4.1 Make rules on the apprehended/captured animals destination. **(25 Points)**

GOAL 4.2 Implement the destination rules. **(17 Points)**

GOAL 4.3 Standardize the selection and rehabilitation centers operation. **(11 Points)**

GOAL 4.4 Implement new selection and rehabilitation centers. **(7 Points)**

***PROBLEM 5:** Loss (negative impacts on in-situ populations)*

Goal 5.1 Estimate the loss by road kills. **(22 Points)**

Goal 5.2 Reduce the loss by road kills. **(20 Points)**

Goal 5.3 Estimate the predation rate of domestic animals by maned wolf (**10 Points)**

Goal 5.4 Reduce loss by hunting, illegal trade and use as pet **(12 Points)**

GOALS: Ranking

GOAL 1 Promote integration between research institutions, fomentation agencies, government and non governmental organizations to optimize conservation actions directed to maned wolf and its habitat (5 years).

GOAL 2 Convince government and fomentation agencies about the necessity of funds and efforts to the conservation of the maned wolf and its habitat (5 years).**GOAL 3** Characterize and evaluate the impact of environmental alterations over maned wolf populations (3 years).

GOAL 4 Request from the government the improvement and compliance of the environmental legislation (immediately).

GOAL 5 Increase studies on epidemiology of this species' diseases (2 years).

P.S.: Initially, the group classified the goals by rating, but during discussions the group found out that some of them were overlapped and could be assembled, for this reason some of the goals above are not exactly the ones that got more points.

ACTION PLAN

GOAL 1 *Promote integration between research institutions, fomentation agencies, government and non governmental organizations to optimize conservation actions directed to maned wolf and its habitat (5 years).*

ACTION 1.1 Ensure that the Committee for the Conservation of the Maned Wolf implements the Action Plan.

Responsible: Brazil: CENAP's director / Argentina: Marcela Orozco
Collaborators: Brazil: ICMBio, IBAMA, scientific societies, non governmental organizations, institutions of education and research, zoological institutions / Argentina: non governmental organizations, zoological institutions, institutions of education and research / Paraguay: SEAM, non governmental organizations, institutions of education and research / Uruguay: MGAP-Fauna, DINAMA, institutions of education and research and non governmental organizations.
Time to accomplish: 1 year
Indicator: Execution of the Action Plan
Costs: None
Consequences: Implementation of the action of the Action Plan.
Obstacles: Lack of financial resources.

ACTION 1.2 Create a Committee for the Conservation of the Maned Wolf in Paraguay.

Responsible: Paraguay: Maria Luisa Ortiz
Collaborators: SEAM, non-governmental organizations, and institutions of education and research.
Time to accomplish: 1 year.
Indicator: Creation of the Committee for the Conservation of the Maned Wolf in Paraguay.
Costs: None.
Consequences: Implementation of the action of the Action Plan.
Obstacles: Conflicts between institutional and personal relationships.

ACTION 1.3 Elaboration of an Internet Page (Portuguese and Spanish) to make public the researchers, researches in progress, protocols, bibliography and Action Plan.

Responsible: CENAP's director e Marcela Orozco.
Collaborators: CENAP/ICMBio and Instituto Pró-Carnívoros.

Time to accomplish: 1 year.
Indicator: webpage available in the internet.
Costs: None.
Consequences: Socialization of information.
Obstacles: Motivation of people involved in elaborating and maintaining the webpage.

ACTION 1.4 Promote environment education campaigns directed to reducing deaths due to road kills and hunting, using also the media space available by law.

Responsible: Brazil: Canids Conservation Committee / Argentina: G.A.A.G. - Grupo Argentino Aguara Guazú / Paraguay: Guyra Paraguay.
Collaborators: MMA – Brazilian Environment Ministry, IBAMA, non-governmental organizations, government and media.
Time to accomplish: 3 years.
Indicator: Number of campaigns performed and in progress.
Costs: US$500,00
Consequences: Decrease in the number of deaths due to hunting and road kills.
Obstacles: Lack of financial and human resources.

ACTION 1.5 Unite the methodologies and protocols of physical restraint, biometry and biologic material sampling.

Responsible: Joares May Júnior e Marcela Orozco
Collaborators: CENAP/ICMBio, Instituto Pró-Carnívoros, and researchers.
Time to accomplish: 1 year.
Indicators: Assemblage of methodologies and protocols published in the internet.
Costs: None.
Consequences: Unification the methodologies of physical restraint, biometry and biologic material sampling.
Obstacles: Difficulties on accessing to the different methodologies and protocols.

GOAL 2 *Convince government and fomentation agencies about the necessity of funds and efforts to the conservation of the maned wolf and its habitat (5 years).*

ACTION 2.1 Promote meeting with the governmental agencies, fomentation and funding agencies to make public the Action Plan and induce research demands.

Responsible: Brazil: Rose Gasparini Morato e Otávio Borges Maia / Paraguay: José Luis Cartes / Argentina: G.A.A.G. - Grupo Argentino Aguara Guazú / Uruguay: Diego Queirolo.
Collaborators: Ibama, MMA – Brazilian Environment Ministry, and non-governmental organizations.
Time to accomplish: 2 years.
Indicator: Number of meetings promoted.
Costs: US$ 10,000
Consequences: Announcements directed to projects on conservation of the maned wolf and its habitat.
Obstacles: Financial resources and agenda-setting of the meetings.

GOAL 3 *Characterize and evaluate the impact of environmental alterations over maned wolf populations (3 years).*

ACTION 3.1 Assemble the information about impacts on the maned wolf's occurrence area.

Responsible: Diego Queirolo, José Roberto Moreira, e Ronaldo Morato.
Collaborators: Brazil: ICMBio, IBAMA, MMA - Brazilian Environment Ministry, e INPE – Brazilian National Institute of Spatial Researches / Argentina: G.A.A.G. - Grupo Argentino Aguara Guazú / Paraguay: Guyra Paraguay.
Time to accomplish: 1 year.
Indicator: Map elaboration.

Costs: US$10,000
Consequences: Providing to implementation of co-related actions.
Obstacles: Lack of financial resources and insufficient data.

ACTION 3.2 Correlate information from the last action and determine the impacts over the species (correlating with Action 1.2.1 of the Group of Distribution And Status)

Responsible: Brazil: Canids Conservation Committee / Argentina: Lucía Soler / Paraguay: Guyra Paraguay / Uruguay: Diego Queirolo
Collaborators: Governmental agencies, non-governmental organizations, and institutions of education and research.
Time to accomplish: 5 years
Indicator: Results published.
Costs: US$ 10,000
Consequences: Knowledge about the impacts of the environment alteration over the maned wolf's populations.
Obstacles: Lack of financial resources and quality of the available information.

ACTION 3.3. Assemble the information on road kills and hunting of maned wolves.

Responsible: Brazil: Flávio Rodrigues / Argentina: G.A.A.G. - Grupo Argentino Aguara Guazú / Paraguay: Guyra Paraguay.
Collaborators: Governmental agencies, non governmental organizations, and institutions of education and research.
Time to accomplish: 1 year
Indicator: Results published.
Costs: US$5,000
Consequences: Access to and quality of the available information.
Obstacles: Lack of financial resources and quality of the available information.

ACTION 3.4. *Perform projects that make possible the estimation of the impact of road kills over maned wolf's populations.*

Responsible: Brazil: Canids Conservation Committee / Argentina: G.A.A.G. - Grupo Argentino Aguara Guazú / Paraguay: Guyra Paraguay / Uruguay: Diego Queirolo
Collaborators: Governmental agencies, non governmental organizations, and institutions of education and research.
Time to accomplish: 3 years
Indicator: Results published
Costs: US$ 500,000
Consequences: Knowledge on the impact of road kills over maned wolf's population
Obstacles: Lack of financial resources and capacitated staff.

GOAL 4: *Request from the government the improvement and compliance of the environmental legislation (immediately).*

ACTION 4.1. Call the Public Ministry every time it is noticed impacts over maned wolf populations due to infractions or non appliance of the current law.

Responsible: Committee and Work Groups
Collaborators: Governmental agencies, researchers, and non governmental organizations.
Time to accomplish: Immediately
Indicator: Number of actions promoted by the Public Ministry.
Costs: US$500/year
Consequences: Appliance of the environmental law.
Obstacles: None

ACTION 4.2. Ask the transportation infra-structure agencies for an adequate signalization of roads with road kills occurrence.

Responsible: Brazil: Flávio Rodrigues / Argentina: G.A.A.G. - Grupo Argentino Aguara Guazú / Paraguay: Guyra Paraguay
Collaborators: Road and highway concessionaires, National Transportation Infra-structure Department (DNIT), MMA – Brazilian Environmental Ministry, ICMBio, IBAMA – Brazilian Environmental Agency, Dirección Vialidad Argentina, and Instituto Pró-Carnívoros.
Time to accomplish: 1 year
Indicator: Installation of signs.
Costs: US$5,000
Consequences: Decrease in the number of road kills.
Obstacles: Lack of financial resources and politic will.

ACTION 4.3. Prepare and send to the public power a document showing the importance of current law compliance and of the implementation of the Action Plan.

Responsible: Rogério Cunha de Paula.
Collaborators: Participants of the PHVA Workshop of the Maned Wolf (October 2005), researchers, and non governmental organizations.
Time to accomplish: 4 months
Indicator: Number of sent documents.
Costs: US$500 (?)
Consequences: Environmental law appliance.
Obstacles: None.

***GOAL 5**: Increase studies on epidemiology of this species' diseases (2 years).*

ACTION 5.1. Identify, map and make public the studies in progress.

Responsible: Brazil: Jean Carlos Ramos and Rodrigo Silva Pinto Jorge / Argentina: Marcela Orozco / Paraguay: Guyra Paraguay
Collaborators: CENAP/ICMBio, Tríade, G.A.A.G. - Grupo Argentino Aguara Guazú, Guyra Paraguay, SZB - Sociedade de Zoológicos do Brazil, and Fundação Zoobotânica de Belo Horizonte.
Time to accomplish: 1 year
Indicators: Documents and maps.
Costs: US$1,000
Consequences: Providing to implementation of correlated actions.
Obstacles: Access and quality of the available information.

ACTION 5.2. Define the diseases with potential impact on maned wolf and public health.

Responsible: Brazil: Jean Carlos Ramos and Rodrigo Silva Pinto Jorge / Argentina: Marcela Orozco / Paraguay: Guyra Paraguay
Collaborators: CENAP/ICMBio, Tríade, G.A.A.G. - Grupo Argentino Aguara Guazú, Guyra Paraguay, SZB - Sociedade de Zoológicos do Brazil, and Fundação Zoo-Botânica de Belo Horizonte.
Time to accomplish: 1 year
Indicator: Disease list.
Costs: US$10,000
Consequences: Providing to implementation of correlated actions.
Obstacles: Access and quality of the available information.

ACTION 5.3. Identify and make public, in each country, the reference laboratories to diagnosis of the diseases.

Responsible: Brazil: Jean Carlos Ramos and Rodrigo Silva Pinto Jorge / Argentina: Marcela Orozco / Paraguay: Guyra Paraguay
Collaborators: CENAP/ICMBio, Tríade, G.A.A.G. - Grupo Argentino Aguara Guazú, Guyra Paraguay, SZB - Sociedade de Zoológicos do Brazil, and Fundação Zoobotânica de Belo Horizonte.

Time to accomplish: 1 year
Indicator: Laboratory list.
Costs: Integrated to the previous action.
Consequences: Providing to implementation of correlated actions.

ACTION 5.4. Perform projects in areas with no or little information on the maned wolf's populations' health.

Responsible: Committees and Work Groups
Collaborators: Brazil: ICMBio, Ibama, scientific societies, non governmental organizations, institutions of education and research , and zoological institutions / Argentina: non governmental organizations, zoological institutions, e institutions of education and research / Paraguay: SEAM, non governmental organizations, institutions of education and research / Uruguay: Veterinary School - Universidade da República, MGAP-Sanidade Animal, zoological institutions, institutions of education and research and non governmental organizations.

Time to accomplish: 5 years

Indicators: Number of projects executed and in progress.

Costs: US$1,000.00 – Integrated with other actions.

Consequences: Knowledge on the impacts of diseases over maned wolf's populations.

Obstacles: Lack of financial resources and capacitated staff.

WORK GROUP

Distribution and status

Members

Cosette Barrabas Xavier da Silva (Ibama-PR), Brazil
Eduardo Eizirik (Instituto Pró-Carnívoros & PUC - Rio Grande do Sul), Brazil
Joaquim de Araújo Silva (Instituto Biotrópicos), Brazil
José Roberto Moreira (Embrapa Recursos Genéticos e Biotecnologia), Brazil
Marco Aurélio Sábato (Fundação Zoobotânica de Belo Horizonte), Brazil
Marianela Velilla Fernandez (Guyra Paraguay), Paraguay
Pablo Cuello (Huellas & G.A.A.G.), Argentina

PROBLEMS: Brainstorm

1.	Distribution (precisely where the species occurs at the present time and historically)
2.	Lack of information on habitat characterization, and also when and how alterations occurred
3.	Problems when comparing data due to mistrust on historical registers and use of different methodologies. Results also by the lack of people integration
4.	Lack of information on maned wolf's population density in different regions and habitats along the distribution area
5.	Lack of information on the continuity or discontinuity of areas (if it's present o historical)
6.	Lack of detailed information on genetic structure of the maned wolf's populations (if there is no discontinuity of habitat, there is a probability that there is no deep difference between areas, this means, subspecies
7.	Lack of knowledge on the causes of changes (expansion and retraction) in the geographical distribution of the species
8.	Lack of knowledge on the species endurance to habitat alterations due to human action
9.	Lack of knowledge on the landscape elements responsible for persistence or exclusion or maned wolf's population in that landscape
10.	Lack of natural resources to sustain and auto maintain the species in Rio Grande do Sul (Brazil) and Uruguay, resulting in a greater sensibility to possible disturbances in the environment and extinction of populations
11.	Lack of knowledge on the original quality of habitat, considering the peripherical original geographic distribution
12.	Lack of information on genetic diversity on maned wolf's regional populations
13.	Lack of financial resources to execute surveys of the occurrence areas of the species – it's the main problem to execute the researches in Argentina and Paraguay
14.	Lack of advertising, financial resources and interest in the species

15.	Methodological limitations to obtain basic information about the species and its habitat, i.e. satellite images, aerial pictures and specific studies
16.	Lack of interest about the species and its habitat
17.	Lack of environmental (cultural) education to the conservation of the species
18.	Lack of integration between the institutions and researchers
19.	Lack of governmental interest
20.	Bad dispose of the governmental resources: the way the resources are used with priority to other activities that are not focused in the environment
21.	Need of environmental conscientiousness among politics and industrial owners (Brazil); lack of technicians interest (biologists, veterinarians) in politic issues (Argentina)
22.	Lack of communication of the researchers to modify the population's ecological conscience

PROBLEMS: Categorization and Ranking

The group discussed the methodology to be used to rank the problems priority. Between relevance and capacity of happening, relevance was defined as the most important aspect for research.

Lack of information about:

1.	**Species occurrence**
1.1 –	Current and historical areas of maned wolf's occurrence
1.2 –	Trustworthiness of historical registers
1.3 –	Causes of changes in the distribution area of the maned wolf
2.	**Spatial ecology and habitat requirement**
2.1 –	Characteristics of the habitat of occurrence
2.2 –	Density along the distribution area
2.3 –	How the landscape structure turns viable the maned wolf's persistence
2.4 –	Tolerance to human alterations
2.5 –	Demographic connectivity between maned wolf's populations
3.	**Population Genetics**
3.1 –	Genetic structure of maned wolf's populations
3.2 –	Genetic diversity of local maned wolf's populations
4.	**Population Viability**
4.1 –	Local and regional maned wolf's population viability

Compilation and data analysis

Trustworthiness in historical data:

Many historical data do not seem to be trustworthy; many times they are anecdotal or are not documented. There is no guiding methodology to evaluate how trustworthy are these data.

Causes of maned wolf's geographical distribution:

There are suppositions about these causes in Brazilian biomes (thee is no equivalent information in the other countries):

- Expansion due to the substitution of Atlantic and Amazon Forests for open human-altered areas.
- Reduction of 'Campos Sulinos' biome due to loss of important elements of the original landscape. The role of different types and levels of human alteration *versus*

geographical position (central or peripherical) is uncertain concerning extinction or rarity of occurrence in great part of Rio Grande do Sul state (Brazil), Uruguay and Argentina. There is lack of trustful data on species' occurrence areas (historical and current) in this peripherical portion of the distribution area.

Density along the distribution area:

There are few data about species' population density, and these come from some conservation units in central Brazil (Serra da Canastra National Park – MG, RPPN Serra do Caraça – MG, Estação Ambiental Galheiro – MG, Emas National Park – GO and Estação Ecológica Águas Emendadas - DF). There are some preliminary data on species' abundance in other Brazilian areas and some areas in Bolivia. There are suppositions about the species' abundance in different areas in Uruguay, Argentina, Paraguay and south of Brazil.

Tolerance to human alterations:

There is a supposition that the species have tolerance for human altered landscapes, as long as the resultant mosaic has a significant portion of favorable habitat. There is not enough information to define what exactly a favorable habitat is.

How the landscape structure turns viable the species persistence:

Lack of information.

Genetic structure between maned wolf's populations:

There is no deep genetic structure between great regions. More detailed information on regional differentiation is needed.

Genetic diversity in local maned wolf's populations:

Lack of enough information to evaluate the regular levels of variability in this species' wild populations.

Distribution, Status and Habitat Characteristics of the Maned Wolf in South America:

BRAZIL

Rondônia	The species occurs in the southeast of the state in Cerrado areas, it is expanding its distribution to human-altered areas in the Amazon forest (deforestation).
Pará	The species occurs in the southeast of the state in Cerrado areas, it might be expanding its distribution to human-altered areas in the Amazon forest (deforestation).
Tocantins	The species occurs in Cerrado areas all over the state, examples are the Reserva Indígena dos Krahós and the Presidente Kennedy city. There are occurrences of distribution expansion to human altered areas of Amazon forest in the direction of Bico do Papagaio region. There are registers in the Angico and Araguaína cities.
Maranhão	The species occurs in the south of the state, in Cerrado areas, with registers in Arame, Grajaú, Fortaleza dos Nogueiras, Balsas, Mirador, Colinas and Tassso Fragoso cities.
Piauí	The species occurs in the southwest of the state, in areas of Cerrado plateau at Serra do Uruçuí and in Corrente city, south of the state.
Bahia	The species occurs in the west of the state in Cerrado areas in plateaus, near the limit with the Caatinga biome. Occurrence in Riachão das Neves, Barreiras, Correntina, Coribe and Cocos cities. Register of capture in coast area at Caravelas city.

Mato Grosso The species occurrence is limited to Cerrado areas in the north of the state, but might be expanding its distribution to human-altered areas in the Amazon forest (deforestation). Registers in Ribeirão Cascalheira, Canarana, Água Boa, Nova Xavantina and Sinop cities. In North Pantanal, southwest of the state, there are sporadical occurrences in peripheric areas.

Mato Grosso do Sul Western distribution limit in Pantanal peripheric areas. The species does not occur in the southeast limit of the State.

Goiás Present all over the state, including human-altered areas.

Minas Gerais Area distribution limit in the northeast of the State in the limits between Cerrado and Caatinga. There is occurrence in Montalvänia, Itacarambí, Jaíba, Janaúba, Porteirinha and Grão Mogol cities. Apparently, it occurs in low density at Cadeia do Espinhaço. In the south of the state, it expanded the distribution area for deforested Atlantic forest as in Conceição do Ibitipoca, Lima Duarte, Juiz de Fora and Poços de Caldas cities.

São Paulo The species occurs in Cerrado areas and has expanded its distribution to human altered areas of Atlantic Forest in the east and southeast of the state, as in Campos do Jordão, São João da Boa Vista, Mogi Mirim, Mogi Guaçu and São José do Barreiro cities. It has also expanded its distribution in the west of the state in human altered areas such as Ilha Solteira city.

Espírito Santo There are registers of captures by IBAMA in the south limit of the state with Rio de Janeiro, east to Serra do Mar. A maned wolf was captured at São José do Calçado city.

Rio de Janeiro There are registers of captures in human-altered areas of deforested Atlantic Forest in Conservatória city.

Paraná There are registers of the species in the cities listed below:

City	Register	Landscape used
Carambei	Sample of biologic material	Dry and moist grasslands, cattle ranches and monocultures
Castro	Visual, sample of biologic material and road killed animal	Dry and moist grasslands, cattle ranches and monocultures. Guartelã State Park
Curitiba	Visual	Human altered area (urban area)
Foz do Iguaçu	Road killed animal	
Guarapuava	Road killed animal	Dry and moist grasslands, cattle ranches and monocultures
Jaguariaiva	Sample of biologic material	Human altered areas of Cerrado, monocultures and cattle ranches. Cerrado State Park
Tibagi	Visual, sample of biologic material	Dry and moist grasslands, cattle ranches and monocultures
Palmas	Visual	Dry and moist grasslands, cattle ranches and monocultures
Palmeira	Capture of animal, sample of biologic material and road killed animal	Dry and moist grasslands, cattle ranches and monocultures
Pirai do Sul	Visual	Dry and moist grasslands, cattle ranches and monocultures

continue

City	Register	Landscape used
Ponta Grossa	Visual, capture of animal, sample of biologic material and road killed animal	Dry and moist grasslands, cattle ranches and monocultures. Vila Velha State Park
Porto Amazonas	Visual, sample of biologic material	Dry and moist grasslands, cattle ranches and monocultures
Senges	Road killed animal	Human altered areas of Cerrado
Telêmaco Borba	Capture, road killed animal and sample of biologic material	Araucária Forest (Floresta Ombrofila Mista), grasslands and forestry areas
Ventania	Visual	Human altered areas of Cerrado
Vila Alta	Indirect signs (tracks)	Moist grasslands

Santa Catarina In grasslands in the east of the state, probably connected to Paraná and Rio Grande do Sul states. There are registers in Serra Geral National Park, São Joaquim National Park and Lages, Tubarão and São Bento do Sul cities. There are some possible registers in southwest cities. There is a supposition of discontinuity between south and north of the state.

Rio Grande do Sul The species occurs in the following landscapes: Southern Pampas – grasslands – (Alegrete, Dom Pedrito, São Borja and Santana do Livramento cities), central lowlands (Guaíba and Butiá cities) and mountain grasslands (Esmeralda and São José dos Ausentes cities) (Chapter of the Red Book "Fauna ameaçada de Extinção no Rio Grande do Sul"). There is a possible discontinuity of the species occurrence between the Northeast (highland grasslands) and Southeast (grasslands) of the state.

ARGENTINA

There are registers of maned wolf occurrence in the provinces as listed below:

Province	Locality	Reference	Landscape
Corrientes	Ituzaingo	(Soler, 2003, not published)	wetlands – sugar cane fields and pastures
	Empedrado	(Soler, 2003, not published)	wetlands – sugar cane fields and pastures
	Caa Cati	(Soler, 2003, not published)	wetlands – sugar cane fields and pastures
	Colonia Leibig	(Soler, 2003, not published)	wetlands – sugar cane fields and pastures
	Mercedes	(Soler, 2003, not published)	wetlands – sugar cane fields and pastures
	Bella Vista	(Soler, 2003, not published)	wetlands – sugar cane fields and pastures
	Loreto	(Soler, 2003, not published)	wetlands – sugar cane fields and pastures
	Paso de los libres	(Soler, 2003, not published)	wetlands – sugar cane fields and pastures
	Buena Vista	(Soler, 2003, not published)	wetlands – sugar cane fields and pastures
Santiago del Estero	Colonia Alpina	(Galliari, 2004, SAREM)	
	Paso Cina Cina	(Galliari, 2004, SAREM)	
	Palo Negro	(Galliari, 2004, SAREM)	

continue

Province	Locality	Reference	Landscape
	Las Viboritas	(Orozco, 2005, not published)	Tacural – high pastures - marshlands
	Ruta 34 km 426	(Orozco, 2005, not published)	Road
	Ruta 34 km 427	(Orozco, 2005, not published)	Road
	Ruta 34 km 429	(Orozco, 2005, not published)	Tacural - high pastures - marshlands
	La Providencia	(Orozco, 2005, not published)	Tacural - high pastures - marshlands
	Nueva Lema	(Orozco, 2005, not published)	Tacural - high pastures - marshlands
	Camino Alto	(Orozco, 2005, not published)	Marshland
Córdoba	Dto San Justo	(Haro, 2001)	Marshlands
Santa Fé	Aguara Grande	(Beccaceci, 1993, Haro, 2001)	
	Hersilia	(Galliari, 2004, SAREM)	
	Ambrosetti	(Galliari, 2004, SAREM)	
	Villa Trinidad	(Galliari, 2004, SAREM)	
	Ceres	(Galliari, 2004, SAREM)	
	Montefiore	(Galliari, 2004, SAREM)	
	Arrufo	(Galliari, 2004, SAREM)	
	Ceres	(Orozco, 2005, not published)	Human-altered area
Formosa	East	(Beccaceci, 1992)	
	Pilcomayo	Cercanias a PNRP (Carpinetto, 2005)	Palm tree field – pasture
Chaco	South	(Beccaceci, 1992, Soler & Salvatori, 2003, not published)	Dry Chaco
	Northeast	(Soler & Salvatori, 2003, not published)	Dry Chaco
	Ruta 11 km 17	(Rago, 2005, not published)	Moist Chaco
	Ruta 11 km 1055	(Rago, 2005, not published)	Moist Chaco
Misiones	South	(Chebez, 1994)	
	La Candelaria	(Rinas, 2004, not published)	
Entre Rios	La Paz	(Ceruti, 1990, Sosa, 2003-2005, not published)	Espinal

PARAGUAY

The registers resulting from the assemblage of all data of the last 20 years (interviews, collections and general observations) indicate that the species occur in the whole country, except the northwest corresponding to the Dry Chaco.

About the verified registers (considering just scientific collections, direct observations and vocalizations) it was found that the species is associated to swamps of the following ecoregions: Low Chaco (Oriental Chaco), Cerrado, Atlantic Forest, and Neembucu's swamps.

In Low Chaco the main studied places are: Estancia Trebol, Estancia Sta Maria del Doce, Maroma, PN Tinfunque, and Patino wetland over the transchaco road (Pte. Hayes Department). Here it is also considered the registers for road 3 and the one of Estancia Sombrero of the Cordillera department.

Cerrado's registers are: Serranias de San Luis National Park, Rio Tagatija, Rio Apa (Concepcion), Bella Vista, Cerro Cora National Park (Amambay), Laguna Blanca and Ea Don Luis (San Pedro) and the Reserva Natural del Bosque Mbaracayu in Canindeyu (Zuercher 2001).

The Atlantic Forest's registers correspond to Cerrado areas inside this ecoregion, or to areas similar to flooding savannas or sedimentation river basins and streams. Here it is considered the registers of Reserva Privada Morombi, Reserva Privada Tapyta, and el San Rafael National Park.

In Neembucu wetlands there are valid registers in Estancia Redondo (Neembucu department), Reserva Yabebyry and Yacyreta (Misiones department). There is also an important register from the savannas corresponding to Campos de las Misiones, in Estancia La Graciela (Dpto. de Misiones), it was the observation of a maned wolf in a rice field.

The protected areas of these registers have a total of 862.000 hectares, but if the parks that are not regularized yet are not considered, they have a total of 242.000 hectares divided in six national and private protected areas.

The observed registers suggest the presence of population in ecoregions that have continued areas, as in Low Chaco (+-100.000 km2) in a good conservation condition. They also suggest the presence of important population in Neembucu, the river Pilcomayo flooding area, Pantanal and the sedimentation basin of the Tebicuary River.

URUGUAY

There is register of maned wolf in the west region of Uruguay, where, at the present time, the vegetation is open and disposed in pasture, highly altered by humans with cattle ranching and soybean and rice culture, among others, besides monocultures of exotic forestry species. In the past five (5) years individuals were seen in grassland in Artigas (information given by researchers), Salto e Rivera (inhabitants stories) departments.

A captured of an adult male occurred in 1990 in Rio Negro department, near the Nuevo Berlin city, the local vegetation is of hard access natural pastures (about 2 meters high), with flooded areas and riparian forests along the Uruguay river and its affluents. The animal was captured by a wild boar hunter, who said it was the first time he saw a maned wolf, this specimen was killed and sent to the Natural History Museum of Montevidéu (MNHN-M 3259) (Mones & Olazarri 1990).

In 1990 it was included in the List of Mammal Species of Uruguay; there is no list of threatened species for this country, and no information about the status.

BOLIVIA

Apparently there are continued populations of maned wolf in the natural grasslands in the Beni department in the central region of the country. In the protected area Pampas del Health, northwest of the country near the frontier with Peru, there is the biggest protected population of maned wolf. There is also discontinued population in the Noel Kempff Mercado National Park, in the frontier with Brazil. In the East part of the country, in the Santa Cruz Department, in the cerrado area there is a small density of maned wolf.

Just one estimative of population size was done in the country, in the Noel Kempff Mercado National Park, where it was estimated 120 couples of the species. Nowadays it is believed to be an overestimation.

PERU

There is recent registers of the species in the border with Bolívia at Pampas del Heath (information from Peruvians researchers).

GOALS

PROBLEM 1*: Lack of information about the species occurrence:*

1.1 – Current and historical areas of maned wolf's occurrence

1.2 – Trustworthiness in the historical data

1.3 – Causes of changes in the distribution area of the maned wolf

GOAL 1.1: Get to know, with details, the current and historical areas of the species' occurrence, in two (2) years.

GOAL 1.2: Understand the species' extinction causes in part of its distribution, in three (3) years.

GOAL 1.3: Understand the causes of species' expansion in some areas, in three (3) years.

PROBLEM 2*: Lack of information about spatial ecology and habitat requirement:*

2.1 – Characteristics of the habitat of occurrence

2.2 – Density along the distribution area

2.3 – How the landscape structure turns viable the maned wolf's persistence

2.4 – Tolerance to human alterations

2.5 – Demographic connectivity between maned wolf's populations

GOAL 2.1: Obtain information about the species' demography, in five (5) years.

GOAL 2.2: Obtain the knowledge about spatial ecology of the maned wolf, in five (5) years.

PROBLEM 3*: Lack of information about population genetics:*

3.1 – Genetic structure of maned wolf's populations

3.2 – Genetic diversity of local maned wolf's populations

GOAL 3.1: Get to know the genetic structure of maned wolf's populations, in two (2) years.

GOAL 3.2: Obtain information about the genetic diversity of local maned wolf's populations, in five (5) years.

PROBLEM 4: *Lack of information about population viability:*
4.1 – Local and regional maned wolf's population viability

GOAL 4: Evaluate the local and regional maned wolf's population viability, in five (5) years.

GOALS: Ranking

GOAL 1. Get to know, with details, the current and historical areas of the species' occurrence, in two (2) years.

GOAL 2. Understand the species' extinction causes in part of its distribution, in three (3) years.

GOAL 3. Obtain information about the species' demography, in five (5) years.

GOAL 4. Obtain the knowledge about spatial ecology of the maned wolf, in five (5) years.

GOAL 5. Get to know the genetic structure of maned wolf's populations, in two (2) years.

ACTION PLAN

***PROBLEM 1**: Lack of information about the species occurrence:*

1.1 – Current and historical areas of maned wolf's occurrence

1.2 – Trustworthiness in the historical data

1.3 – Causes of changes in the distribution area of the maned wolf

Goal 1.1: Get to know, with details, the current and historical areas of the species' occurrence, in two (2) years.

ACTION 1.1.1. Create protocols to:
(a) Survey maned wolf occurrence, and
(b) Evaluation of trustworthiness of the historical data about the presence of the species.

Responsible: José Roberto Moreira, Diego Queirolo, and Marco Aurélio Sábato.
Collaborator: ICMBio
Time to accomplish: 2 years
Indicator: Protocols published and available.
Costs: US$20,000
Consequences: Pattern of the information acquirement, improving the integration of data.
Obstacles: Difficulty in the access to not published information and lack of financial resources to publish the protocol.

ACTION 1.1.2. Assemble the available information about the historical geographic distribution of the maned wolf in Brazil, Bolivia, Peru, Paraguay, Uruguay and Argentina.

Responsible: Diego Queirolo, Marianela Velilla Fernandez and Lucía Soler.
Collaborators: ICMBio, IBAMA, Guyra Paraguay and G.A.A.G.
Time to accomplish: 2 years
Indicator: Data bank integrated to the implemented Geographic Information System / Map of historical geographic distribution georeferenced.
Costs: US$30,000
Consequences: Turn viable comparative analysis over the occurrence area of the species.
Obstacles: Difficulty in the access to not published information and lack of financial resources.

ACTION 1.1.3. Assemble the available information about the current geographic distribution of the maned wolf in Brazil, Bolivia, Peru, Paraguay, Uruguay and Argentina.

Responsible: José Roberto Moreira, Marco Aurélio Sábato, Marianela Velilla Fernandez, and Lucía Soler.
Collaborators: Ibama, Guyra Paraguay and G.A.A.G. - Grupo Argentino Aguara Guazú.
Time to accomplish: 2 years
Indicator: Data bank integrated to the implemented Geographic Information System (SIG).
Costs: US$ 30,000
Consequences: Turn viable comparative analysis over the occurrence area of the species.
Obstacles: Difficulty in the access to not published information and lack of financial resources.

Action 1.1.4. Create a webpage to collect information about the current geographic distribution of the maned wolf.

Responsible: José Roberto Moreira, Flávio Rodrigues, Marianela Velilla Fernandez, and Lucía Soler.

Collaborators: ICMBio, Guyra Paraguay, and G.A.A.G. - Grupo Argentino Aguara Guazú.
Time to accomplish: 1 year
Indicator: Implementation of the webpage.

ACTION 1.1.5. Perform field surveys about maned wolf's occurrence in South America.

Responsible: Flávio Rodrigues, Rogério Cunha de Paula, Pablo Cuello, and Maria Luisa Ortiz.

Collaborators: Instituto Pró-Carnívoros, EMBRAPA, Guyra Paraguay, and G.A.A.G. - Grupo Argentino Aguara Guazú.

Time to accomplish: 2 years

Indicator: Data bank integrated to the implemented Geographic Information System (SIG).

Costs: US$200,000

Consequences: Turn possible the knowledge of the precise current areas of the species occurrence.

Obstacles: Lack of financial resources and specialized staff.

ACTION 1.1.6. Compare historical and current distribution to identify species' patterns of expansion and contraction.

Responsible: Diego Queirolo, Marianela Velilla Fernandez, and Lucía Soler.
Collaborators:ICMBio, Guyra Paraguay, and G.A.A.G. - Grupo Argentino Aguara Guazú.
Time to accomplish: 2 years
Indicator: Data bank integrated to the implemented Geographic Information System (SIG).
Costs: US$5,000
Consequences: Identification of patterns of alterations of the species' patterns.
Obstacles: Difficulty in the access to not published information and lack of financial resources.

GOAL 1.2: Understand the species' extinction causes in part of its distribution, in three (3) years.

ACTION 1.2.1. Correlate local species' extinction occurrence and documented environment alterations (link to Action 10 from Threats and Habitat Management Working Group).

Responsible: Diego Queirolo, Maria Luisa Ortiz, and Lucía Soler.
Collaborators: ICMBio, Guyra Paraguay, and G.A.A.G.
Time to accomplish: 5 years
Indicator: Published articles
Costs: US$10,000
Consequences: Identification of possible causes of species' local extinction.
Obstacles: Lack of financial resources and knowledge.

GOAL 1.3: **Understand the causes of species' expansion in some areas, in three (3) years.**

Action 1.3.1. Correlate the occurrence of species' local expansion and documented environment alterations.

Responsible: José Roberto Moreira, Maria Luisa Ortiz and Lucía Soler.
Collaborators: ICMBio, Guyra Paraguay, and G.A.A.G.
Time to accomplish: 3 years
Indicator: Published articles
Costs: US$ 5,000

Consequences: Identification of possible causes of species' local extinction
Obstacles: Lack of financial resources and knowledge.

Problem 2: Lack of information about spatial ecology and habitat requirement:

2.1 – Characteristics of the habitat of occurrence

2.2 – Density along the distribution area

2.3 – How the landscape structure turns viable the maned wolf's persistence

2.4 – Tolerance to human alterations

2.5 – Demographic connectivity between maned wolf's populations

GOAL 2.1: Obtain information about the species' demography, in five (5) years.

ACTION 2.1.1. Develop techniques of abundance and density estimation of the species.

Responsible: Flávio Rodrigues.
Collaborators: Instituto Pró-Carnívoros and ICMBio
Time to accomplish: 5 years
Indicator: Protocols published and available.
Costs: US$ 50,000
Consequences: Turn viable the species monitoring.
Obstacles: Lack of financial resources and specialized staff.

ACTION 2.1.2. Develop studies about species' population dynamics and structure.

Responsible: Flávio Rodrigues, Rogério Cunha de Paula, and Joaquim de Araújo Silva.
Collaborators: Instituto Pró-Carnívoros and ICMBio
Time to accomplish: 5 years
Indicator: Published articles.
Costs: US$ 750,000
Consequences: Obtain information about population biology.
Obstacles: Lack of financial resources, knowledge and specialized staff.

ACTION 2.1.3. Monitor maned wolf's populations particularly threatened or in risk areas.

Responsible: Flávio Rodrigues, Rogério Cunha de Paula, Joaquim de Araújo Silva, Lucía Soler, and José Luis Cartes.
Collaborators: Instituto Pró-Carnívoros, ICMBio, IBAMA, Guyra Paraguay, and G.A.A.G.
Time to accomplish: 5 years
Indicator: Monitoring started.
Costs: US$ 500,000
Consequences: Turn viable the detection of the status of maned wolf's populations threatened or in risk areas.
Obstacles: Lack of financial resources and specialized staff.

GOAL 2.2: Obtain the knowledge about spatial ecology of the maned wolf, in five (5) years.

ACTION 2.2.1. Develop researches on landscape ecology and habitat requirement.

Responsible: Joaquim de Araújo Silva, Rogério Cunha de Paula, Pablo Cuello, and José Luis Cartes.
Collaborators: Instituto Pró-Carnívoros, ICMBio, Ibama, Guyra Paraguay, and G.A.A.G.
Time to accomplish: 5 years
Indicator: Studies on landscape ecology started.
Costs: US$ 750,000

Consequences: Identification of patterns in habitat usage, landscape and tolerance to human alterations.
Obstacles: Lack of financial resources, knowledge and specialized staff.

***PROBLEM 3**: Lack of information about population genetics:*

3.1 – Genetic structure of maned wolf's populations

3.2 – Genetic diversity of local maned wolf's populations

GOAL 3.1: **Get to know the genetic structure of maned wolf's populations, in two (2) years.**

ACTION 3.1.1. Develop, improve and standardize informative molecular markers to maned wolf.

Responsible: Eduardo Eizirik
Collaborators: PUC - Rio Grande do Sul and ICMBio
Time to accomplish: 2 years
Indicator: Markers developed and available.
Costs: US$ 20,000
Consequences: Turn viable genetic studies of all levels for the species.

ACTION 3.1.2. Collect samples of biologic material, representing maned wolf wild populations, using adequate protocols.

Responsible: Ronaldo Morato, Marianela Velilla Fernandez, and Marcela Orozco.
Collaborators: PUC - Rio Grande do Sul, ICMBio, IBAMA, Guyra Paraguay, and G.A.A.G.
Time to accomplish: 2 years
Indicator: Samples collected and available to researchers.
Costs: US$ 20,000
Consequences: Turn viable genetic studies of all levels for the species.
Obstacles: Lack of integration and consciousness of researchers, protocols communication, financial resources and technical staff.

ACTION 3.1.3. Perform studies about genetic structure of maned wolf's populations.

Responsible: Eduardo Eizirik, Daniela Salim, María de la Cruz Pino, and José Luis Cartes.
Collaborators: PUC - Rio Grande do Sul, ICMBio, Guyra Paraguay, and G.A.A.G. - Grupo Argentino Aguara Guazú.
Time to accomplish: 5 years
Indicator: Results published.
Costs: US$ 200,000
Consequences: Verify the genetic differentiation level between local and regional populations.

Obstacles: Lack of technique development (Items 3.1.1 e 3.1.2) and financial resources.

GOAL 3.2: Obtain information about the genetic diversity of local maned wolf's populations, in five (5) years.

Action 3.2.1. Perform studies about genetic diversity in wild populations based on focused local sampling.

Responsible: Eduardo Eizirik, María de la Cruz Pino and José Luis Cartes.
Collaborators: PUC - Rio Grande do Sul, ICMBio, Guyra Paraguay, and G.A.A.G. - Grupo Argentino Aguara Guazú.
Time to accomplish: 5 years
Indicator: Initial results published.
Costs: US$ 200,000
Consequences: Characterize the natural levels of variability in different sizes of maned wolf's populations.
Obstacles: Lack of technique development (Items 3.1.1 e 3.1.2) and financial resources.

PROBLEM 4: *Lack of information about population viability:*

4.1 – Local and regional maned wolf's population viability

GOAL 4: **Evaluate the local and regional maned wolf's population viability, in five (5) years.**

ACTION 4.1. Perform an International Workshop about the species to re-evaluate the viability and status of local and regional populations, assembling the data from the actions above.

Responsible: CENAP/ICMBio, Instituto Pró-Carnívoros, Guyra Paraguay, and G.A.A.G. - Grupo Argentino Aguara Guazú.

Time to accomplish: 5 years (2010)

Indicator: Workshop performed.

Costs: US$ 30,000

Consequences: Review of the Maned Wolf PHVA Workshop (October 2005) and establishment of new actions to the species conservation.

Obstacles: Financial resources, lack of integration and technical providing to perform the actions of the first workshop.

Final Comment: After the last plenary discussion, a discussion with the WORK GROUP OF THREATS AND HABITAT MANAGEMENT was done to match the actions of both groups. This resulted in the exclusion of one of the actions of the WORK GROUP OF THREATS AND HABITAT MANAGEMENT, which was already included in a detailed way by GROUP 4, and also in a link between the actions of both groups to correlate the effects of environment change with local extinction or maned wolf's population declines.

WORK GROUP

Environmental education, social aspects and economic alternatives

Members

Abel Fleita (Huellas), Argentina
Ângela Alves Lutterbach (Fundação Zoo-Botânica de Belo Horizonte), Brazil
Daniela Salim (UnB - Universidade de Brasilia), Brazil
Devra Kleiman (Smithsonian Inst./National Zoo), USA
Fernanda Cavalcanti de Azevedo (Instituto Pró-Carnívoros), Brazil
Gerald Post (Oncology and Hematology Center), USA
Jean Pierre Santos (Instituto Pró-Carnívoros), Brazil
Marcelo Ximenes Bizerril (UnB - Universidade de Brasilia), Brazil
Maria Soledad Rosso (Zoológico de la Ciudad de Buenos Aires), Argentina
Rose Lílian Gasparini Morato (CENAP/ICMBio), Brazil

PROBLEMS: Brainstorm

1. Who and how (methodology) the educative programs will be done. Necessity of capacitation of people (from the groups) that will participate in environmental education programs
2. Lack of communication and integration between people that do environment education
3. Cultural differences between educator and communities.
4. Lack of exchange (communication) between researchers and environmental educators. Need of results and acquired knowledge communication.
5. Lack of exchange between environmental education work groups and the community.
6. Lack of knowledge about the appropriated environmental education methods/techniques to reach the different target publics
7. Lack of population interest for species conservation.
8. How is it possible to improve population attitude toward the maned wolf?
9. Damages to communities caused by the maned wolf (economic loss).
10. Community perception about maned wolf habits, the ideas that it is a domestic animal's predator. Culture vision that the species represents.
11. Erroneous idea of competition between maned wolf and hunters for common preys, i.e. capybaras, what makes hunters kill maned wolves.
12. Beliefs: people believe that maned wolf's body parts have "magical powers".

13. Even with the existing Law exigency, environmental education is still little discussed in schools. In addition, the programs in schools do not include education for conservation.
14. Lack of interest of the media for the native fauna in the countries where the maned wolf occurs.
15. The species occurs in areas of increasing urban and farming development, areas of high economic value.
16. Lack of interaction between maned wolf holders and wild research groups.
17. Lack of resources, knowledge and interest of zoological institutions to improve the work with environmental education related to maned wolf.
18. Lack of communication between institutions that hold captive maned wolves about environmental education programs.
19. Lack of financial and human resources and nee of prioritizing the environmental education by the institutions (captivity, governmental, research groups)
20. Absence of governmental involvement in environmental issues.

PROBLEMS: Definition

1. There are few capacitated people to work in environmental education (D)
2. We don't know the best method/way to do and evaluate environmental education. (D)
3. There are great culture differences between the work groups and the communities they try to attend. (C)
4. There is little communication between the groups that do environmental education and between them and the field researchers. (B)
5. The communities do not know and do not understand what research groups do. (B)
6. Lack communities' commitment with conservation. (A) (C).
7. The population doesn't have interest for maned wolf's conservation. (B) (C)
8. Population's attitude toward the maned wolf's conservation is not nice. (A) (B) (C)
9. Economic loss caused by wild animals' predation of domestic animals. (A)
10. Population perception about the species and predation of domestic animals; the maned wolf is always considered guilty. (C)
11. Maned wolf competes with population for natural preys. (A).
12. There are beliefs on magic powers associated to body parts of the animal, as the tail, paw and eye. (C)
13. School program do not include education for conservation. (D)
14. There is still little interest of the media for Brazilian fauna. (B) (D)
15. The species occurs in areas of economic value due to farming. (A).
16. Little communication between zoological institutions and between them and field researchers. (B)
17. It is needed that institutions (zoological, governmental, research groups) give priority of financial and human resources for environmental education. (E)
18. Population has difficulties of coexistence with the species and wild fauna in general. (A) (C)
19. Lack of law knowledge (community, researchers, educators) (B) (D) (E)
20. There is no sufficient information/knowledge about the species' biology in natural and human altered areas. (D)
21. Expansion of disordered ecological tourism. (A) (E)
22. Difficulties in having them implementation and maintenance of Conservation Units accepted by communities. (A) (B) (C) (E)
23. Lack of governmental ability to develop social economic alternatives to conservation and to mediate conflicts. (E)
24. Conservation research and environmental education projects have not been considering the local culture. (C) (D)
25. Insufficient researches in environmental education. (D).
26. There is little evaluation of environmental education projects and programs. (D)

PROBLEMS: setting categories

1. Social-economic problems

The species occurrence in areas of economic interest brings conflicts, such as: domestic animals' predation, competition for natural preys and restrictions for expansion of farming frontiers. These facts, associated to the lack of community's interest, takes to a negative attitude toward the species and habitat's conservation. Even when the attitude is positive, as in the ecological tourism, if it is not ordered in an adequate way, it can be damaging.

2. Communication problems

In all levels, communication has a very important role, but it is not the solution of all environmental problems, it is though, a way that should be considered since the relation between the actors (researchers, educators, zoological institutions, governmental agencies, non governmental organization, communities and "the ones that employ the law") to sensitize the population and, in consequence, raise its interest and commitment in conservation.

3. Cultural problemas

Due to the differences between the work groups and the communities, there is difficulty in conciliate research/ environmental education work and the necessities and cultures of local communities. Because of the absence of interest and commitment of the community about the conservation of the maned wolf, they do not have a good relationship with the species and promote difficulties in the implementation and maintenance of Conservation Units. Many people that visit zoological institutions do so for hobby, not searching for environmental education.

4. Capacitation problems in environmental education and research

There is little interest in participating and few capacitated people to perform researches and programs in formal and informal environmental education. It is not known the best methods of work and no guarantee of precise results. There is lack of sufficient information about the species biology in natural and human altered areas. Many zoological institutions and maned wolf holders have no resource for environmental education.

5. Political and legislation problems

The implementation and maintenance process of protected areas is not easily accepted by communities, and the institutions involved do not have the ability to face and mediate conflicts. In addition, financial and human resources are not taken as priority to turn this process viable. About the community, many times this one does not follow the existent laws, although they are present. The Brazilian formal education law ('Lei de diretrizes e base') does not guarantee that the education about conservation of Brazilian fauna is considered.

PROBLEMS: ranking

1. Social-economic problems (**14 points**).
2. Communication problems (**29 points**).
3. Capacitation problems in environmental education and research (**29 points**).
4. Cultural problems (**31 points**).
5. Political and legislation problems (**32 points)**.

Method of Ranking: Each member evaluated the categories in urgency order, and gave them values from 1 to 5. The most urgent category received 1 and the less urgent, 5. After all, the values were added by each category and the levels of urgency (the ranking) were defined.

Compilation and data analysis

1 Social-economic problems

Facts	Suppositions	Lack of Information
• Maned wolf is a predator of domestic animals (1) • Among domestic animals, only chickens are preys of the maned wolf. • The maned wolf is not the lone responsible for domestic animals predation. • Domestic animals represent a small part of maned wolf's diet (1). • Maned wolves are killed because of domestic animals predation (2) • Maned wolf might eat carcasses (3) • Farmers do not receive financial incentives for conservation • The maned wolf is killed due to its competition with human population for natural preys (4) • Farming area expansion reduces maned wolf's habitat (5) • The species occurs in human altered areas of high economic interest (6) • The ecotourism is indicated as one of the main economical alternatives to natural areas (7) • The disordered ecotourism causes negative impacts to maned wolf's conservation (8). • The roads construction has not been considering the environmental impacts, bringing risks to fauna survival (i.e. maned wolf). • There are difficulties in implementing economical alternatives to the traditional practices (9)	• As much as the human alterations increase, the predations over domestic animals also increase. • People that see the maned wolf eating carcasses associate the animal to predations. • People do not have financial resources to protect their animals. • Vague information in Argentina.	• •Quantitative and qualitative analysis of the economic loss. •How representative are domestic preys in the maned wolf's diet\ •More data about ecotourism impact

2 Communication problems

Facts	Suppositions	Lack of Information
• There is little communication between researchers, educators, zoological institutions and government, inside each group and between them (9). • The media is still little used. • The media have positive and negative influence in people attitude toward conservation. • The media talks little about the subject "maned wolf" and/or "cerrado's conservation" • The capacitation of researcher to use/work with the media is still insufficient. • The scientific research product generally do not reach (or take too long to reach) the communities (10). • The communities, in general, do not feel participating in conservation projects • Many times the wildlife researcher is not concerned about meeting the communities and knowing what they have to say (9). • Many unpublished data (9). • Little financial resources to produce informative material in popular language (10). • Lack of educative signs for fauna's conservation (i.e. roads)	• **Educators do not sufficiently search for scientific information.** • **Researchers are not concerned in producing more accessible publishing**	• Evaluate the frequency and the type of information about maned wolf conservation in the media. • Specific studies about the subject and its relationship with the species' conservation.

3 Cultural problems

Facts	Suppositions	Lack of Information
• There are great cultural differences between educators/researchers and communities (12) • These differences can turn unviable the educational actions (12) • There are beliefs that attribute mystic and medical powers to some parts of the maned wolf's body (2) • Many people believe that the maned wolf is a potential and dangerous predator, what makes difficult the protection of the species (16) • Many people still think animals exist just for human use, so that they can do whatever they want with them.	• The beliefs delay maned wolf's conservation • The communities show interest in knowing and having a good relationship with the specie. • The majority of researchers and educators has an urban culture and do not know life alternatives in contact with nature.	• It is unknown the localities of occurrence of the many beliefs about the maned wolf • It is unknown the motivations to these beliefs • It is not known the impact of these beliefs in conservation • Data and ways are needed to work a better coexistence of communities and maned wolf and its habitat • There is lack of data about the community attitude toward the maned wolf

4 Capacitation problems in environmental education and research

Facts	Suppositions	Lack of Information
• Environmental education is not part of the researcher education (9) • In his/her education, the researcher s no motivated to have interest on environmental education (9) • There are just a few formation courses in environmental education, specially the ones focused in wildlife (11) • The environmental educator is not sufficiently prepared to perform researches, and many times to work with rural communities (11) • Environmental education works with subjective aspects and is of difficult evaluation (12)	• For conservation, environmental education is less valued than scientific research. • People have less interest in working with environmental education because of the subjectivity of the practice and results. • The majority of the funding agencies give more value (or even demand) projects that contemplate actions of community involvement, but the groups are not yet prepared to this demand.	• Maned wolf's diet (Argentina) • Interaction between community and the species. • Evaluation of the environmental education courses • Data about conservation researchers' perception of environmental education.

5 Political and legislation problems

Facts	Suppositions	Lack of Information
• Communities have difficulties in giving value to natural area's conservation (13) • The implementation of protected areas have been causing negative impacts to the communities (14/15) • The elaboration and implementation of conservation politics are not enough discussed with the population. (15) • The Brazilian environmental legislation is good, but, many times, is not adequately prescribed and followed in Brazil (9) • Argentina's environmental legislation is not good (4) • Fiscalization actions are not sufficient, neither efficient (9) • In Argentina, the maned wolf is "specially protected" just locally, in three regions, and not nationally (4) • There are little politicians and influent people committed with conservation (environmental) causes, and the access to them is difficult. (9) • The formal educational legislation does not guarantee the contemplation of the native fauna conservation teaching (Brazil and Argentina) • Many zoological institutions and maned wolf holders have no financial or personal resources to environmental education.	••The political corruption restrains the maned wolf conservation. • The existing resources for conservation in Brazil are not adequately distributed. • The processes of financial resources destination are exigent and complicated, turning them restricted to a few professionals prepared for fundraising.	••Lack of sufficient researches to investigate a way of diminishing/ reducing the negative impacts of the implementation of protected areas over the communities. • Lack of knowledge of how to influence/ convince politics, people with power and money, to get committed with the environment cause. • Knowledge about the situation of these aspects in the other countries where the species occurs.

GOALS

The goals are already ranked by priority, followed by their sub goals:

PROBLEM 4: *Capacitation problems in environmental education and research.*

GOAL 1: Increase the education efficiency in maned wolf's conservation:

- Increase the participation and capacitation of professionals in environmental education programs
- Increase environmental education researches for maned wolf's conservation
- Include native fauna topics in the formal study
- Develop techniques to verify the efficiency of the used methods
- Apply more resources for environmental education in zoological institutions and breeders

PROBLEM 5: *Political and legislation problems.*

GOAL 2: Increase the elaboration and implementation of public politics for maned wolf conservation.

PROBLEM 1: *Social-economics*

GOAL 3: Contribute to minimize the social-economic conflicts between the communities and the actions for the maned wolf's conservation.

- Reduce maned wolf's predation over domestic animals
- Modify people perception of the maned wolf as a competitor
- Reduce wild animals hunting (maned wolf's natural preys)
- Increase community's interest about maned wolf's conservation and biology
- Promote the adequate use of ecotourism in benefit of the maned wolf and the community
- Create economical incentives to farmers to conserve the maned wolf
- Reduce maned wolf's road kills

PROBLEM 2: *Communication.*

GOAL 4: Increase communication between the different actors involved and affected in the activities for the maned wolf's conservation.

- Increase researches and conservation actions publishing and turn them accessible
- Increase community participation in conservation actions
- Increase communication and interaction methods between the actors

PROBLEM 3: *Cultural.*

GOAL 5: Reduce the negative impact cause by the maned wolf due to cultural differences.

- Reduce maned wolf's deaths due to popular beliefs
- Change people's negative perception of the maned wolf as predator and aggressive

ACTION PLAN

PROBLEM 4: *Capacitation problems in environmental education and research*

GOAL 1: Increase the education efficiency in maned wolf's conservation.

- *Increase the participation and capacitation of professionals in environmental education programs*
- *Increase environmental education researches for maned wolf's conservation*
- *Include native fauna topics in the formal study*
- *Develop techniques to verify the efficiency of the used methods*
- *Apply more resources for environmental education in zoological institutions and breeders*

ACTION 1.1 Develop a data bank with the available information about education for maned wolf's conservation in all the countries where the species occurs in the wild and captivity.

Responsible: Marcelo Bizerril, Cosette Barrabas Xavier da Silva, Maria Soledad Rosso, Nucharin Songsassen and Gerald Post.

Collaborators: Universities (UnB - Universidade de Brasília & PUC - Minas Gerais), zoological institutions (Zoos of São Paulo, Sorocaba, Estoril, Fundação Zoo-Botânica de Belo Horizonte), CBMM, G.A.A.G. - Grupo Argentino Aguara Guazú, and CRC - Smithsonian Institution/National Zoo, United States.

Time to accomplish: 1 year

Indicator: New available website / information assembled

Costs: US$ 500,00.

Consequences: Increase in the availability of environmental education information

Obstacles: Time availability of the responsibles and collaborators.

ACTION 1.2 Perform a survey about the existing environmental education courses and publish to the public interested in conservation.

Responsible: Ângela Lutterbach and Maria Soledad Rosso.

Collaborators: UnB - Universidade de Brasília, Fundação Zoo-Botânica de Belo Horizonte, Fundação Biodiversitas, Tríade and GAAG - Grupo Argentino Aguará Guazú.

Time to accomplish: 1 year.

Indicator: Publish the list of courses in 20 communication channels.

Costs: Human resources.

Consequences: Increase in the availability of environmental education information.

Obstacles: Time availability of the responsibles and collaborators.

ACTION 1.3 Develop didactic material about maned wolf and its habitat and make them to be distributed in the formal and informal education, and also to the Education Secretary and other public agencies, by:

- *1 book/chapter to formal education about maned wolf and its habitat (already developed by Marcelo Bizerril): Vivendo no Cerrado e aprendendo com ele – Living in Cerrado and learning with it. Ed. Saraiva, São Paulo, 2004)*
- *1 book of children story about the maned wolf and its habitat*
- *1 educative primer to the communities, zoological institutions, protected areas (there are already some of them - AZA Species Survival Plan (SSP) Maned Wolf).*

- *Videos/DVDs about the maned wolf and its habitat*
- *Educative games*

Responsible: Marcelo Bizerril, Cosette Barrabas Xavier da Silva, Ângela Lutterbach, Cleyde Chieregatto, Rose Gasparini Morato, Laura Teodoro Fernandes, Soledad Rosso (Zoológico de Buenos Aires, Argentina), Marianela Velilla Fernandez (Guyra Paraguay, Paraguai) and Melissa Rodden.

Collaborators: Formal education professionals, zoological institutions on the species' occurrence areas.

Time to accomplish: 5 years.

Indicator: Material produced.

Costs: Establish partnerships with governmental agencies, non governmental organizations, zoological institutions and private institutions committed with the environmental cause.

Consequences: Increase the efficiency of the education for maned wolf's conservation.

Obstacles: Difficulties to obtain the financial resources to produce the material and lack of interest of this area's professionals.

ACTION 1.4 Develop and implement 1 extension/formation course to researchers and other professionals that act in maned wolf's conservation.

Responsible: Devra Kleiman.

Collaborators: IPÊ - Instituto de Pesquisas Ecológicas (Cláudio e Suzana Pádua) and UnB (Marcelo Bizerril).

Time to accomplish: 3 years.

Indicator: 1 course developed and implemented.

Costs: US$ 50,000.

Consequences: Increase the information availability about environmental education

Obstacles: Time availability from the responsibles.

ACTION 1.5 Develop a unified educational politic inside zoological institutions that hold maned wolves, for each country, by promoting a workshop.

Responsible: Ângela Lutterbach, Cleyde Chieregatto (Brazil) and Soledad Rosso (Argentina).

Collaborators: Captive institutions (Zoos of São Paulo, Sorocaba, Estoril, Fundação Zoo-Botânica de Belo Horizonte), CBMM, GAAG - Grupo Argentino Aguará Guazú and CRC - Smithsonian Institution/National Zoo, United States.

Time to accomplish: 2 years.

Indicator: A document that contains the methodology and goals unified, and that will be delivered to all zoological institutions.

Costs: US$ 20,000.

Consequences: Unification for environmental education in the zoological institutions.

Obstacles: Lack of human and financial resources to promote the workshop.

ACTION 1.6 Implement a research project to evaluate the existing environmental education activities, in two captive institutions, two conservation projects and two schools near Conservation Units.

Responsible: Marcelo Bizerril, Cosette Barrabas Xavier da Silva, Cecília Pessutti, Rodrigo S. P. Jorge (Brazil), Soledad Rosso and Abel Fleita (Argentina).

Collaborators: Zoological institutions, CBMM, GAAG - Grupo Argentino Aguará Guazú and CRC - Smithsonian Institution/National Zoo, United States.

Time to accomplish: 3 years.

Indicator: A report with suggestions to improve the activities.

Costs: Financial and human resources.

Consequences: Improvement in education activities.

Obstacles: Difficulties on commitment from institutions towards the research.

PROBLEM 1: *Social-economics*

GOAL 3: Contribute to minimize the social-economic conflicts between the communities and the actions for the maned wolf's conservation.

- *Reduce maned wolf's predation over domestic animals*
- *Modify people perception of the maned wolf as a competitor*
- *Reduce wild animals hunting (maned wolf's natural preys)*
- *Increase community's interest about maned wolf's conservation and biology*
- *Promote the adequate use of ecotourism in benefit of the maned wolf and the community*
- *Create economical incentives to farmers to conserve the maned wolf*
- *Reduce maned wolf's road kills.*

Observation: Many actions in this GOAL contemplate actions related to cultural problems: "Reduce the negative impact caused by the maned wolf due to cultural differences".

ACTION 3.1 Prepare an informative material (folder) to be distributed in protected areas, tourism agencies, lodges and hotels, containing orientations about how to reduce possible ecotourism's negative impacts over maned wolf's populations, on its occurrence areas.

Responsible: Fernanda Cavalcanti de Azevedo, Marcelo Bizerril, Soledad Rosso, Abel Fleita and Melissa Rodden.

Collaborators: CRC - Smithsonian Institution/National Zoo, Estados Unidos, GAAG - Grupo Argentino Aguará Guazú, Cenap/ICMBio, tourism agencies, hotels and lodges.

Time to accomplish: Immediately.

Indicator: 100.000 informative folders produced and distributed.

Costs: Financial (US$10.000) and human resources.

Consequences: Reduce ecotourism impact over maned wolf.

Obstacles: Difficulties to obtain the financial resources.

ACTION 3.2 Develop specific orientation program to farmers about how to prevent domestic animal predation by the maned wolf using questionnaires and interviews, primers, presentations and related courses.

Responsible: Rose Gasparini Morato, Rogério Cunha de Paula, Cosette Barrabas Xavier da Silva, José Roberto Moreira, Soledad Rosso and Abel Fleita.

Collaborators: Cenap/ICMBio, Ibama-PR/Ibama-Sede, and Instituto Pró-Carnívoros.

Time to accomplish: Immediately and permanent.

Indicator: Verified data about the real effects of predation.

Costs: Financial and human resources.

Consequences: Decrease of predation impacts upon domestic animal.

Obstacles: Non participation of farmers.

ACTION 3.3 Publish and implement alternative methods to prevent domestic animals predation by the maned wolf.

Responsible: Rogério Cunha de Paula, Rose Gasparini Morato, Cosette Barrabas Xavier da Silva, José Roberto Moreira, Otávio Borges Maia, Soledad Rosso and Abel Fleita.

Collaborators: ICMBio, IBAMA, Acen, IUCN/SSC Canid Specialist Group, GECM and GAAG - Grupo Argentino Aguará Guazú.

Time to accomplish: 1 year

Indicator: Records of animals attacked before and after the implementation of preventive methods and the elaboration of a conflict form.

Costs: Financial and human resources.

Consequences: Decrease in domestic animals predation by maned wolf, and decrease in wolves persecution/deaths.

ACTION 3.4 Develop a certifying stamp to farmers that support maned wolf conservation.

Responsible: Rogério Cunha de Paula, Ronaldo Morato, Flávio Rodrigues, Otávio Borges Maia, Cosette Barrabas Xavier da Silva, Soledad Rosso and Abel Fleita.

Collaborators: Instituto Pró-Carnívoros, ICMBio, and G.A.A.G. - Grupo Argentino Aguara Guazú.

Time to accomplish: 1 year.

Indicator: Number of certified farmers.

Costs: Financial and human resources.

Consequences: Preservation and conservation of maned wolf.

Obstacles: Difficulties to obtain the financial resources.

ACTION 3.5 Identify and contact ecotourism agencies to suggest to them to include in their itineraries, places where the species occurs.

Responsible: Devra Kleiman and Gerald Post.

Time to accomplish: 1 year.

Indicator: : Increase of 50% in tourist visiting in protected areas, within maned wolf occurrence areas.

Consequences: Increase society's knowledge about the maned wolf and its habitats

PROBLEM 2: *Communication.*

GOAL 4: Increase communication between the different actors involved and affected in the activities for the maned wolf's conservation:

- *Increase researches and conservation actions publishing and turn them accessible*
- *Increase community participation in conservation actions*
- *Increase communication and interaction methods between the actors*

Observation: It was included in GOAL 21, from the Work Group *Threats and Habitat Management:* "Promote the integration between research institutions, fomentation, public power and civil society to optimize the actions for the conservation of the maned wolf and its habitat (5 years)".

ACTION 4.1 Send a recommendation letter to all conservation/research projects on maned wolf to seek for local community participation since the beginning of the project.

Responsible: Ronaldo Morato, Rogério Cunha de Paula and Cecília Pessutti.

Collaborators: Cenap/ICMBio, Instituto Pró-Carnívoros, Fundação Zoo-Botânica de Belo Horizonte, PUC - Minas Gerais, PUC - Rio Grande do Sul, UFMG - Universidade Federal de Minas Gerais, UnB - Universidade de Brasília and Unesp - Universidade do Estado de São Paulo.

Time to accomplish: Permanent.

Indicator: Published letter.

Consequences: Community involvement/commitment in maned wolf conservation projects.

Obstacles: Lack of interest from researchers directly involved in the projects.

ACTION 4.2 Develop a database that complements the webpage, about governmental and non-governmental organizations that fund conservation actions and projects in maned wolf occurrence areas.

Responsible: Rose Gasparini Morato, Marcelo Bizerril, Melissa Rodden, Soledad Rosso and Abel Fleita.

Collaborators: Instituto Pró-Carnívoros, ICMBio, CRC - Smithsonian Institution/National Zoo, Estados Unidos, IPÊ - Instituto de Pesquisas Ecológicas and GAAG - Grupo Argentino Aguará Guazú.

Time to accomplish: 1 year

Indicator: Available and updated database in the webpage.

Costs: Human resources to perform research, to develop a webpage, and maintain updated.

Consequences: Increase the number of actions and researches related to maned wolf'conservation.

Obstacles: Institutional resistance on publishing their names in a webpage.

ACTION 4.3 Encourage researchers and educators to participate in cultural, religious and institutional events in the actuation areas, to identify and interact with community leaders to guarantee the projects' success.

Responsible: Lucía Soler, Cosette Barrabas Xavier da Silva and Marcelo Bizerril.

Collaborators: Research projects coordinators, GAAG - Grupo Argentino Aguará Guazú and Fundação Zoo-Botânica de Belo Horizonte.

Time to accomplish: 1 year.

Indicator: Communication of the information to the communities by the leaders.

Costs: Financial and human resources.

Consequences: Increase the participation/involvement of community leaders on maned wolf conservation.

Obstacles: Lack of community interest restraining this participation

ACTION 4.4 Intensify the commitment from research projects' coordinators on making available accessible informative material to be published in local and national communication media.

Responsible: Flávio Rodrigues, Abel Fleita e Marcelo Bizerril.

Collaborators: Research projects' coordinators, press media, television and radio and GAAG - Grupo Argentino Aguará Guazú.

Time to accomplish: Permanent.

Indicator: Informative material ready.

Costs: Financial and human resources.

Consequences: Increase the information disclosure generated by research projects.

ACTION 4.5 Encourage the responsibles for maned wolf conservation/research projects to promote annual debates between local community and the Public Authority (Power) to integrate the research projects actions.

Responsible: Rogério Cunha de Paula, Flávio Rodrigues, Marcelo Bizerril, Abel Fleita and Ângela Lutterbach.

Collaborator: Research projects' coordinators, community, Public Authorithy e GAAG - Grupo Argentino Aguará Guazú.

Time to accomplish: Immediately..

Indicator: Recommendation letter and presence list..

Custo: Financial and human resources.

Consequences: Increase the information disclosure generated by research projects.

PROBLEMA 3: *Cultural*

GOAL 5: Reduce the negative impact caused by maned wolf due to cultural differences.

- *Reduce maned wolf's deaths due to popular beliefs*
- *Change people's negative perception of the maned wolf as predator and aggressive*

ACTION 5.1 Produce educative material to deliver in internet pages and hunting-specialized stores.

Responsible: Soledad Rosso and Abel Fleita.

Collaborator: GAAG - Grupo Argentino Aguará Guazú.

Time to accomplish: 1 year.

Indicator: 10.000 folders of educative material published and distributed.

Costs: Financial (US$5,000) and human resources.

Consequences: Decrease of maned wolf hunting.

Obstacles: The acceptance of people involved in hunting maned wolf.

WORK GROUP
Ex situ conservation

Members

Ana Maria Beresca (Zoológico de São Paulo, Brazil)
Cecília Pessutti (Zoológico de Sorocaba, Brazil)
Cleyde Chieregatto (Zoológico Estoril de São Bernardo do Campo, Brazil)
Francisco Rogério Paschoal (SZB - Sociedade de Zoológicos do Brazil)
Joares May Júnior (Instituto Pró-Carnívoros, Brazil)
Laura Teodoro Fernandes (CBMM, Brazil)
Marcelo Lima Reis (DIBIO/ICMBio-DF, Brazil)
María de la Cruz Pino (Zoológico de Buenos Aires & G.A.A.G., Argentina)
Melissa Rodden (CRC-Smithsonian Institution/National Zoo, United States)
Nucharin Songsassen (CRC-Smithsonian Institution/National Zoo, United States)
Rosana Nogueira de Morais (UFPR - Universidade Federal do Paraná, Brazil)
Valéria do Socorro Pereira (Fundação Zoobotânica de Belo Horizonte, Brazil)
Viviana Quse (Fundación Temaikén & G.A.A.G., Argentina)

PROBLEMS: Brainstorm

1.	Low reproductive success.
2.	Lack of standardized management.
3.	Inadequate nutrition, lack of data on nutrition.
4.	Frequent sanitary problems.
5.	Lack of pattern in protocols.
6.	Excess of animals coming from wildlife.
7.	Small availability of space.
8.	Conflicts on defining who is the owner of the animal.
9.	Deficiency on environmental education.
10.	Lack of information broadcasting.
11.	Low quality of enclosures.
12.	Excess of animals.
13.	Lack of integration between zoos.
14.	Lack of funds.
15.	Management of animals to rehabilitation and release.
16.	Lack of captive environmental enrichment.
17.	Capable human resources.
18.	Media.
19.	Management of maned wolf offspring.

20. Need of a global management of population
21. Better communication between groups.
22. Better use of biologic samples.
23. Difficulties related to laws.
24. Re-introduction.
25. Controlled reproduction.
26. Lack of participation or involvement of directors of the maned wolf holders.
27. Transportation.
28. Genetics.
29. Assisted reproduction.
30. Review of Brazilian protocols of management.
31. Basic research on reproduction.
32. Technology transference and material acquirement.
33. Lack of commitment from institutions on giving information to the management plans.
34. Lack of organized data records on Argentina, Paraguay and Bolivia.
35. Need of an outline guide of management to give information in Argentina.
36. Lack of interchange between professionals from wild and from zoos, alert to the possibilities of exchanges between them.
37. Logistics of biologic samples.
38. Give more importance to directors and staff from zoological institutions in the decision process.
39. Lack of commitment on daily registers of animals at zoos.
40. Spread of information on the current researches.

PROBLEMS: Setting Categories and Priorities

1. Management (Husbandry) and Register
Low reproductive success.
Inadequate nutrition, lack of data on nutrition.
Lack of pattern sanitary practice.
Excess of animals coming from wildlife.
Low availability and quality of captive space.
Lack of protocols to rehabilitation management.
Lack of implementation of environment enrichment programs.
High mortality rates of maned wolf offspring.
Lack of knowledge to implement animals' reintroduction projects.
Lack of uniformity of management .
Lack of pattern to protocols.
Lack of available space.
Conflicts related to defining who is the owner of the animal.
Low quality of enclosures.
Excess of animals.
Lack of protocols to manage the animals to rehabilitation and release.
Lack of captive environmental enrichment.
Lack of capable human resources.
Inadequate management of maned wolf offspring.
Lack of a population global management .
Controlled reproduction.
Necessity of reviewing the Brazilian management protocols.
Lack of organized data records on Argentina, Paraguay and Bolivia.
Lack of orientation in a way of an outline guide of management in Argentina.
Transport difficulty.

continue

1.	**Management (Husbandry) and Register**
Genetics	
Logistics of biologic samples.	
Lack of commitment on daily registers of animals at zoos.	
2.	**Education and Communication**
Insufficient number of environmental education projects.	
Lack of efficiency evaluation on the environmental education projects.	
Lack of information dissemination .	
Lack of capable human resources.	
Media sub-utilization.	
Communication problems between groups.	
Lack of interchange between professionals from wild and from zoos.	
3.	**Administration and Policies**
Lack of integration between zoos.	
Lack of involvement of zoological institutions' administrators.	
Excess of bureaucracy to follow the legal exigencies .	
Lack of participation or involvement of directors of the zoological institutions.	
Lack of commitment from institutions on giving information to the management plans.	
4.	**Research**
Lack of studies on assisted reproduction.	
Lack of basic researches on reproduction.	
Lack of technology transference and material acquirement.	
Lack of informative network on the current researches .	
Lack of financial resources.	
Lack of capable human resources.	
Little use of biologic material.	

A moderator's question to the group:

What is the reason to maintain a captive population for the maned wolf conservation?

1.	Environmental educational programs as a support to the wildlife conservation.
2.	Scientific research involving management.
3.	Genetic bank to re-introduction.
4.	Environmental education about the problems associated to conservation.
5.	Scientific research that can produce information to the wildlife populations.
6.	Fundraising to support projects in the wild.
7.	Housing of animals coming from wild.
8.	Bank of genetic material to interchanges of material between wild and captive metapopulations.

Conclusions: Role of Captivity to the Maned Wolf Conservation:

1. Environmental education.
2. Scientific research as a base to studies in the wild.
3. Accommodation of "confiscated" animals without releasing possibility.
4. Conservation through the development of captive management (reproduction).
5. Genetic stock (re-introduction).

Compilation and data analysis

Managment and register	Facts	Suppositions	Information Needed	Reference
High mortality of maned wolf offspring combined to low rates of births (United States, Paraguay and Argentina) takes to a low reproductive success.	World Data: 1532 births from 1980-1998 (world) 44% of survival > 1 year 56% mortality Mortality < 30 days 77% National Data 4 years 65 births Mortality < 30 days High mortality due to: parental incompetence (trauma, enclosure, management, disease) Low birth rates due to: age, management mistake in couple arrangement, failure and success, couple rose artificially.	Other not mentioned countries, that have captive maned-wolves, must follow the same pattern due to the International Studbook.		Maia & Gouveia 2002 Protocolo de Manejo para o Lobo-Guará - Plano de Manejo - SZB (1994) International Studbook
Diet	There are protocols in Brazil, Argentina and United States The protocols are not followed	Lack of communication of *In-Situ* and *Ex-Situ* – Important to reproduction	Lack of research to define nutritional necessities. Lack of research to define the impact of nutrition in health and reproduction.	Husbandry Manual for the Maned Wolf (United States) Protocolo de Manejo para o Lobo-Guará - Plano de Manejo - SZB (1990 and 2000)
Sanitary problems	Infectious diseases, parasitic diseases and Cystinuria. About 50 % of the zoo stock is vaccinated in Brazil and in the United States 100% is vaccinated. In Argentina not the whole zoo stock is vaccinated and many times inadequate vaccines are used.	Disease can be transmitted from animals coming from wild	Lack of information about diseases in Argentina.	

continue

Managment and register	Facts	Suppositions	Information Needed	Reference
Animals coming from wild	There is a compilation of information on the entrance of animals to captivity It interferes on the collection plan of the maned wolf holders Limitations from relations Lack of space in zoos Information are collected about space to the animals in captivity	More information is needed	Animal origin and sanitary condition In Argentina there is not information on availability of space.	International Studbook Relatório SZB Relatório CETAS/IBAMA IBAMA - Lei 00402002
Enclosures / quality	There is a protocol in Brazil/ There is not a protocol in Argentina There are projects about enclosures, stress and reproduction happening in Brazil and United States. The efficiency of the protocols is being reevaluated. 90's DECADE: research projects were done about this topic, and also a partial analysis of animal enclosures and the analysis of enclosures in Brasília.		Lack of research/ lack of information	IBAMA - Lei 00402002
Data base to an adequate management	At least 50% of biologic and veterinary data records are dispersed in the institutions.		% (?) of the needed registers	IBAMA, Zoological institutions
Possession of the Animals	At about 10% of transferences betweens institutions are stopped due to possession conflicts.			SZB, CENAP/ICMBio International Studbook
Biologic samples	Biologic samples used in researches are documented, although scattered in different projects. Data of carcass destination suggest that biologic samples are not used for scientific purposes.		Dada on % of samples discarded without use	Studbooks

continue

Managment and register	Facts	Suppositions	Information Needed	Reference
Information transference	**80% of the 44 zoological institutions in Brazil send annual reports to the Studbooks.** **60% of the 8 zoological institutions in Argentina participated in the maned wolf workshop.** **100% of the 29 zoological institutions of the United States send information to the International Studbook and 90% communicate to each other regularly by the AZA Species Survival Plan (SSP) Maned Wolf.** **The zoological institutions from Paraguay don't send information.**			**Studbooks**

Administration and public politics	Facts	Suppositions	Information Needed	Reference
Involvement and commitment from the decision makers in the zoological institutions	Some decision makers don't follow the recommendations accorded in specific meetings by technicians of the zoological institutions.		Lack of quantitative data about how many decision takers don't follow the technique decisions accorded by the technicians.	
Financial Resources	Limited budget of the zoological institutions In the United States there is data about the annual budget spent specifically in the management of the captive maned wolf.		There is no available quantitative data about available resources to maned wolf management in Brazil and Argentina.	Zoological Institutions AZA Species Survival Plan (SSP) Maned Wolf

continue

RESEARCH	Facts	Suppositions	Information Needed	Reference
Reproduction	There is data about the reproductive biology: information about gestation length, number of maned wolf youngsters, etc. Information on reproductive behavior available Information on reproductive cycles		Lack of detailed information to enhance the reproductive efficiency of the maned wolf.	Adauto Nunes Veloso Nucharin Songsassen Wildt
Financial and human resources	There are available financial resources from different sources: FNMA, CNPq, Fundação Boticário, FAPESP, and International Funds. Information about the number of researches that work with the species There are training courses: Smithsonian Institution - National Zoo, IPÊ - Instituto de Pesquisas Ecológicas, Instituto Pró-Carnívoros, Universities, Breeding Centers, and Internships.	The resources are insufficient. There are difficulties on getting the financial resources	Information about the number of submitted projects and that are denied by financial sources	Studbooks AZA Species Survival Plan (SSP) Maned Wolf Maned Wolf PHVA Workshop (October 2005)
Data publishing	Many scientific data already acquired are not available	Some difficulty in accessing the published data	There is no quantitative data on how many scientific information is not published	

GOALS

PROBLEM: *High mortality rates of offspring in captive populations of maned wolves.*

GOAL 1 Reduction of mortality of captive maned wolf youngsters from 0 to 1 year to 50% or less in five years.

PROBLEM: *Low birth rates in captivity in United States and Argentina.*

GOAL 2 Increase birth rates (females with offspring) in captivity in the United States from 40% to at least 60% and in Argentina from the present time rate to at least 30% in five years.

PROBLEM: *The captive protocols (nutritional, prophylactic, enclosures' quality, acquirement, storage and usage of biologic material and data registration) are partially followed and are not completely developed.*

GOAL 3 Achieve that 100% of zoological institutions follow the existing protocol(s) to captivity (nutritional, prophylactic, enclosure's quality, acquirement, storage and usage of biologic material and data registration) in one year in Brazil and in two years in Argentina.

GOAL 4 Publication of captive reviewed protocols (nutritional, prophylactic, enclosure's quality, acquirement, storage and usage of biologic material and data registration), also based in the exchange of research information from *in* and *ex-situ*, in five years.

PROBLEM: *Lack of space to house the great number of animals that come from wild and that don't have possibility to be released.*

GOAL 5 Increase, in five years, in at least 10% the number of enclosures to receive animals from wild without possibility of being released, in Brazil and Argentina.

PROBLEM: *There are conflicts related to the possession of the individuals, what complicates transferences that are necessary to conservation.*

GOAL 6 Put an end to the conflicts about possession that interfere in the transference of individuals between zoological institutions in up to two years.

PROBLEM: *Lack of commitment of the decision makers and the financial investors with the Ex-Situ conservation of the species.*

GOAL 7 Achieve that at least 50% of the decision makers of the zoological institutions will be involved and committed with management agreements and with the fundraising to the ex-situ conservation of the species in up to five years.

PROBLEM: *Lack of financial resources and capable people to ex-situ research.*

GOAL 8: Increase in at least 100% the fund raised to *ex-situ* research with the species and in at least 30% the capable staff involved with the management in captivity, in up to five (5) years.

PROBLEM: *Lack of scientific production from the zoological institutions.*

GOAL 9: Increase in at least 50 % the number of the scientific publication about the Ex-Situ management, in up to five (5) years.

GOALS: Ranking (Paired Ranking)

1. Increase in at least 100% the fund raised to ex-situ research with the species and in at least 30% the capable staff involved with the management in captivity, in up to five years. (81 Points)

2. Publication of captive reviewed protocols (nutritional, prophylactic, enclosure's quality, acquirement, storage and usage of biologic material and data registration), also based in the exchange of research information prom In and Ex-Situ, in five years. (75 Points)

3. Achieve that 100% of zoological institutions follow the existing protocol(s) to captivity (nutritional, prophylactic, enclosure's quality, acquirement, storage and usage of biologic material and data registration) in one year in Brazil and in two years in Argentina. (70 Points)

4. Achieve that at least 50% of the decision makers of the zoological institutions will be involved and committed with management agreements and with the fundraising to the ex-situ conservation of the species in up to five years. (68 Points)

5. Increase in ate least 50 % the number of the scientific publication about the Ex-Situ management, in up to five years. (56 Points)

6. Increase birth rates (females with offspring) in captivity in the United States from 40% to at least 60% and in Argentina from the present time rate to at least 30% in five years. (51 Points)

7. Increase, in five years, in at least 10% the number of enclosures to receive animals from wild without possibility of being released, in Brazil and Argentina. (42 Points)

8. Reduction of mortality of captive maned wolf youngsters from 0 to 1 year to 50% or less in five years. (36 Points)

9. Put an end to the conflicts about possession that interfere in the transference of individuals between zoological institutions in up to two years. (25 Points)

ACTION PLAN

PROBLEM: *Lack of financial resources and capable people to Ex-Situ research.*

GOAL 1 *Increase in at least 100% the fund raised to ex-situ research with the species and in at least 30% the capable staff involved with the management in captivity, in up to five years.*

ACTION 1.1 Make and maintain an internet list (Internet Page of Carnivores Specialist Group of IUC) of information about possibilities of fundraising for *ex-situ* researches, with semestral actualizations.

Responsible: Melissa Rodden.
Collaborators: Laura Teodoro Fernandes, María de la Cruz Pino, SZB – Sociedade Brasileira de Zoológicos, Ibama and non governmental organizations (links).
Time to accomplish: 3 months.
Indicator: List on people's knowledge.
Costs: none.
Consequences: better chances to obtain funds and better integration between the institutions involved.
Obstacles: none.

ACTION 1.2 Make and maintain an internet list about training courses on fundraising, with actualizations at least at every six months.

Responsible: Cecília Pessutti.
Collaborators: IPÊ - Instituto de Pesquisas Ecológicas, SZB - Sociedade de Zoológicos do Brazil, SPZ – Sociedade Paulista de Zoológicos, Ibama, ICMBio, and non governmental organizations (links).
Time to accomplish: 3 months.
Indicator: List on people's knowledge.
Costs: none.
Consequences: Better chances to obtain financial resources and better integration between the involved institutions.
Obstacles: none.

ACTION 1.3 Make and maintain an internet list about training courses on captive management, with actualizations at least at every six months.

Responsible: Cecília Pessutti.
Collaborators: IPÊ - Instituto de Pesquisas Ecológicas, SZB - Sociedade de Zoológicos do Brazil, IBAMA, ICMBio, AZA Species Survival Plan (SSP) Maned Wolf – United States, and non governmental organizations (links).
Time to accomplish: 3 months.
Indicator: List on people's knowledge.
Costs: none.
Consequences: increase the number of capable people.
Obstacles: none.

ACTION 1.4: **Incite the creation of capacitating courses to increase capability on captive management.**

Responsible: Cecília Pessutti.
Collaborators: SZB - Sociedade de Zoológicos do Brazil, IBAMA, ICMBio, AZA Species Survival Plan (SSP). Maned Wolf – United States, and non governmental organizations (links).
Time to accomplish: 3 years.
Indicator: Created courses.
Costs: none.
Consequences: Increase the number of capable people.
Obstacles: none.

***PROBLEM**: The captive protocols (nutritional, prophylactic, enclosure's quality, acquirement, storage and usage of biologic material and data registration) are partially followed and are not completely developed.*

***GOAL 2** Publication of captive reviewed protocols (nutritional, prophylactic, enclosure's quality, acquirement, storage and usage of biologic material and data registration), also based in the exchange of research information prom In and Ex-Situ, in five years.*

ACTION 2.1 Make regional diagnosis meetings about the existing protocols and the gaps and priorities for studies.

Responsible: Cecília Pessutti, Viviana Quse, and Melissa Rodden.
Collaborators: SZB - Sociedade de Zoológicos do Brazil, IBAMA, ICMBio, non-governmental organizations (Brazil), AZA Species Survival Plan (SSP) Maned Wolf – United States, and captive institutions (Argentina).
Time to accomplish: 6 months (Brazil) / 1 year (Argentina and United States).
Indicator: Meeting accomplished.
Costs: US$6,000 for 20 people (Brazil) / None (United States).
Consequences: Systematization on the reviewing process of the protocols (Brazil and United States) and of the creation of the protocols (Argentina) and identification of priority areas for research.
Obstacles: Budget, lack of commitment.

ACTION 2.2 Promote the collaboration of researchers that will do the researches that will provide the protocols' review.

Responsible: Cecília Pessutti, Viviana Quse, and Nucharin Songsassen.
Collaborators: SZB - Sociedade de Zoológicos do Brazil, ICMBio, non-governmental organizations, UFPR - Universidade Federal do Paraná (Brazil), and captive institutions (Argentina).
Time to accomplish: From 1 year on.
Indicator: Network implementation.
Costs: None.
Consequences: Scientific information production.
Obstacles: Lack of interest and researchers working on this subject.

ACTION 2.3 Promote Work Meeting to review the existing protocols.

Responsible: Cecília Pessutti, Viviana Quse, and Melissa Rodden.
Collaborators: SZB - Sociedade de Zoológicos do Brazil, ICMBio, non-governmental organizations (Brazil), AZA Species Survival Plan (SSP) Maned Wolf (United States), and zoological institutions (Argentina).
Time to accomplish: 4 and half years.
Indicators: Meeting accomplished and reviewed protocols published.
Costs: US$ 8,000 for 20 people (Brazil), None (United States).
Consequences: Improvement in captive management.
Obstacles: Budget, technical limitations.

***PROBLEM:** The captive protocols (nutritional, prophylactic, enclosure's quality, acquirement, storage and usage of biologic material and data registration) are partially followed and are not completely developed.*

***GOAL 3** Achieve that 100% of zoological institutions follow the existing protocol(s) to captivity (nutritional, prophylactic, enclosure's quality, acquirement, storage and usage of biologic material and data registration) in one year in Brazil and in two years in Argentina.*

ACTION 3.1 Resend the protocols with a presentation letter about the importance of undertaking the orientations and of the decisions assumed in the Maned Wolf PHVA Workshop (October 2005).

Responsible: Cecília Pessutti.
Collaborators: Brazil: SZB - Sociedade de Zoológicos do Brazil, Studbook Keeper and ICMBio / Argentina: Viviana Quse.
Time to accomplish: 2 months.
Indicator: Sent of protocols to all maned wolf holders.
Costs: None.
Consequences: Improvement in captive management.
Obstacles: None.

ACTION 3.2 Elaboration of a rule that determines that all zoological institutions follow the recommendations of the official management plans.

Responsible: Marcelo Lima Reis.
Collaborators: Ibama, SZB - Sociedade de Zoológicos do Brazil, and Studbook Keeper.
Time to accomplish: 1 year.
Indicator: Regulation published.
Costs: None.
Consequences: Greater number of zoological institutions following the captive management plan, improving the work of the Studbook Keeper.
Obstacles: Burocracy.

ACTION 3.3 Search for assistance in Argentina, from AZARA and G.A.A.G. – Argentina's Group Aguara Guazú, to recommend that zoological institutions follow the sent protocols.

Responsible: Viviana Quse.
Collaborators: AZARA and G.A.A.G. – Argentina's Group Aguara Guazú.
Time to accomplish: 6 months.
Indicator: Notification of receipt.
Costs: None.
Consequences: Improvement in management.
Obstacles: Lack of assistance from institutions.

ACTION 3.4 Suggest (request) that the implementation of the protocols is requested in fiscalization activities.

Responsible: Marcelo Lima Reis.
Collaborators: IBAMA, SZB - Sociedade de Zoológicos do Brazil, and Studbook Keeper.
Time to accomplish: 6 months.
Indicators: Suggestion accepted.
Costs: None.
Consequences: Greater number of zoological institutions following the captive management plan, enhancing the captive management.
Obstacles: General politics.

PROBLEM: *Lack of commitment of the decision makers and the financial investors with the ex-situ conservation of the species.*

GOAL 4 *Achieve that at least 50% of the decision makers of the zoological institutions will be involved and committed with management agreements and with the fundraising to the ex-situ conservation of the species in up to five years.*

ACTION 4.1 Insert between the programs of the Brazilian Congresses of Zoos, specific meetings with the decision makers (directors) to introduce them to the conservation program of the maned wolf.

- *Especial invite to each of the decision maker*
- *To hire marketing and public relations consultancy for the methodology generation*
- *Invite a person from the official institution (ICMBio)*

Responsible: Francisco Rogério Paschoal.

Collaborators: SZB - Sociedade de Zoológicos do Brazil, SPZ - Sociedade Paulista de Zoológicos, IBAMA, and Cleyde Chieregatto.
Time to accomplish: 1 year and to be continued.
Indicators: Meetings and number of participants.
Costs: US$ 1,000.
Consequences: Increase in the number of committed directors, enhancement in management and increase in availability of enclosures to maned wolves.
Obstacles: Lack of interest of the decision makers.

ACTION 4.2 Creation and Implementation of a certificate seal for the participation of zoological institutions on the maned wolf conservation program.

- *Determine the criteria and marketing strategy*

Responsible: Cleyde Chieregatto.
Collaborators: Laura Teodoro Fernandes, IBAMA, SZB - Sociedade de Zoológicos do Brazil, Studbook Keepers, Comitê para a Conservação dos Canídeos Brasileiros, AZA Species Survival Plan (SSP). Maned Wolf, and G.A.A.G. - Grupo Argentino Aguara Guazú.
Time to accomplish: 3 years.
Indicators: Creation and implementation of the seal, number of certified institutions.
Costs: US$ 1,000.
Consequences: Better commitment of the institutions, program improvement in terms of communication, positive impact in environment education programs, enhancement in management and increase the number of available enclosures to maned wolf.
Obstacles: judicial, bureaucratic and financial problems.

ACTION 4.3 Creation of an annual award to the institution in evidence on ex-situ conservation of the maned wolf.

- *Determine the criteria and divulgation.*

Responsible: Valéria do Socorro Pereira.
Collaborators: Ana Maria Beresca, Viviana Quse, companies, and non governmental organizations.
Time to accomplish: 2 years
Indicators: Creation of the award and winner reward.
Costs: To be defined.
Consequences: motivation to conservation and increase the number of committed institutions.
Obstacles: Financial.

***PROBLEM**: Lack of scientific production from the zoological institutions.*

***GOAL 5** Increase in ate least 50% the number of the scientific publication about the Ex-Situ management, in up to five years.*

ACTION 5.1 Creation of an electronic "journal" (English, Portuguese and Spanish) to publish and research divulgation.

- *Define the editorial committee.*
- *Define the rules of publishing (notes, articles, etc.).*
- *Establish a group of collaboration consultants.*

Responsible: Joares May Júnior and Rosana Nogueira de Morais.
Collaborators: Non governmental organizations, SZB - Sociedade de Zoológicos do Brazil, Viviana Quse, Melissa Rodden, and Nucharin Songsassen.
Time to accomplish: 2 years.
Indicators: Journal publishing and number of articles.
Costs: To be defined.

Consequences: Increase the number of articles, improvement of information spread and motivation to data collection.
Obstacles: Lack of commitment.

ACTION 5.2 Creation of training courses in methodology design, data analysis and adequate scientific writing to publish in peer-reviewed journals.

• *Create a list of journals/magazines/periodicals to which articles about maned wolf ex-situ conservation could be sent.*

Responsible: Rosana Nogueira de Morais and Joares May Júnior.
Collaborators: Non governmental organizations, SZB - Sociedade de Zoológicos do Brazil, Viviana Quse, Melissa Rodden and Nucharin Songsassen.
Time to accomplish: 1 year.
Indicators: Course created and number of trained people.
Costs: To be defined.
Consequences: Increase in the number of published articles, increase in the number of capacitated people.
Obstacles: Financial problems, human resources.

***PROBLEM**: Low birth rates in captivity in United States and Argentina.*

GOAL 6 Increase birth rates (females with offspring) in captivity in the United States from 40% to at least 60% and in Argentina from the present time rate to at least 30% in five years.

ACTION 6.1 Compile and produce documents with information on reproductive aspects of maned wolf females on the last five years.

• *Establish the methodology.*

Responsible: María de la Cruz Pino, Nucharin Songsassen, and Cecília Pessutti.
Collaborators: Captive institutions, maned wolf holders (Brazilian, Argentine, North-American).
Time to accomplish: 1 year.
Indicator: Production of the document.
Costs: None.
Consequences: Accurate information on maned wolf reproduction in captivity.
Obstacles: Lack of collaboration from institutions.

ACTION 6.2 Based on the consequences of Action 6.1, determine research priorities and implement collaborative projects.

• *Establish the methodology.*

Responsible: María de la Cruz Pino, Nucharin Songsassen & Melissa Rodden and Cecília Pessutti.
Collaborators: Captive institutions, maned wolf holders (Brazilian, Argentine, North-American).
Time to accomplish: 2 years.
Indicator: Production of the document.
Costs: To be defined.
Consequences: Increase in birth rates of maned wolf in captivity.
Obstacles: Lack of collaboration from institutions.

***PROBLEM:** Lack of space to house the great number of animals that come from wild and that do not have possibility to be released.*

GOAL 7 Increase, in five years, in at least 10% the number of enclosures to receive animals from wild without possibility of being released, in Brazil and Argentina.

ACTION 7.1 Same ACTIONS of Goal 4.

ACTION 7.2 Make a campaign to convince more institutions to be maned wolf holders.

Responsible: G.A.A.G. - Grupo Argentino Aguara Guazú (Argentina) and Cleyde Chieregatto.
Collaborator: Cecília Pessutti.
Time to accomplish: 1 year.
Indicator: Campaign made.
Costs: To be defined.
Consequences: Increase the number of institutions and/or enclosures to maned wolves.
Obstacles: Lack of commitment.

PROBLEM: *High mortality rates of offspring in captive populations of maned-wolves.*

GOAL 8 Reduction of mortality of captive maned wolf youngsters from 0 to 1 year to 50% or less in five years.

ACTION 8.1 Compile and produce documents with information on maned wolf offspring mortality in the last five years.

- *Establish the methodology.*

Responsible: María de la Cruz Pino, Nucharin Songsassen, Cecília Pessutti and Valéria do Socorro Pereira.
Collaborators: Captive institutions, maned wolf holders (Brazilian, Argentine, North-American).
Time to accomplish: 1 year.
Indicator: Production of the document (compiled data).
Costs: None.
Consequences: Accurate information on maned wolf offspring mortality in captivity.
Obstacles: Lack of collaboration from institutions.

ACTION 8.2 Based on the consequence of Action 8.1, determine research priorities, and implement collaborative projects.

- *Establish the methodology.*

Responsible: María de la Cruz Pino, Nucharin Songsassen & Melissa Rodden, and Cecília Pessutti & Valéria do Socorro Pereira.
Collaborators: Captive institutions, maned wolf holders (Brazilian, Argentine, North-American.
Time to accomplish: 2 years.
Indicators: Production of documents.
Costs: To be defined.
Consequences: Increase maned wolf youngsters' survival.
Obstacles: Lack of collaboration from institutions.

PROBLEM*: There are conflicts related to the possession of the individuals, what complicates transferences that are necessary to conservation.*

GOAL 9 Put an end to the conflicts about possession that interfere in the transference of individuals between zoological institutions, in up to two years.

ACTION 9.1 Request IBAMA to establish of a rule that regulates the Brazilian native fauna property.

Responsible: Marcelo Lima Reis.
Collaborators: ICMBio,IBAMA, SZB-Sociedade de Zoológicos do Brazil, and universities
Time to accomplish: 1 year
Indicator: Rule published
Costs: None
Consequences: Make easier the following of the management protocols, including animal transferences.
Obstacles: Lack of juridical expertise and political will.

GOALS – WHOLE GROUP

GOAL 16 *Increase the efficiency of education on conservation of the maned wolf.*

Suggestion of Action: Develop a unified education politic between people that work with maned wolf, ex-situ and In-Situ, to each country, by performing a workshop.

GOAL 21 *Promote the integration between research institutions, sponsors, government and society to optimize actions to the conservation of the maned wolf and its habitat.*

Suggestion of Action: Actions 1 and 2 of Goal 5 (ex-situ Conservation Group) and Actions 1 and 3 of Goal 4 (ex-situ Conservation Group) contribute to this Goal.

GOAL 11 *Obtain information with details, on the current and historical occurrence areas of the species in two years.*

Sugestion of Action: Promote a pattern to the registering protocols of the apprehended animals (origin), by promoting meeting with zoological institutions, environmental police, firefighters, and others – Regional Meetings.

Responsible: Francisco Rogério Paschoal and Marcelo Lima Reis.
Collaborators: Non-governmental organizations, SZB - Sociedade de Zoológicos do Brazil, SPZ - Sociedade Paulista de Zoológicos, IBAMA, AZARA, and G.A.A.G. - Grupo Argentino Aguara Guazú (Viviana Quse & María de la Cruz Pino, Argentina).
Time to accomplish: 1 year.
Indicators: Meeting done and establishment of the protocol.
Costs: To be defined (regional meetings).
Consequences: Improve the knowledge about maned wolf distribution and areas or origin.
Obstacles: Financial problems, burocracy, political will.

WORK GROUP
Population dynamics and modeling

Modelers:

Anders Gonçalves da Silva (University of British Columbia & CBSG Brasil- IUCN/SSC), Brazil

Arnaud Desbiez (DICE - Kent University & CBSG Brasil - IUCN/SSC), Brazil

Kathy Traylor-Holzer (CBSG - IUCN/SSC), USA

Members:

Eduardo Eizirik (PUC-RS & Instituto Pró-Carnívoros), Brazil

Flávio Rodrigues (UFMG & Instituto Pró-Carnívoros), Brazil

José Luis Cartes (Guyra Paraguay), Paraguay.

Lucía Soler (Huellas & G.A.A.G.), Argentina

Rogério Cunha de Paula (CENAP/ICMBio & Instituto Pró-Carnívoros), Brazil

PROBLEMS: Definition

1. There are no sufficient information about populations' sizes, number of populations, and the connectivity level in all countries of maned wolf distribution.
2. There is no common definition of population viability among the countries of maned wolf distribution.
3. There are no precise data on demographic rates in wild populations.
4. There is information about potential threats, but there is no sufficient information about their impact over maned wolf's population.

GOALS

***PROBLEM 1**: There are no sufficient information about populations' sizes, number of populations, and the connectivity level in all countries of maned wolf distribution.*

GOAL 1.1: Guarantee the access to maned wolf's ecology and demography data to develop better risk analysis.

GOAL 1.2: Define the wild populations and evaluate the viability of each of them.

***PROBLEM 2**: There is no common definition of population viability among the countries of maned wolf distribution.*

GOAL 2.1: Define what a minimum viable population is.
Problem 3: There are no precise data on demographic rates in wild populations.

GOAL 3.1: Use sensibility analysis in demographic parameters to guide maned wolf's natural history research.

***PROBLEM 4**: There is information about potential threats, but there is no sufficient information about their impact over maned wolf's population.*

Goal 4.1: Classify the risks in order of population effect magnitude, to guide the research efforts.

GOALS: Ranking

GOAL 1: Define what a minimum viable population is.

GOAL 2: Guarantee the access to maned wolf's ecology and demography data to develop better risk analysis.

GOAL 3: Use sensibility analysis in demographic parameters to guide maned wolf's natural history research.

GOAL 4: Define the wild populations and evaluate the viability of each of them.

GOAL 5: Classify the risks in order of population effect magnitude, to guide the research efforts.

ACTION PLAN

***PROBLEM 1**: There are no sufficient information about populations' sizes, number of populations, and the connectivity level in all countries of maned wolf distribution.*

Goal 1.1: Guarantee the access to maned wolf's ecology and demography data to develop better risk analysis.

ACTION 1.1.1. Elaborate a chronogram of scientific events that have available space for mini-symposiums or round tables focused in the maned wolf to motivate data and information exchange between researchers from the distribution countries, with one event per year from 2006-2010, and at least one per country during this period.

Responsible: Flávio Rodrigues, José Luis Cartes, and Lucía Soler.
Collaborators: Louise Emmons (Bolivia), Damian Rumiz (Bolivia), and Lila Sains (Bolivia).
Deadline: February of 2006
Indicators: Chronogram, and identification of the responsible people to turn the meetings viable.
Costs: None
Consequences: Creation of periodical spaces to exchange information and up to date data.
Obstacles: Lack of financial resources to perform the events.

ACTION 1.1.2. Improve the scientific publication bank about the maned wolf, in a way that it includes 90% of publishing in PDF format, and prepare and implement a semestral actualization plan.

Responsible: Pablo Cuello, José Luis Cartes, and Rogério Cunha de Paula.
Collaborators: Otávio Borges Maia, Lucía Soler and Maria Luisa Ortiz.
Deadline: March of 2006 to have an implementation plan for the bank / September of 2006 to complete bank implementation.
Indicator: Implementation of the publication base and with actualizations at least ate every six (6) months.
Costs: US$ 300-500
Consequences: Fast access of all researchers to the major, if not all, publications about maned wolf.
Obstacles: Little efficient communication between the responsible people for the implementation of the bank.

ACTION 1.1.3. Perform a maned wolf PVA (Population Viability Analysis) in 2010 with improved and up to date data based in this Maned Wolf PHVA Workshop (October 2005).

Responsible: Rogério Cunha de Paula

Collaborators: Instituto Pró-Carnívoros, CENAP/ICMBio, Huellas (Argentina), G.A.A.G. - Grupo Argentino Aguara Guazú, Fundación Temaikén (Argentina), and zoological institutions.
Deadline: 2010
Indicator: PVA performed / A new evaluation of risks to the maned wolf based in up to date information.
Costs: US$ 16,000
Consequences: Actualization of the Action Plan, establishment of new research proposals.
Obstacles: Lack of financial resources.

GOAL 1.2: Define the wild populations and evaluate the viability of each of them.
ACTION 1.1.3. of Goal 1.1.

***PROBLEM 2**: There is no common definition of population viability among the countries of maned wolf distribution.*

GOAL 2.1: Define what a minimum viable population is.

ACTION 2.1.1. Prepare a document in Portuguese and Spanish, developed in cooperation between the distribution countries, that explain the following criteria to determine a maned wolf's minimum viable population (extinction probability ≤1% & genetic loss ≤10% in 100 years), and that will be made public to professionals and relevant institutions, in the context of the workshop and adequate references.

Responsible: Rogério Cunha de Paula, Lucía Soler, and José Luis Cartes.
Collaborators: Anders Gonçalves da Silva, and Louise Emmons (Bolivia contact).
Deadline: January of 2006
Indicators: Document ready, published and general acceptance of the proposed criteria.
Costs: None
Consequences: Standard in the Minimum Viable Population criteria for the maned wolf's distribution countries. Increase the consciousness of governmental institutions about the problems faced by the maned wolf due to the contextualization of the problem in the document.
Obstacles: Acceptance of the proposed document.

***PROBLEM 3**: There are no precise data on demographic rates in wild populations.*

GOAL 3.1: Use sensibility analysis in demographic parameters to guide maned wolf's natural history research.

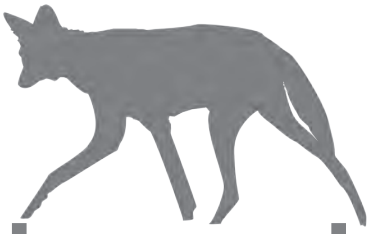
ACTION 3.1.1. Model maned wolf's populations with the best available data to evaluate the demographic effects in population viability and propose direction to future research projects.

Responsible: Kathy Traylor-Holzer, Arnaud Desbiez, and Anders Gonçalves da Silva.
Collaborators: Instituto Pró-Carnívoros (Brazil), G.A.A.G. - Grupo Argentino Aguara Guazú, and Guyra Paraguay.
Time to accomplish: 3 months
Indicator: Recommendations to researches related with maned wolf's demography.
Costs: None
Consequences: Guidance of research actions related to maned wolf's demography.
Obstacles: None

***PROBLEM 4**: There is information about potential threats, but there is no sufficient information about their impact over maned wolf's population.*

GOAL 4.1: Classify the risks in order of population effect magnitude, to guide the research efforts.

ACTION 1.1.3. of Goal 1.1.



Population and Habitat Viability Assessment (PHVA)

Population and Habitat Viability Assessment (PHVA)

Modelers

Arnaud Desbiez (DICE - Kent University & CBSG Brasil - IUCN/SSC), Brazil
Anders Goncalves da Silva (University of Britich Columbia & CBSG Brasil, IUCN/SSC), Brazil
Kathy Traylor-Holzer (CBSG, IUCN/SSC), USA

Participants

Flavio Rodrigues (UFMG & Instituto Pro-Carnivoros), Brazil
Jose Luis Cartes (Guyra Paraguay), Paraguay
Lucia Soler (Huellas & G.A.A.G.), Argentina
Rogerio Cunha de Paula (CENAP/ICMBio & Instituto Pro-Carnivoros), Brazil

Introduction

The maned wolf (*Chrysocyon brachyurus*) is the largest of the South American Canidae. This species inhabits the grasslands and scrub forests of central South America. Its present geographic range covers about 5 million km^2 and 5 countries (Argentina, Bolivia, Brazil, Paraguay, Peru), although the species also formerly was found in Uruguay (Dietz, 1985). The maned wolf is classified by the World Conservation Union (IUCN) as "Vulnerable" and as "Endangered" by agencies of the Brazilian government. Primary threats to the species include habitat fragmentation through economic development, increased mortality of individuals due to road kills, and persecution and capture of pups. There is increasing evidence that disease from domestic dogs also could be a threat to smaller, fragmented populations (Deem & Emmons, 2005). These forces serve to reduce population size, with resultant demographic and genetic instability that can lead to local population extinction.

Population viability analysis (PVA) can be an extremely useful tool for investigating current and future risk of wildlife population decline or extinction. In addition, the need for and consequences of alternative management strategies can be modeled to suggest which practices may be the most effective in managing and conserving populations. *Vortex*, a simulation software package written for population viability analysis, was used here as a mechanism to study the interaction of a number of maned wolf life history and population parameters upon population viability, to explore which demographic parameters may be the most sensitive to data uncertainty or alternative management practices, and to test the effects of selected management scenarios. Threats and management options were then explored at a country level. Many of the parameters included in the models are best guesses due to the

lack of current data. Although the input data cannot be regarded as accurate, the exercise was valuable in highlighting gaps in knowledge, critical problems, main threats and, most importantly, providing a general overview of the species situation and persistence in each country.

Problems, goals and measures of success.

During the Maned Wolf PHVA members of the Population Dynamics and Modeling Working Group identified four major problems regarding modeling of endangered maned wolf populations. First, because of its wide spread distribution, across different countries and across various levels of threats, it was found to be very hard to define a common definition of population viability for maned wolf populations in all of its distribution. Second, researchers argued that there is still insufficient knowledge pertaining to many basic demographic parameters, which they argued would be needed for more precise models to be constructed. Third, even though there is much information on potential threats to maned wolves, there is little information on how these threats actually affect the individuals and populations. For this reason researchers were unsure as how to include these effects into current models and how to manage the affected populations. Finally, there is no tally on the actual number of maned populations, their sizes and levels connectivity across its distribution. In order to tackle these problems, the researchers proposed several goals, and action related to each goal.

A common criterion for what constitutes a minimum viable maned wolf population has proven to be quite elusive. The researchers started by adopting the following preliminary definition: a maned wolf population is considered viable if it has a probability of extinction over 100 years equal to, or smaller then, 1% AND with which loses 10% or less of the original genetic variation over the same 100 years. Following the workshop, a stakeholder wide discussion will start by writing and sending a letter in both Spanish and Portuguese to relevant institutions explaining the rational behind the adoption of such a criterion, within the context of the workshop, and requiring people to comment, and help refine it.

In so far as gathering more basic demographic data to refine current models, all researchers agreed that priorities should be set, so as to direct data collection to parameters that have the higher impact on the models. As such, it was agreed that a sensitivity analysis should be carried out to identify the most sensitive parameters. The modeling group undertook the task, and the results will be published within this report (see below).

As mentioned above, there is much information on potential threats to maned wolf populations, however few studies have been carried out showing the real short- and long-term impacts that these threats have on these populations. It was agreed that priorities should be set to focus research on threats that are potentially more dangerous than others. Yet, it was pointed out that better demographic models would be necessary to allow for confident priorities to be set. Therefore, a new PVA is planned for 2010 that will include all new demographic information that will be gathered.

In relation to data on number of populations, population sizes and level of connectivity, it was concluded that better communication among researchers must be promoted, this could be achieved through (1) organized dedicated maned wolf workshops organized within the larger mammalogy, conservation or other related disciplines conferences; (2) the creation of an electronic bibliographic database on maned wolf; and, (3) by running a PVA in 2010 with newly gathered data. It was also concluded that it was necessary to define what are in fact natural populations, and define the viability status of each one to prioritize conservation

efforts. It was determined that this should be done in the 2010 PVA.

Overall, with the exception of the first issue identified, all the concerns mentioned by the workshop attendees were related to lack of biological information. Research efforts should therefore be prioritized to address the gaps in knowledge identified during the PHVA. As for defining a single viability criterion for such a wide-ranging species, with so many possible permutations of threats, across so many national and local legislations, participants felt the criterion defined might become too broad to the point of being meaningless from a biological perspective. Instead, country specific criteria might prove to be a more pragmatic and effective approach, however, this still remains to be defined by the maned wolf conservation community.

Vortex Simulation Model

Computer modeling is a valuable and versatile tool for assessing risk of decline and extinction of wildlife populations. Complex and interacting factors that influence population persistence and health can be explored, including natural and anthropogenic causes. Models can also be used to evaluate the effects of alternative management strategies to identify the most effective conservation actions for a population or species and to identify research needs. Such an evaluation of population persistence under current and varying conditions is commonly referred to as a population viability analysis (PVA).

The simulation software program *Vortex* (v9.57) was used to examine the viability of maned wolf populations. *Vortex* is a Monte Carlo simulation of the effects of deterministic forces as well as demographic, environmental, and genetic stochastic events on wild populations. *Vortex* models population dynamics as discrete sequential events that occur according to defined probabilities. The program begins by creating individuals to form the starting population and stepping through life cycle events (e.g., births, deaths, dispersal, catastrophic events), typically on an annual basis. Events such as breeding success, litter size, sex at birth, and survival are determined based upon designated probabilities. Consequently, each run (iteration) of the model gives a different result. By running the model hundreds of times, it is possible to examine the probable outcome and range of possibilities. For a more detailed explanation of *Vortex* and its use in population viability analysis, see Lacy, 1993, 2000; Miller & Lacy, 2003.

Vortex Baseline Model Parameters

Due to the variation of various parameters between countries, regions and populations, it was decided to construct a general baseline model for maned wolves that could then be tailored to countries or specific regional populations. The baseline population model was designed to investigate the viability of a non-existent but biologically accurate maned wolf population. Alternative values for demographic parameters were then explored through sensitivity testing. Models were also developed for each country, and sometimes even populations within each country.

The baseline model was developed based on published information and through discussions among working group participants. Representatives of each country modeled were present to discuss the models developed, except for Bolivia, which was based on a report that Dr. Louise Emmons wrote specifically for the PHVA. The following population characteristics and model inputs were accepted as realistic by working group members for a free-ranging maned wolf population.

Number of iterations: 500

500 independent iterations were run for each scenario.

Number of years: 100

Life expectancy of maned wolves is approximately 10-12 years in the wild (Flavio Rodrigues, pers. comm.). The population was modeled for 100 years (approximately 15 generations) so that long-term population trends could be observed, and still not so far into the future that results become too uncertain and selection would start to play a more important role.

Extinction definition: Only one sex remains

Extinction is defined in the model as no animals of one or both sexes.

Number of populations: 1

In the baseline model only one population is considered (i.e., no metapopulation dynamics are explored).

Dispersal among populations: None

In the baseline model only one population is considered, with no immigration or emigration.

Initial population size (N): 100

Carrying capacity (K): 100

The carrying capacity was considered as the same as the initial population. No environmental variation was added to the carrying capacity, as variations in population size are accounted for by environmental variation in reproduction and survival.

Inbreeding depression: Yes

Inbreeding is thought to have major effects on reproduction and survival, especially in small populations, and so was included in the model. The impact of inbreeding was modeled as 3.14 lethal equivalents, the median value estimated from analysis of studbook data for 40 captive mammal populations (Ralls *et al.*, 1988), with 50% of the effect of inbreeding due to recessive lethal alleles. Inbreeding was implemented in the model as reduced first-year survival of inbred individuals.

Concordance between environmental variation in reproduction and survival: Yes

Environmental variation (EV) is the annual variation in reproduction and survival due to random variation in environmental conditions. Environmental variation not only affects maned wolves directly but also prey populations and fruit production, which in turn affects maned wolf survival and reproduction. EV for survival and reproduction were linked in the model (i.e., good years for reproduction are also good years for survival).

Mating system: Long-term monogamy

Maned wolves form stable, long-lasting, pair bonds, in which an individual mate seems to be only replaced at death (Dietz, 1985).

Age of first offspring: 2 years (both sexes)

Vortex defines reproduction onset as the time the first litter is born rather than sexual maturity. This parameter represents the average age of first reproduction, not the earliest age at which reproduction can occur.

Maximum age of reproduction: 10 years

Vortex assumes that animals can reproduce throughout their adult life and does not model reproductive senescence. Individuals are removed from the model after they pass the maximum age of reproduction. Maximum age of reproduction according to studbook data was estimated at 10 years.

Maximum number of progeny per year: 5 pups

In captivity maned wolves give birth to 1 to 7 pups per litter. Field observations show, on average, a much lower number of pups per litter. However, this might be due to high

cub mortality before leaving the den (field researchers cannot count litter size before den emergence). After some group discussion, the maximum number of progeny per year was estimated at 5 for the baseline model to produce a more conservative estimate.

Density-dependent reproduction: No

Reproduction was assumed to be density-independent in the model.

Percent adult females breeding: 60%

Field researchers have observed some pairs of maned wolves breeding each year (Flavio Rodrigues, pers. comm.). To be conservative the percent of females breeding each year was modeled at 60% (mean interbirth interval less than 2 years), with a SD due to environmental variation of 10%.

Distribution of offspring per female per year: See below

Distribution of offspring was specified using data from the studbook, group discussion and through model refinement.

Table 1. Distribution of number of offspring produced per breeding female in one year.

Number	Percent
1 Offspring	21%
2 Offspring	24%
3 Offspring	28%
4 Offspring	19%
5 Offspring	8%

Percentage of adult males in the breeding pool: 90%

Young males might be sexually mature, but because they are still dispersing or have not established their own territory they might not be an effective part of the breeding pool. Therefore, the group decided to only include an average of 90% of males reproducing each year. It was thought that this would be a more conservative and therefore appropriate value, in light of the lack of additional field information.

Mortality rates: See below

First-year mortality in captivity is generally reported to be around 50% (Maia & Gouveia, 2002; Veado, 1997). However, data on mortality rates for natural populations are very scarce. Therefore, different values based on personal observations of group members were investigated in the model, and final values were chosen based on those that yielded conservative and reasonable deterministic growth rates for a carnivore of the size of a maned wolf. Table 2 contains mortality rates used for the maned wolf *Vortex* baseline model.

Table 2. Mean annual mortality rates for male and female maned wolves by age class.

Life stage	Females			Males		
	Age class	Mean annual mortality	EV	Age class	Mean annual mortality	EV
Juvenile	0 – 1	60%	10%	0 – 1	60%	10%
Sub-adult	1 – 2	20%	5%	1 – 2	20%	5%
Adult	>2	10%	2%	>2	10%	2%

These values do not take into account mortality due to road kills, which may have a significant impact in wolves ≥ 1 years old. Road kill mortality was not incorporated into the baseline model, because road kill frequency and impact vary between countries, regions and populations. Road kill was included under harvesting in sensitivity testing of the general model (as the annual removal of a fixed number of wolves) and in the country-specific models (as the annual removal of a percentage of wolves). The above mortality rates do take into account sub-adult mortality due to natal dispersal. The relative effect of mortality values on overall population demographic rates were explored through sensitivity analysis. Additionally, country and population conditions were separately modeled whenever it was deemed necessary.

Number of catastrophes: None

Catastrophes are singular environmental events that are outside of the bounds of normal environmental variation affecting reproduction and/or survival. Natural catastrophes can be tornadoes, floods, droughts, disease, or similar events. These events are modeled in *Vortex* by assigning an annual probability of occurrence and a pair of severity factors describing their impact on survival (across all age-sex classes) and the proportion of females successfully breeding in a given year. These factors range from 0 (maximum or absolute effect) to 1 (no effect), and are imposed during the single year of the catastrophe, after which time the demographic rates rebound to their baseline values.

Fires are a natural occurrence in the *cerrado* and are not considered a catastrophe. Mortality caused directly or indirectly by fire was included in the baseline mortality rates and EV. An example of a catastrophe for maned wolves might be a disease such as distemper. Values for this parameter were explored through sensitivity testing.

Harvest: No

No harvest was included in the baseline model. Causes and intensity of harvest varied between countries, regions and populations. Values for this parameter were explored through sensitivity testing and were explored for each country and for populations within each country.

Supplementation: No

No supplementation from other unrelated populations, wild or captive, was incorporated into the model.

Table 3. Summary of parameter input values used in the baseline model.

Parameter	Baseline value
Number of populations	1
Initial population size	100
Carrying capacity	100
Inbreeding depression	3.14 LE
% of the effect of inbreeding due to recessive lethal alleles	50
Breeding System	long-term monogamy
Age of first reproduction (♀ / ♂)	2 years
Maximum age of reproduction	10 years
Annual % adult females reproducing (SD)	60 (10)
Density dependent reproduction?	No
Maximum litter size	5

continues

Parameter	Baseline value
Distribution of offspring per breeding female per year	
1 Offspring	21%
2 Offspring	24%
3 Offspring	28%
4 Offspring	19%
5 Offspring	8%
Overall offspring sex ratio	50:50
% adult males in breeding pool	90
% mortality from age 0-1 (SD)	60 (10)
% mortality from age 1-2 (SD)	20 (5)
% mortality from age 2+ (SD)	10 (2)
Catastrophe	none
Harvest	none
Supplementation	none

Baseline Model Results

Deterministic Output

The demographic rates (reproduction and mortality) included in the baseline model can be used to calculate deterministic characteristics of the model population. These values reflect the biology of the population in the absence of stochastic fluctuations (both demographic and environmental variation), inbreeding depression, limitation of mates, and immigration/emigration. The baseline model results in a deterministic growth rate (r_{det}) of 0.091 (λ= 1.096). This represents an annual potential growth rate of about 10%. Generation time (the average age of reproduction) is 5.3 years for both males and females. Adult sex ratio of adult males to adult females is 1. Stable age distribution is presented in Table 4. Overall, these population characteristics were accepted as realistic for free-ranging maned wolves and lend validity to this model as a reasonable representation of wild maned wolf populations. They also suggest that maned wolf populations have the potential to grow quickly in the absence of additional threats or stochastic events.

Table 4. Stable age distribution of maned wolves.

Age Class	Females	Males
0	0.192	0.192
1	0.070	0.070
2	0.051	0.051
3	0.042	0.042
4	0.035	0.035
5	0.028	0.028
6	0.023	0.023
7	0.019	0.019
8	0.016	0.016
9	0.013	0.013
10	0.011	0.011

Stochastic Baseline Results

It is important that caution be used in interpreting the results described below, which represent a general maned wolf population based on the parameters previously described. No harvest rates, no increase in mortality due to road kill, and no catastrophes are included in this general model.

Results of the baseline model project that a population of 100 maned wolves is likely to persist over the next 100 years. The stochastic growth rate (r_{stoch}) is 0.062, enabling the population to grow when below carrying capacity. There is zero probability of extinction (PE) in 100 years, and the mean population size at 100 years is 95 wolves with 81.8% gene diversity remaining. The loss of gene diversity is in part due to the relatively small population size and because we modeled a closed population in which no immigration of unrelated animals can occur.

Sensitivity Testing

Demographic Rates

Sensitivity analysis is a tool used to evaluate the robustness of a model to variations in parameter values. The more robust the model is to variations in a particular parameter, the less sensitive the model's results are to the input values of that parameter. This tool is used, in the current context, to uncover particularly sensitive parameters that could significantly alter the results and conclusions derived from the model, and therefore require greater certainty in the input values to produce more confident results. Here, sensitivity analyses were performed to evaluate the effect of model parameters on the stochastic growth rate (r-stoc) of maned wolf populations.

The analyses consisted of varying one demographic parameter at a time to a value lower or greater than what was assigned as the baseline value. For all analyses, initial population size and carrying capacity were set to 100, as in the baseline model, and 500 iterations were run for each model and the mean value of r-stoc was calculated over the 500 iterations for each estimated parameter. Parameters and values used are outlined in Table 5 and the results are plotted in Figure 1 (a table with all results can be found in the Appendix at the end of this section).

Table 5. Parameter values used for the sensitivity analyses.

Parameter	Low	Baseline	High
Juvenile male mortality (MM1)	30%	60%	70%
Sub-adult male mortality (MM2)	10%	20%	40%
Adult male mortality (MM3)	5%	10%	20%
Juvenile female mortality (FM1)	30%	60%	70%
Sub-adult female mortality (FM2)	10%	20%	40%
Adult female mortality (FM3)	5%	10%	20%
% adult females breeding (FBR)	50%	60%	70%
Age of first reproduction for males (A1OM)	1	2	4
Age of first reproduction for females (A1OF)	1	2	4
% males in the breeding pool (MBP)	75%	90%	100%
Maximum age of reproduction (MAR)	8	10	12
Inbreeding (lethal equivalents) (INB)	0	3.14	6.28

The results in Figure 1 have been organized to show the most sensitive parameters on the left, while the less sensitive parameters appear in succession to the right. As can be seen, female mortality comprises the first three most sensitive parameters in the model, with a 50% increase in mortality driving the stochastic growth rate close to or below 0. Changes in the percent of females breeding each year and in the maximum age of reproduction had the next largest effect on stochastic growth rate, although population growth remained positive across the values tested. However, male mortality in general seems to be very robust, showing a much smaller variation in r-stoc over the same range of input values used for female mortality. In particular, decreases in male mortality did not have the same significant increases in r-stoc as was observed for female mortality.

At first glance, the sensitivity results for age of first reproduction in females might seem surprising, with earlier reproduction leading to a slightly lower growth rate relative to the baseline. A closer look at how *Vortex* operates shows that this is an artifact of the model, and not necessarily biologically relevant. Lowering the age of first reproduction alters the stable age class distribution calculated by *Vortex*, increasing the number of individuals in the first age class relative to the baseline. Since this age class also suffers the highest mortality rate, a slight (non-significant) decrease in r-stoc was observed.

These results indicate the parameters to which the model is most sensitive across plausible values. In some cases, the country models explored even higher levels of mortality. Research efforts to better estimate the values of the most sensitive parameters would strengthen the ability to project the future viability of maned wolf populations. Also, management actions that can improve female mortality and the percent of females breeding (e.g., adequate food resources for good health, adequate denning sites free from disturbance, underpasses for secure road crossings) would benefit the population.

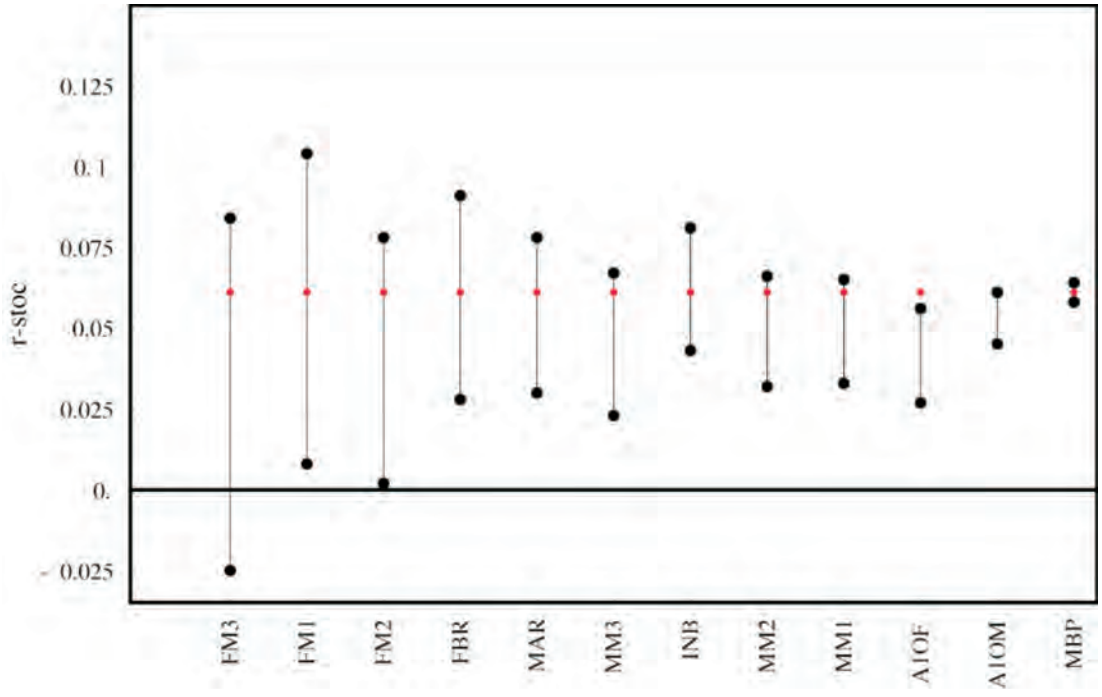


Figure 1. Sensitivity analysis for demographic parameters and inbreeding depression. Small red circles represent the baseline r-stoc; FM3: adult female mortality; FM1: juvenile female mortality; FM2: sub-adult female mortality; FBR: percent females breeding; MAR: maximum age of reproduction; MM3: adult male mortality; INB: inbreeding depression; MM2: sub-adult male mortality; MM1: juvenile male mortality; A1OF: age of first reproduction for females; A1OM: age of first reproduction for males; MBP: proportion of males in the breeding pool.

Primary Threats

Participants of the workshop identified two main threats to maned wolf populations. Threats and modeling conditions are below:

1. Deaths of wolves due to road kill, poaching and shooting of "problem animals". All of these categories fit under the harvest module within *Vortex*, which allows for a specific number of males and/or females to be removed per year over a determined number of years. Here, we modeled different number of males and females being removed annually over the entire period modeled of 100 years.

2. Habitat loss due to land conversion, and encroachment. The proximate result of habitat loss is a decrease in the carrying capacity of the environment. As such, we chose to model this threat as a linear decrease in carrying capacity over 100 years.

Maned wolf populations are spread out across a huge area of South America, encompassing 5 countries. Because of this, a more general approach was chosen to model threats, rather than modeling each known population. As such, each threat was first modeled separately across different levels of threats and different initial population sizes to evaluate the effect of each threat on its own across a possible range of maned wolf population sizes. Subsequently, we modeled both threats simultaneously by varying both threats in a factorial design, but keeping a constant initial population size of 100, to gauge the effect of both threats acting together on a mid-size maned wolf population. This produced results for general maned wolf populations that may guide maned wolf managers in estimating the level of threat for a specific population.

Harvesting vs Initial Population Size

The effect of harvesting on maned wolf populations of different sizes was evaluated. Initial population sizes were chosen based on what participants thought would be a reasonable range of population sizes for actual maned wolf populations (from 15 to 1000). The objective was to gain insight into the relative effect of different harvesting levels on different populations. In total, six different levels of harvesting were tested: 0 (i.e. no harvesting), 2, 4, 6, 10, and 20 adult wolves removed from the population per year (equal number of females and males removed). All scenarios were run for 100 years, with 500 iterations each.

Five different measures of population status were examined: stochastic growth rate (r-stoc); probability of extinction over 100 years (PE_{100}); mean population size after 100 years (N_{100}); average retention of gene diversity (GD); and average time to extinction (MTE). The results are summarized in Figure 2 (a table with all results can be found in the Appendix).

As expected, small populations are more vulnerable to harvesting. Because harvest is modeled as a fixed number of wolves removed, the same harvest level represents a greater proportion of smaller populations. For example, removing 20 individuals represents 80% of a population of 25, but only 2% of a population of 1000. The greater the proportion of the population that is removed each year, the greater the impact harvesting has on the population. With a deterministic annual growth rate of only 9%, populations cannot biologically sustain harvest at this level or greater, even in the absence of stochastic effects. Therefore, even large populations can suffer from harvesting if too many animals are harvested. Furthermore, as seen in the sensitivity analysis, maned wolf growth rates seem to be more sensitive to female mortality than to male mortality, implying that harvesting can be more or less pervasive depending on which animals are removed.

The smallest population modeled (N_{init} = 25) showed negative stochastic growth rates at any level of harvesting; even with no harvest, a population of 25 has a high probability of extinction, with a small population size and low level of gene diversity for those populations that do persist. Only populations with 500 or more individuals display positive growth rates in

all harvest levels tested, which is mirrored with positive results in all other population measures examined. Populations of 100 appear to be most sensitive to the different harvest rates tested (removal of 2-20% of N_{init}); the loss of only a couple of additional wolves each year can have a large effect on population viability.

Loss of Habitat vs Initial Population Size

In the previous analysis, carrying capacity remained constant ($K = N_{init}$), meaning that populations were not limited by habitat resources but by the removal of breeders from the population, affecting the potential of the population to grow to K. In this analysis the effect of habitat loss (permanent reduction in K) was investigated for populations of different size (15 to 1000 wolves). Three different levels of habitat loss were modeled: 5%, 25% and 50% loss over 100 years. This was modeled as a linear decrease in carrying capacity over time (i.e. a total of 5% of the carrying capacity was lost over a 100-year period). This effectively reduced the maximum size that a population could attain, meaning that in the most extreme example of 50% habitat loss, maximum final population sizes were 7, 12, 25, 50, 125, 250 and 500 wolves. All scenarios were run for 100 years, with 500 iterations of each. The same population measures were evaluated, and the results are summarized in Figure 3 (a table with all results can be found in the Appendix).

Again, small populations are affected more than large populations. Populations of N_{init} of 25 or fewer wolves show negative growth rates due to their vulnerability to stochastic processes. Although populations of N_{init} = 50-100 wolves have a relatively low risk of extinction, they lose a significant amount of genetic variation. These scenarios represent cases in which final K is 25-95 wolves, suggesting that the long-term genetic health of populations below 100 wolves may be poor. Initial populations of 250-1000 wolves that decline to a K of 125-950 wolves show better viability over 100 years in the absence of additional losses (harvest) due to road kill, poaching and other sources of removal. As discussed earlier, these additional threats reduce the viability of maned wolf populations, particularly populations with $K < 500$ wolves.

Harvesting vs Habitat Loss

As pointed out by workshop participants, in many cases populations are suffering some form of harvest and habitat loss at the same time. Earlier analyses suggest that populations around 100 wolves may be the most sensitive to such threats. To assess the synergistic effect of both threats, a factorial design was used to model the interaction of different levels of harvest and habitat loss, while keeping initial population size (N_{init}) and K constant at 100 wolves. Five different levels of harvesting (2, 4, 6, 10, 20 individuals/year) and three different levels of habitat loss (5%, 25% and 50%) were analyzed (for a total of 15 scenarios). All models were run for 100 years, with 500 iterations each. The results are summarized in Figure 4 (a table with all results can be found in the Appendix).

The loss of habitat modeled results in final carrying capacities (maximum population sizes) of 95, 75 and 50 wolves, respectively. It is not surprising, therefore, that the results of this analysis are similar to those in Figure 2 for population sizes of 50-100 and harvest > 0. Harvest has an overriding impact over habitat loss; this means that varying maximum population size between 50 to 95 wolves has less impact on population viability than varying annual harvest 10-fold.

Populations of about 50-100 wolves cannot withstand the harvest of more than 2 adults each year, as this results in a negative stochastic growth rate and relatively high PE within 100 years. Even with the lowest level of harvest, substantial genetic diversity is lost. The viability of populations of 100 wolves or fewer is poor over all harvest and habitat loss levels modeled here. Larger populations are more likely to be able to withstand such threats and may yield different results.

Summary

In this section the effects of harvest and habitat loss on maned wolf populations have been explored. In general, populations of 25 or fewer decline and have a high probability of extinction within 100 years, and populations of 50-100 may persist but retain low levels of gene diversity. Several hundred wolves may be needed to maintain a long-term, viable population, depending upon the severity of threats and the management goals and acceptable level of risk for wildlife managers.

These results may serve as a guide to the relative effects of each threat to different sized populations. Furthermore, the results have been displayed in a way that might facilitate a maned wolf conservationist to identify the relative viability of a specific wolf population, based on specific viability criteria and management goals.

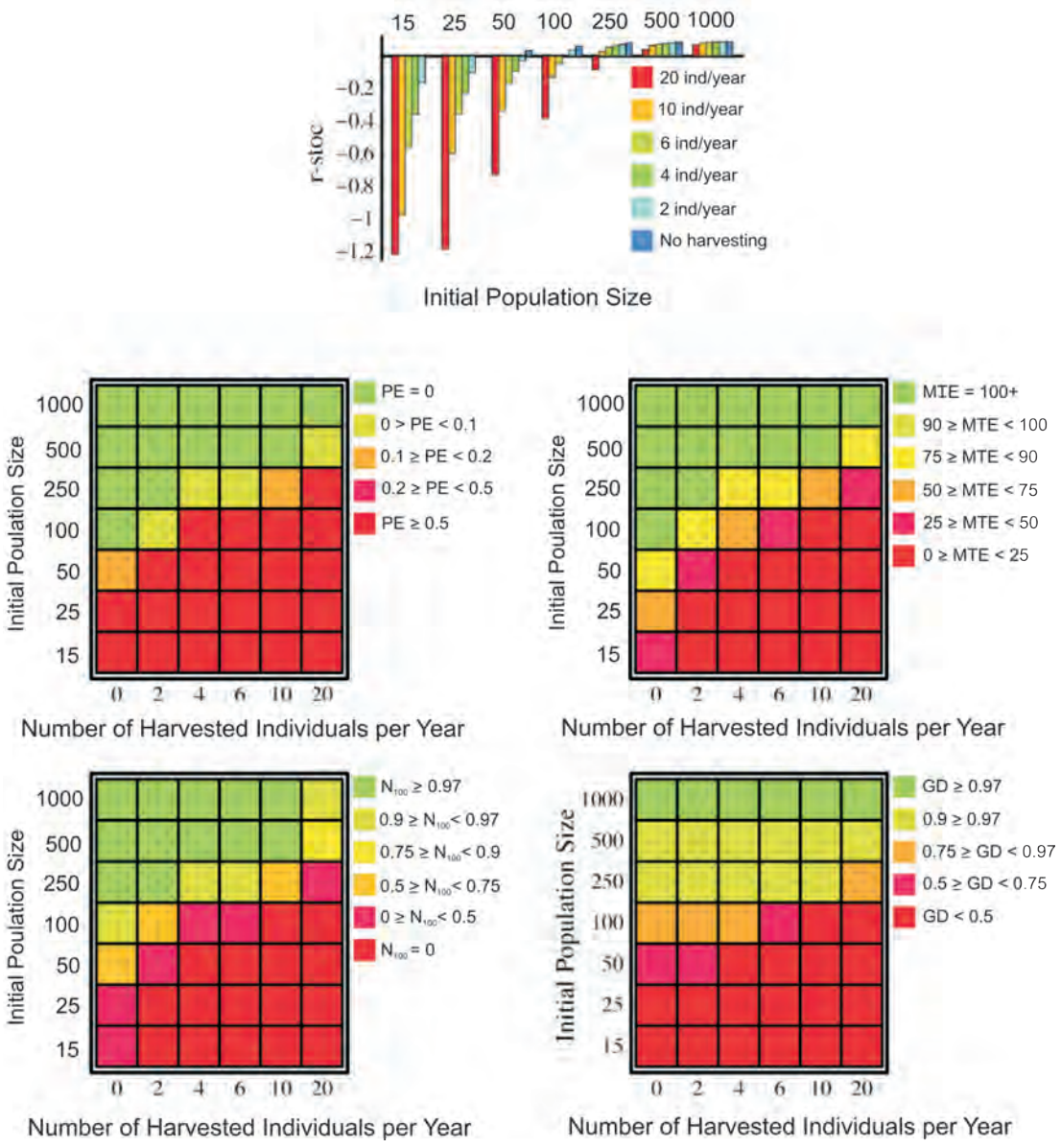


Figure 2. Summary of results obtained from modeling different harvesting levels against populations with different sizes. First row (bar graph): N_{init} vs r-stoc; second row (top 2 matrices): N_{init} vs PE_{100}; N_{init} vs MTE; third row (bottom 2 matrices): N_{init} vs N_{100} shown as the proportion N_{100}/N_{init}; N_{init} vs GD.

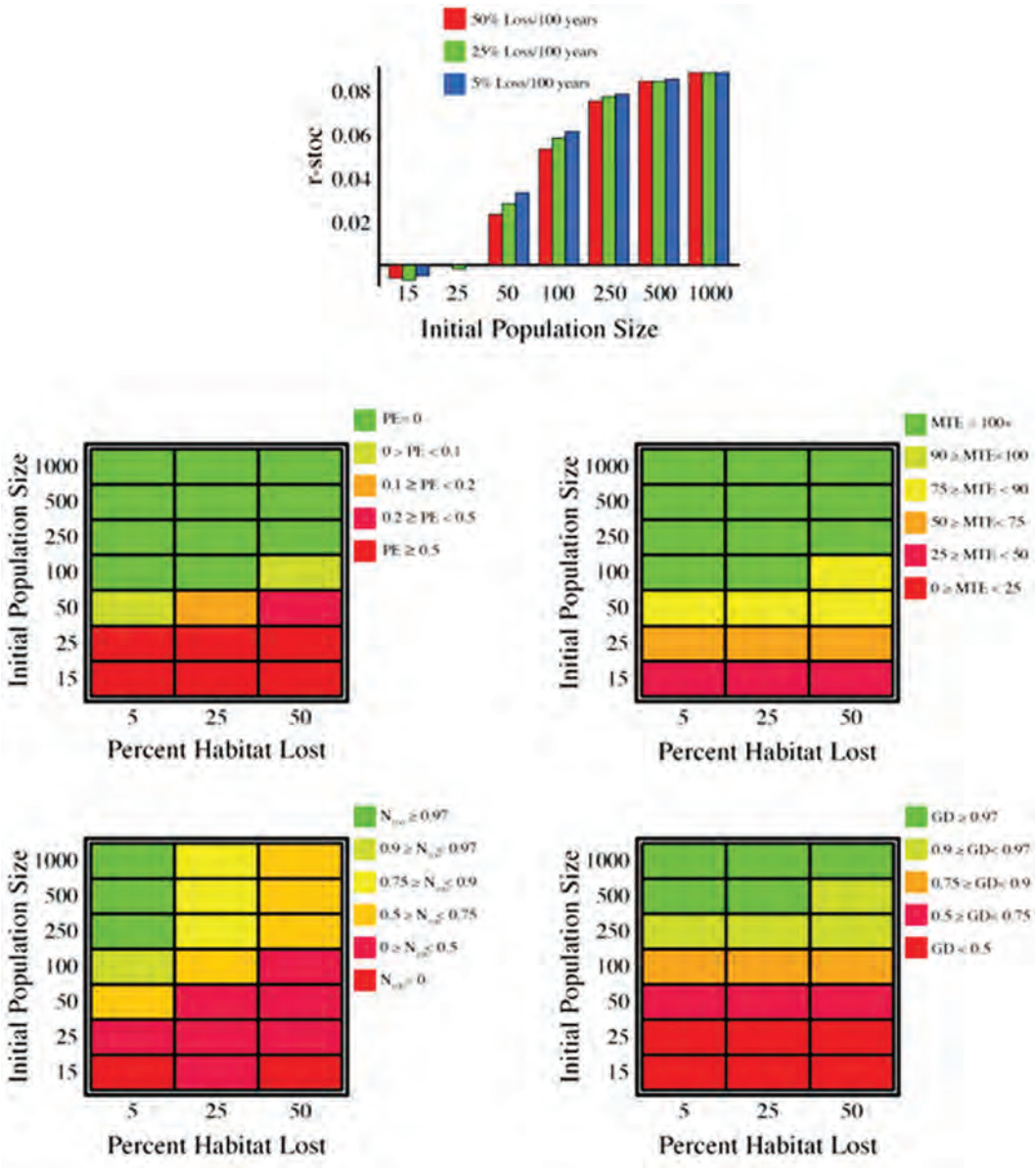


Figure 3. Summary of results obtained from modeling different levels of habitat loss against populations with different sizes. First row (bar graph): N_{init} vs r-stoc; second row (top 2 matrices): N_{init} vs PE_{100}; N_{init} vs MTE; third row (bottom 2 matrices): N_{init} vs N_{100} shown as the proportion N_{100}/N_{init}; N_{init} vs GD.

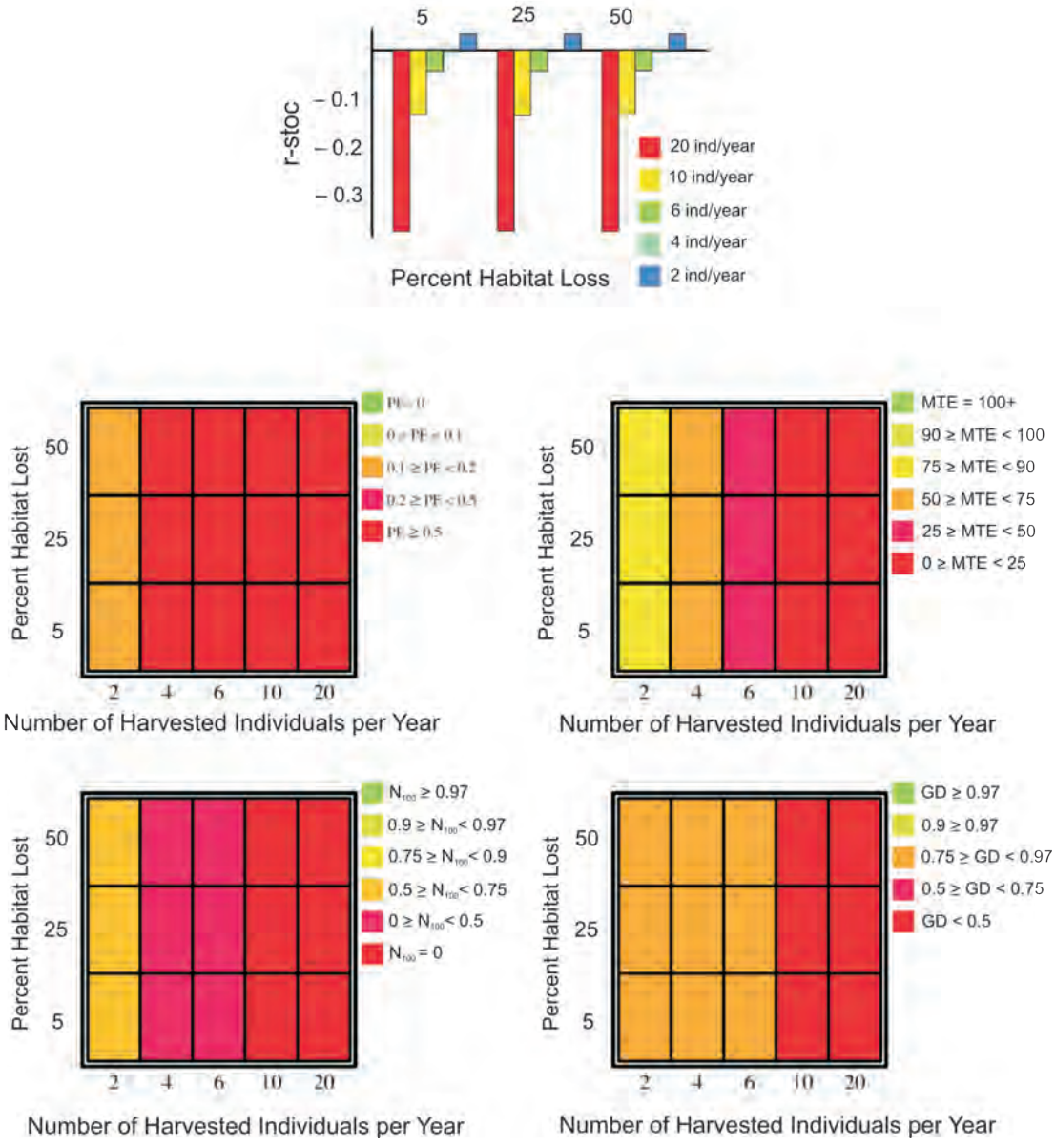


Figure 4. Summary of results obtained from modeling different levels of harvesting against different levels of habitat loss. First row (bar graph): N_{init} vs r-stoc; second row (top 2 matrices): N_{init} vs PE_{100}; N_{init} vs MTE; third row (bottom 2 matrices): N_{init} vs N_{100} shown as the proportion N_{100}/N_{init}; N_{init} vs GD.

Country-Specific Models

PVA methodologies such as the *Vortex* simulation model are not intended to give absolute and precise "answers", since they are projecting the interactions of many randomly-fluctuating parameters used as model input and because there is often considerable measurement uncertainty in wildlife population demography datasets and in the estimation of demographic rates by the workshop participants. Because of these limitations, many researchers have cautioned against the sole use of PVA results to promote specific management actions for threatened populations (Beissinger & McCullough, 2002; Ellner *et al.*, 2002; Lotts *et al.*, 2004; Ludwig, 1999; Reed *et al.*, 2002).

Instead, the true value of an analysis of this type lies in the assembly and critical analysis of the available information on the species and its ecology, and in the ability to compare the quantitative metrics of population performance that emerge from a suite of simulations, with each simulation representing a specific scenario and its inherent assumptions about the available data and a proposed method of population and/or landscape management. Interpretation of the output depends upon our knowledge of the biology and distribution of maned wolves, the environmental conditions and anthropogenic impacts affecting the species, and possible future changes in these conditions.

During the workshop it was clear that there still remains a lot to be learned about maned wolves. Many of the parameter values included in this model are best guesses due to this lack of current data. In particular, the distribution of this animal in the four different countries is still not fully known, and estimation of population sizes of the species was difficult. Biologists at the PHVA workshop agreed that, although the input data for countries could not be regarded as accurate, the process should not be abandoned, as the modeling process could be used to highlight critical problems and provide an overview of the species situation and persistence. Therefore the models are intended to be a guide for further research and conservation work.

A best-guess baseline model and a few selected scenarios were developed for each country. This approach was chosen because there is no significant connectivity among maned wolf populations between different countries due to large rivers and other barriers near country boundaries (Figure 5). The exception was the population in Peru, which was modeled as part of the Bolivian population since it is small and is connected to the Bolivian population.

The country approach was selected to help stimulate an in-depth country analysis of current maned wolf knowledge and the creation of country baseline models. Unfortunately this approach is more general and provides only limited assessment of population viability of specific populations. For specific populations a combination of the country baseline model and the sensitivity testing analysis may shed some light on probable future viability.

None of the maned wolf models included the risk of disease outbreak, such as parvovirus, canine distemper or rabies, on maned wolf populations. Deem and Emmons (2005) observed a very high incidence of numerous canine viral and parasitic diseases in maned wolf populations. Although disease may have an important impact, particularly on small populations, it was difficult to model this for the country-level metapopulations with no specific disease information. The potential impact of disease can be inferred from sensitivity testing results of increased mortality rates.

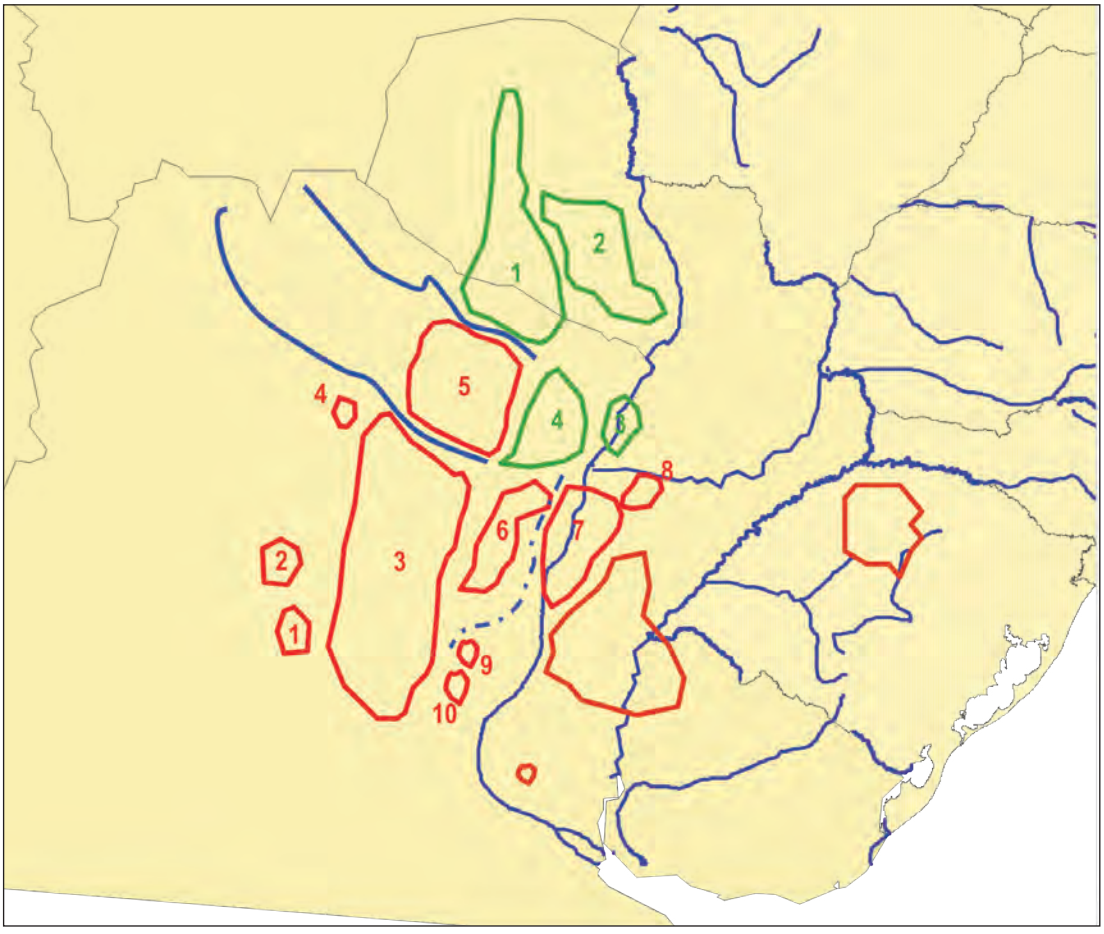


Figure 5. Maned wolf populations of the southern cone. Populations in red are from Argentina, populations in green are from Paraguay and populations in brown are from Brazil and Uruguay.

Results reported for each Vortex modeling scenario include:

r_{stoch} (SD) – The mean rate of stochastic population growth or decline and standard deviation, demonstrated by the simulated populations, averaged across years and iterations, for all simulated populations. This population growth rate is calculated each year of the simulation, prior to any truncation of the population size due to the population exceeding the carrying capacity.

$P(E)_{100}$ – Probability that the population will go extinct. Extinction is defined in the model as no animals of one or both sexes remaining. $P(E)_{100}$ is determined by the proportion of 500 iterations within a given scenario that go extinct within 100 years.

MTE – Mean time to population extinction, in years, over a 100-year period.

N_{100} (SD) – Mean (standard deviation) population size at the end of the simulation, averaged across all simulated populations, including those that go extinct.

GD_{100} – The gene diversity or expected heterozygosity of the extant populations, expressed as a percent of the initial gene diversity of the population. Fitness of individuals usually declines proportionately with gene diversity. Calculated based on gene drop simulations, not on molecular data.

ARGENTINA

Baseline Model

A population model was designed to investigate the viability of the maned wolf population in Argentina. Up to 10 populations of maned wolves were identified in Argentina (Figure 6). However, connectivity among these populations varies and is uncertain. After some discussion it was decided to model maned wolf populations according to 3 different scenarios in which the number of functional populations varied:

10 population scenario (10Pop):

Ten individual populations were modeled, with the opportunity for dispersal between some of the populations.

5 population scenario (5Pop):

Due to high levels of connectivity some of the populations from the 10Pop scenario might function as a single population. This is the scenario that the participants from Argentina felt best reflected reality.

Population 1 (5Pop) = Pop 1, pop 2, pop 3 of 10 pop
Population 2 (5pop)= Pop 4 of 10pop
Population 3 (5pop)= Pop 5 of 10pop
Population 4 (5Pop) = Pop 6, pop 7, pop 8 of 10 pop
Population 5 (5Pop) = Pop 9, pop 10 of 10 pop

2 population scenario (2Pop):

Maned wolf populations in Argentina were modeled as two metapopulations with no connectivity between them due to the river.

After much discussion, and based on literature values for density estimates in different habitats, knowledge of the areas and best guesses, participants estimated that in total there are about 660 maned wolves in Argentina. (Note: numbers of individuals are of the total population and include newborn pups, juveniles and adults). The carrying capacity in the areas where they occur was considered to be higher than the current population estimates. It was estimated that up to 810 maned wolves could survive in the areas identified. Tables 6, 7 and 8 present the values for the estimated initial population size and carrying capacity used in the various scenarios. Parameters from the baseline model were adapted for Argentina and are outlined in Table 9. Furthermore, some parameters such as harvest rates or dispersal rates that were not included in the baseline model are detailed below.

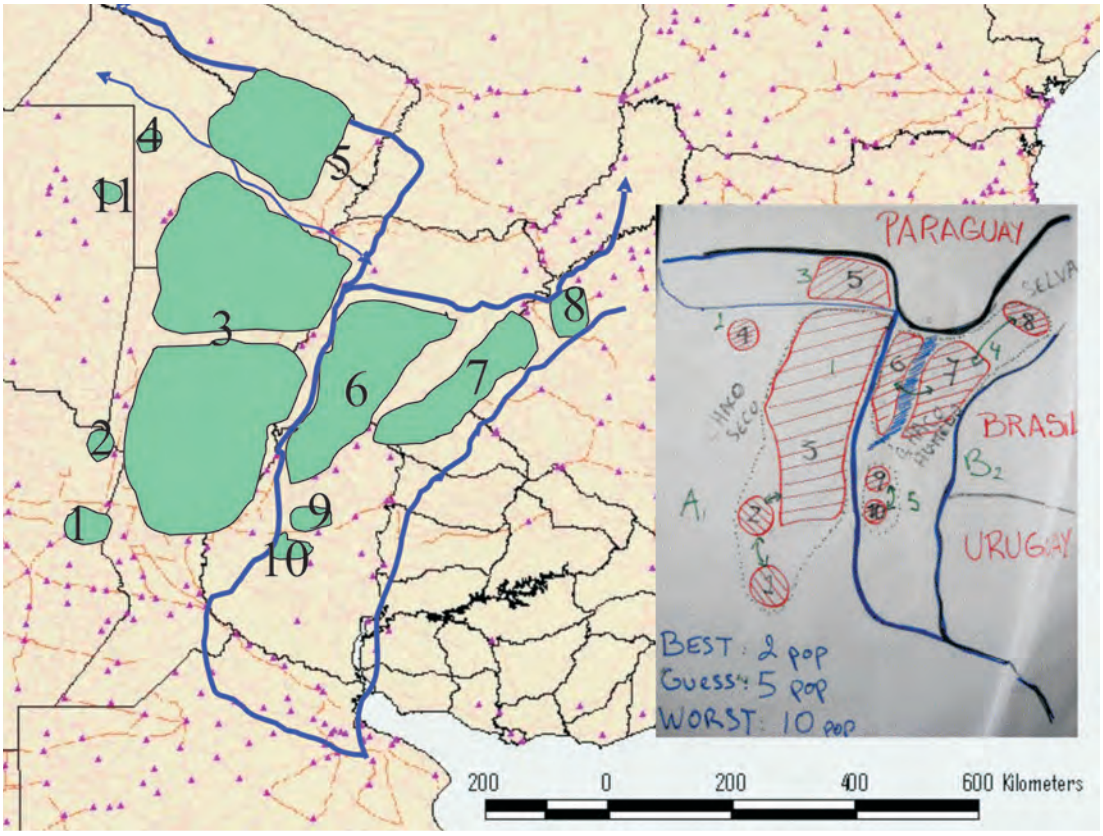


Figure 6. Estimated distribution of maned wolf populations in Argentina.

Population 1: Cordoba
Population 2: Santiago del estero
Population 3: Santa Fe
Population 4: Chaquito
Population 5: Formosa
Population 6: Corrientes 1
Population 7: Corrientes 2
Population 8: Misiones
Population 9: Entre Rios
Population 10:La Paz
Population 11: is a new population in which maned wolves have recently been photographed (Soler, pers. comm.)

Table 6. Initial population size and carrying capacity for 10Pop Scenario, representing 10 populations of maned wolves in Argentina (worst case scenario).

Argentina 10Pop	Initial Population	Carrying Capacity
Population 1	10	10
Population 2	20	20
Population 3	200	250
Population 4	10	10
Population 5	100	130
Population 6	100	130

continues

Argentina 10Pop	Initial Population	Carrying Capacity
Population 7	190	220
Population 8	10	10
Population 9	10	15
Population 10	10	15
Total (metapopulation)	660	810

Table 7. Initial population size and carrying capacity for 5Pop Scenario, representing 5 populations of maned wolves in Argentina (best guess scenario).

Argentina 5Pop	Initial Population	Carrying Capacity
Population 1	230	280
Population 2	10	10
Population 3	100	130
Population 4	300	360
Population 5	20	30
Total (metapopulation)	660	810

Table 8. Initial population size and carrying capacity for 2Pop Scenario, representing 2 populations in Argentina (best case scenario).

Argentina 2Pop	Initial Population	Carrying Capacity
Population 1	340	420
Population 2	320	390
Total (metapopulation)	660	810

Table 9. Parameters entered in the *Vortex* model.

Parameter	Baseline	Argentina
Number of populations	1	10, 5 or 2*
Initial population size	100	660
Carrying capacity	100	810
Dispersal among pop	none	yes
Inbreeding depression? %	3.14 LE	3.14 LE
% of inbreeding effect due to recessive lethal alleles	50	100
Breeding system	long-term monogamy	long-term monogamy
Age of first reproduction (♀ / ♂)	2 years	2 years
Maximum age of reproduction	10 years	10 years
Annual % adult females reproducing (SD)	60 (10)	60 (10)
Density dependent reproduction?	no	No
Maximum litter size	5	5
Distribution of offspring per female per year (given in %)		
1 Offspring	21	21
2 Offspring	24	24
3 Offspring	28	28
4 Offspring	19	19
5 Offspring	8	8

continues

Parameter	Baseline	Argentina
Overall offspring sex ratio	50:50	50:50
% adult males in breeding pool	90	90
% mortality from age 0-1 (SD)	60 (10)	60 (10)
% mortality from age 1-2 (SD)	20 (5)	changed *
% mortality from age 2+ (SD)	10 (2)	10 (2)
Catastrophe	none	none
Harvest	none	Yes*
Supplementation	none	none

* parameters have been modeled for different values from baseline model.

Table 10. Mortality rates used in the Argentina 10Pop Scenario.

	Baseline	Argentina 10Pop									
	single pop	Pop 1	Pop 2	Pop 3	Pop 4	Pop 5	Pop 6	Pop 7	Pop 8	Pop 9	Pop 10
% mortality from age 0-1 (SD)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)
% mortality from age 1-2 (SD)	20 (5)	35 (5)	35 (5)	35 (5)	35 (5)	25 (5)	25 (5)	25 (5)	25 (5)	25 (5)	25 (5)
% mortality from age 2+ (SD)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)

Table 11. Mortality rates used in the Argentina 5Pop Scenario.

	Baseline	Argentina 5Pop				
	single pop	Pop 1	Pop 2	Pop 3	Pop 4	Pop 5
% mortality from age 0-1 (SD)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)
% mortality from age 1-2 (SD)	20 (5)	35 (5)	35 (5)	25 (5)	25 (5)	25 (5)
% mortality from age 2+ (SD)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)

Table 12. Mortality rates used in the Argentina 2Pop Scenario.

	Baseline	Argentina 2Pop	
	single pop	Pop 1	Pop 2
% mortality from age 0-1 (SD)	60 (10)	60 (10)	60 (10)
% mortality from age 1-2 (SD)	20 (5)	35 (5)	25 (5)
% mortality from age 2+ (SD)	10 (2)	10 (2)	10 (2)

Harvest

Each year wolves are removed from the wild population due to anthropogenic causes. These losses include animals that are shot, trapped or captured and sold. Participants felt that this was the major conservation issue for maned wolves in Argentina, as persecution of maned wolves is widespread. The loss of maned wolves from the wild population was modeled as the removal of a constant percentage of wolves each year, as described below.

Argentina 10Pop Scenario:

In Populations 1, 2, 3, 4, 6, 7, 8, 9, 10: 20% of the sub-adults and adults (male and female) are removed each year for 100 years.

In Population 5: 5% of the sub-adults and adults (male and female) are removed each year for 100 years.

Argentina 5Pop Scenario:

In Populations 1, 2, 3, 5: 20% of the sub-adults and adults (male and female) are removed each year for 100 years.

In Population 3: 5% of the sub-adults and adults (male and female) are removed each year for 100 year

Argentina 2Pop Scenario:

In Population 1: 15% of the sub-adults and adults (male and female) are removed each year for 100 years.

In Population 2: 20% of the sub-adults and adults (male and female) are removed each year for 100 years.

Dispersal

In some instances maned wolves are able to disperse from one population to another. Dispersal rates are different among the different scenarios. In the model both sub-adult males and sub-adult females have an equal chance of dispersing, with 50% chance of survival during dispersal. Tables 13 and 14 give the dispersal rates for 10Pop and 5Pop Scenarios; no dispersal was modeled between the two maned wolf populations in 2Pop Scenario.

Table 13. Dispersal estimates among populations in the 10Pop Scenario. Values indicate the probability of an individual wolf moving from one population to another in a given year, independently of other individuals in either the source (row) or recipient (column) populations.

	Pop 1	Pop 2	Pop 3	Pop 4	Pop 5	Pop 6	Pop 7	Pop 8	Pop 9	Pop10
Pop 1	99	1	0	0	0	0	0	0	0	0
Pop 2	1	98	1	0	0	0	0	0	0	0
Pop 3	0	1	99	0	0	0	0	0	0	0
Pop 4	0	0	0	100	0	0	0	0	0	0
Pop 5	0	0	0	0	100	0	0	0	0	0
Pop 6	0	0	0	0	0	99	1	0	0	0
Pop 7	0	0	0	0	0	1	98	1	0	0
Pop 8	0	0	0	0	0	0	1	99	0	0
Pop 9	0	0	0	0	0	0	0	0	99	1
Pop10	0	0	0	0	0	0	0	0	1	99

Table 14. Dispersal estimates among populations in the 5Pop Scenario. Values indicate the probability of an individual wolf moving from one population to another in a given year, independently of other individuals in either the source (row) or recipient (column) populations.

	Pop 1	Pop 2	Pop 3	Pop 4	Pop 5
Pop 1	98	1	1	0	0
Pop 2	1	99	0	0	0
Pop 3	1	0	99	0	0
Pop 4	0	0	0	99	1
Pop 5	0	0	0	1	99

Argentina Baseline Model Results

The mean stochastic rate of population growth (or decline), probability of population extinction, mean population size after 100 years, and mean gene diversity for the three different scenarios modeled are presented in Tables 15-17. The mean number of wolves (across all iterations) in each population over time for the different scenarios is presented in Figures 7-9.

The model results of the three population structure scenarios were very similar. With the exception of Population 5 from the 10Pop Scenario (same as Population 3 in the 5Pop Scenario), none of the other populations of maned wolves are projected to persist for 100 years as modeled. The one viable population inhabits the northern part of Argentina Formosa where there are few roads (and therefore low road kill) and a national park which offers maned wolf population some protection). These simulations suggest that if this northern population is well connected to other populations, as in the 2Pop model, then it may even act as a source of animals for adjacent population "sinks" and eventually go extinct as well.

Due to the current harvest and road kill estimates the projected mean stochastic growth rate of most maned wolf populations in Argentina is negative (except for Population 5 from 10Pop). Population size alone does not account for the better viability of the northern population; rather, this population is estimated to lose a smaller proportion of wolves (5% vs 20%) to anthropogenic causes. This suggests that even relatively large maned wolf populations cannot sustain the loss of 15-20% of its sub-adult and adult individuals each year. If these estimates of removal are close to reality, then maned wolf populations in Argentina are in urgent need of conservation.

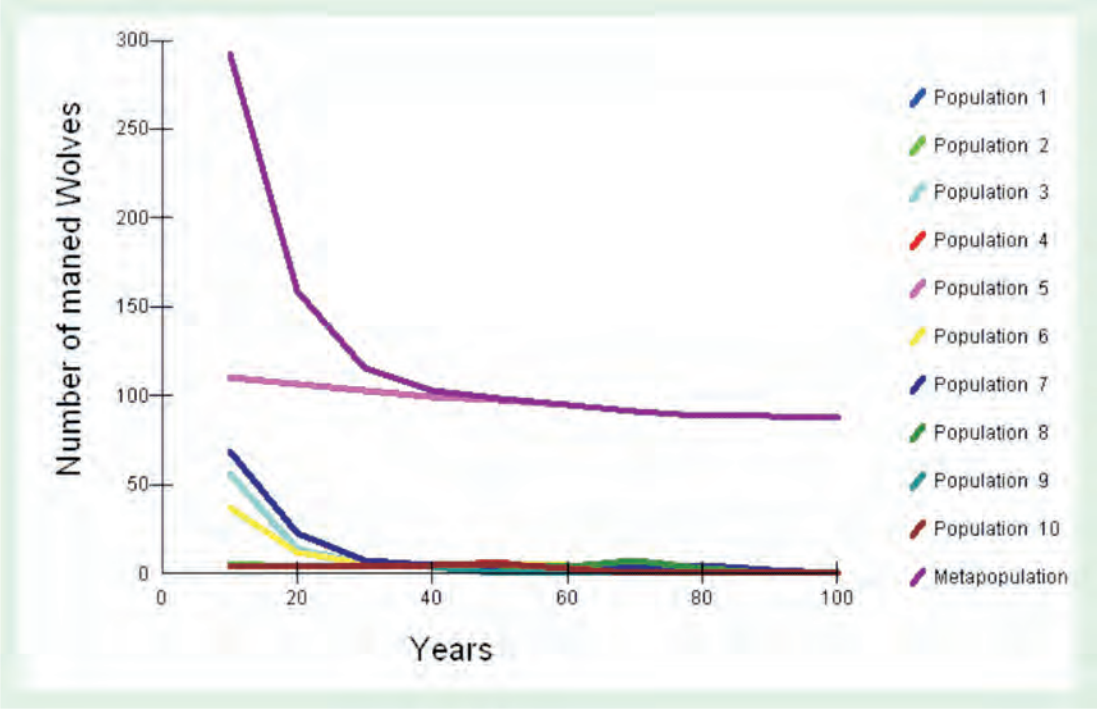


Figure 7. Mean population size (across all iterations) for the 10 populations of maned wolves in the 10Pop model over 100 years.

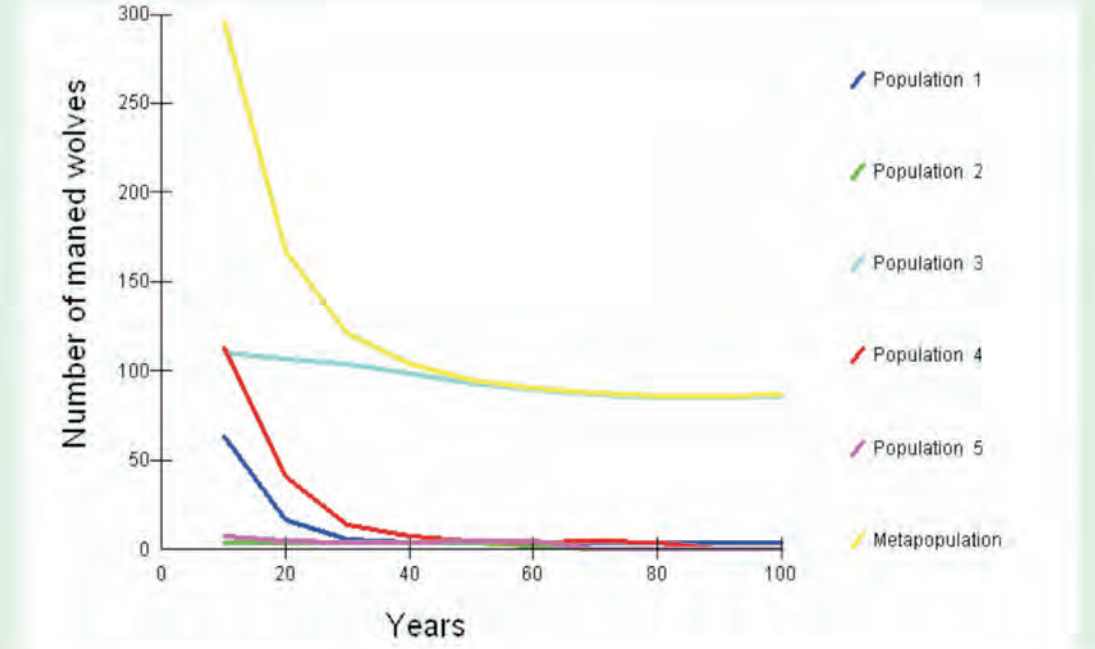


Figure 8. Mean population size (across all iterations) for the 5 populations of maned wolves in the 5Pop model over 100 years.

Table 15. Results of the 10Pop model after 100 years for maned wolf populations in Argentina.

10Pop	N_{init}	r_{stoch}	$SD(r_{stoch})$	$P(E)_{100}$	MTE	N_{100}	$SD(N_{100})$	GD_{100}
Population 1	10	-0.096	0.317	1	13	0	--	--
Population 2	20	-0.110	0.294	1	17	0	--	--
Population 3	200	-0.138	0.233	1	31	0	--	--
Population 4	10	-0.094	0.316	1	13	0	--	--
Population 5	100	0.015	0.138	0.028	75	88	38.5	0.789
Population 6	100	-0.113	0.231	1	32	0	--	--
Population 7	190	-0.115	0.228	1	37	0	--	--
Population 8	10	-0.068	0.307	1	16	0	--	--
Population 9	10	-0.085	0.299	1	15	0	--	--
Population 10	10	-0.090	0.304	1	14	0	--	--
Metapopulation	660	-0.006	0.133	0.028	77	88	38.5	0.789

Table 16. Results of the 5Pop model after 100 years for maned wolf populations in Argentina.

5Pop	N_{init}	r_{stoch}	$SD(r_{stoch})$	$P(E)_{100}$	MTE	N_{100}	$SD(N_{100})$	GD_{100}
Population 1	230	-0.108	0.261	0.934	35	3	1.6	0.615
Population 2	10	-0.078	0.324	1	14	0	--	--
Population 3	100	0.013	0.139	0.052	74	87	38.0	0.788
Population 4	300	-0.113	0.214	1	42	0	--	--
Population 5	20	-0.089	0.286	1	21	0	--	--
Metapopulation	660	-0.009	0.133	0.052	74	88	38.4	0.788

Table 17. Results of the 2Pop model after 100 years for maned wolf populations in Argentina.

2Pop	N_{init}	r_{stoch}	$SD(r_{stoch})$	$P(E)_{100}$	MTE	N_{100}	$SD(N_{100})$	GD_{100}
Population 1	340	-0.135	0.223	1	36	0	--	--
Population 2	320	-0.113	0.211	1	42	0	--	--
Metapopulation	660	-0.122	0.190	1	45	0	--	--

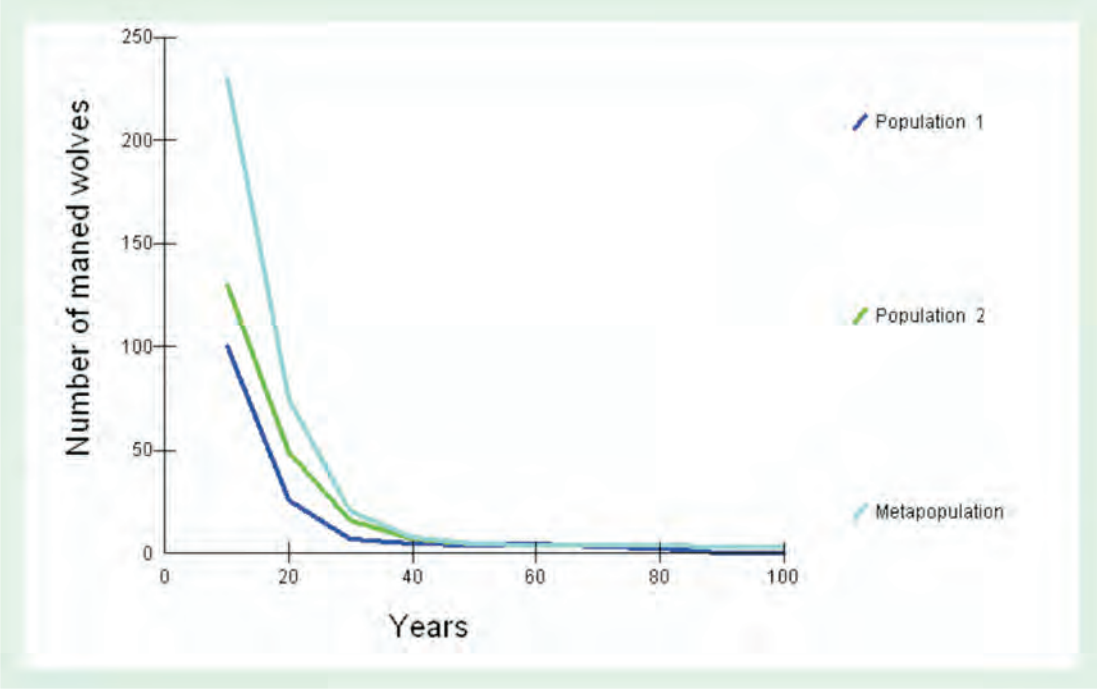


Figure 9. Mean population size (across all iterations) for the 2 populations of maned wolves in the 2Pop model over 100 years.

Alternative Futures: Decreasing Harvest of Maned Wolves

During the workshop all participants from the different regions of Argentina felt that the main threats to maned wolves were shooting, trapping and general persecution. For this reason high annual harvest levels (20% of the sub-adults and adults) were modeled.

Education campaigns, information and promotion of the conservation of maned wolves in the general media, and enforcement of existing laws could help decrease harvest rates. The outcome of an education campaign throughout the distribution areas of maned wolves was assessed and three scenarios outcomes were compared:

- The education campaign is a failure and harvest levels remain the same (Baseline Scenario).
- Harvest levels are reduced by 50% due to a well-targeted and successful education campaign (Low Harvest Scenario).
- Harvest of maned wolves in Argentina is eliminated immediately (considered to be unrealistic) (No Harvest Scenario).

Alternative Futures Model Results

As predicted, changes in harvest rates make an important difference in the probability of extinction of populations of maned wolves. The mean metapopulation size at the end of the

simulation, averaged across all iterations, was higher when harvest levels were decreased as shown in Figures 10-12 and Table 18.

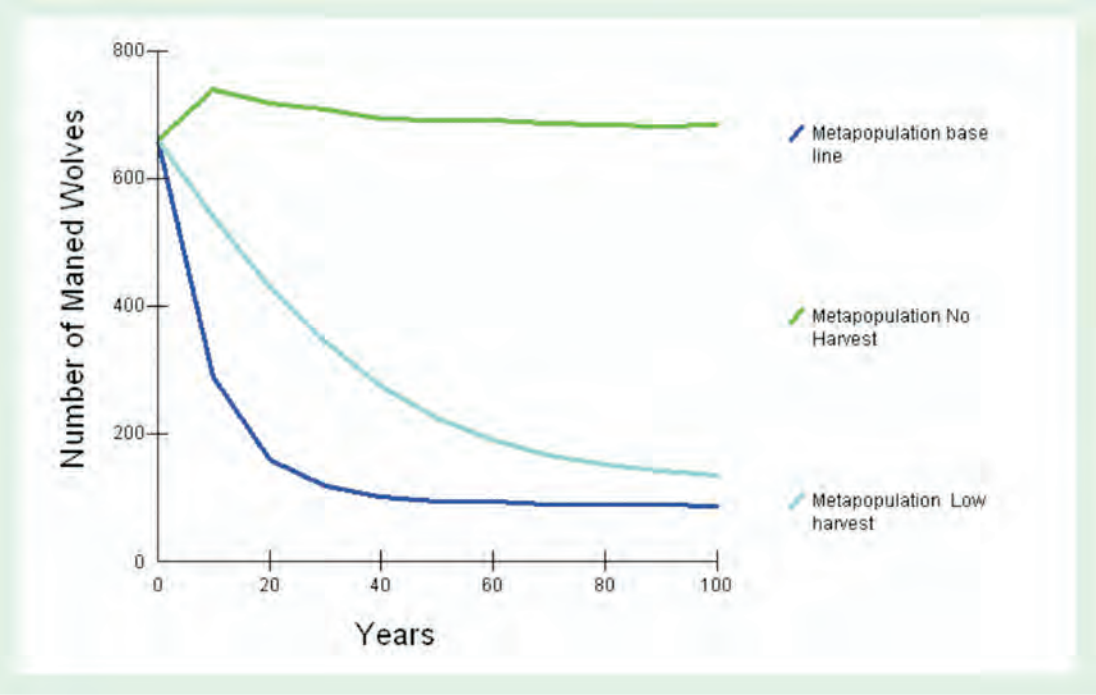


Figure 10. Mean metapopulation size (across all iterations) for the 10 populations of maned wolves under different harvesting pressures over 100 years.

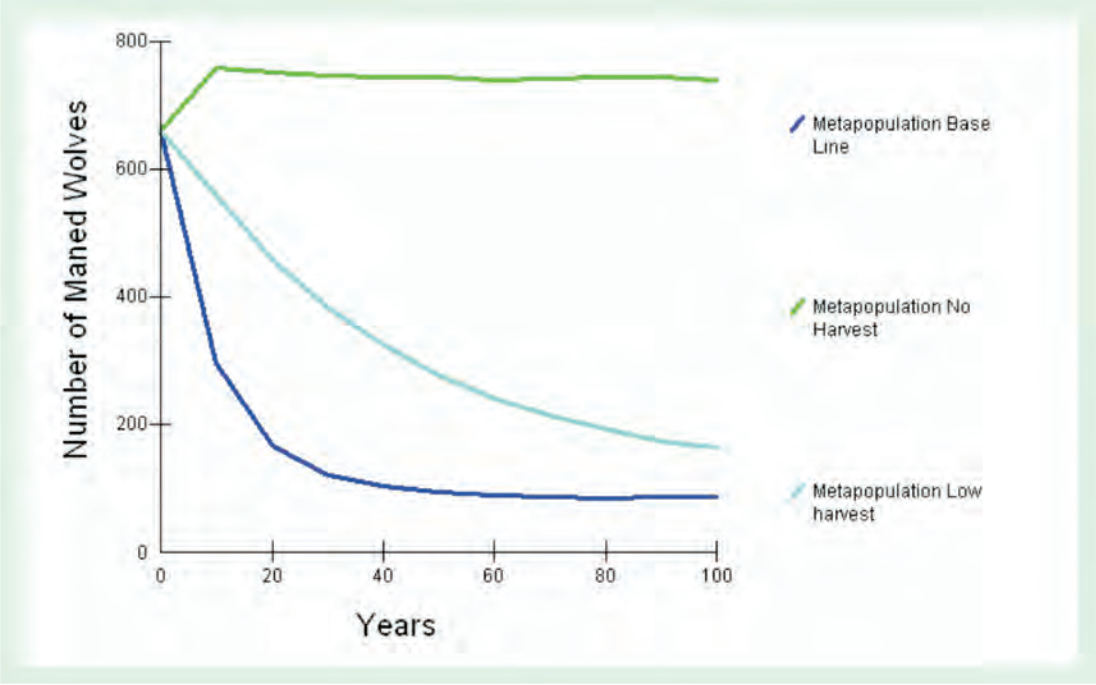


Figure 11. Mean metapopulation size (across all iterations) for the 5 populations of maned wolves under different harvesting pressures over 100 years.

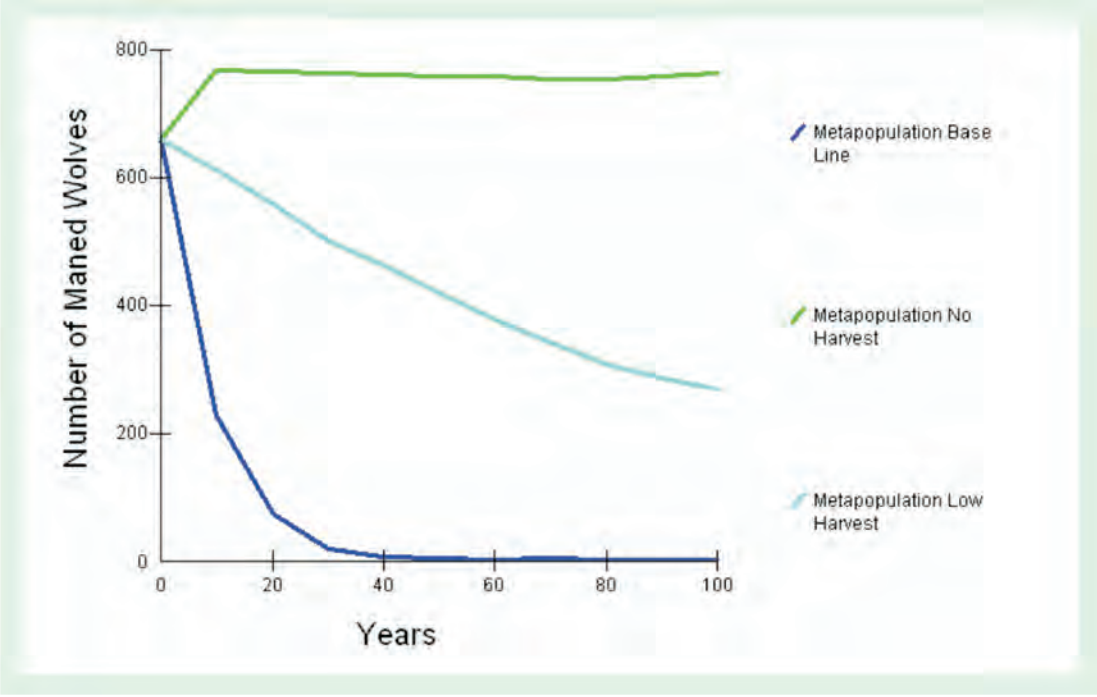


Figure 12. Mean population size (across all iterations) for the 2 populations of maned wolves under different harvesting pressures over 100 years.

Table 18. Effect of decreasing harvest levels on maned wolf metapopulations.

	Baseline		Low Harvest		No Harvest	
	$P(E)_{100}$	N_{100}	$P(E)_{100}$	N_{100}	$P(E)_{100}$	N_{100}
Pop10	0.036	88	0	137	0	682
Pop5	0.060	86	0	163	0	762
Pop2	0.996	4	0.008	268	0	762

Much of the loss of maned wolves is due to direct persecution rather than road kill, suggesting that the direct killing of wolves has a significant impact on the size and viability of maned wolf populations. To verify this we modeled an additional scenario that included harvest but no road kill and compared this to the baseline and no harvest scenarios. Figure 13 clearly shows that a decrease in harvest rates would have a higher impact than a decrease in road kill. These results illustrate that a decrease in the levels of harvest of wild maned wolves through trapping, shooting and killing is one of the immediate conservation measures that must be taken. Interpretation of these results should keep in mind that the analysis is being done at a country level, and may not reflect the reality of a specific population.

The impact of road kill and illegal shooting of maned wolves was assessed by comparing the mean population size at the end of 100 years when:

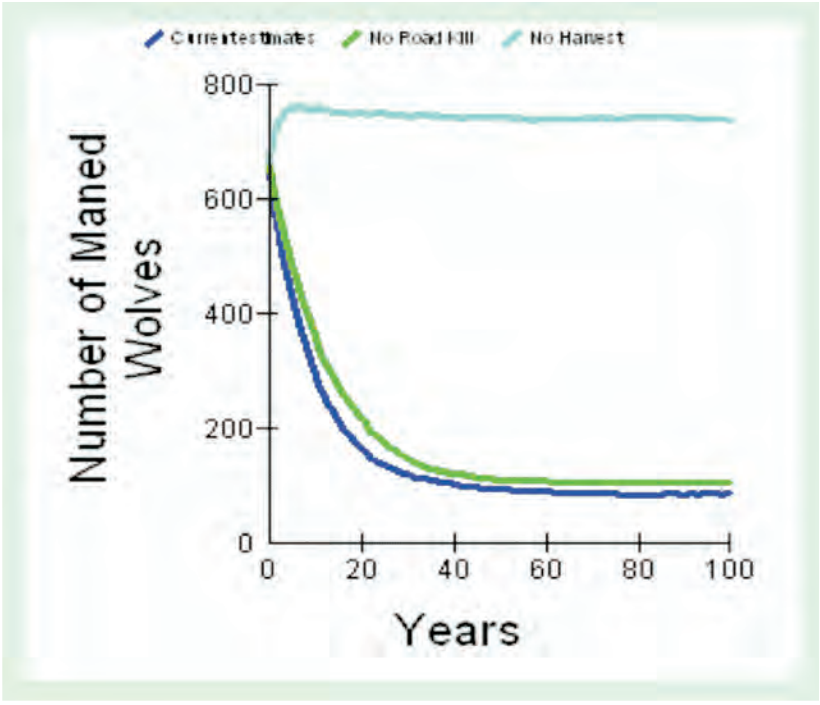


Figure 13. Impact of harvest and road kill on mean metapopulation size (across all iterations) for 5 populations of maned wolves.

Conclusion

Research on maned wolves in Argentina is relatively recent and therefore parameter input values were based on the best guesses of participants. The models described should be considered as a framework for later integration of accurate data from field research results.

One of the main threats identified for Argentina was the persecution and killing of maned wolves. The models were developed using the best estimates available and although they may not be accurate and no estimates of actual harvest levels exist, the models do show that if current trends of harvest continue populations of maned wolves face a high risk of extinction in Argentina. Decreasing the persecution and killing of maned wolves should be a priority in maned wolf conservation efforts in Argentina.

Only one population was identified as potentially viable, with a low probability of extinction over the next 100 years. The population in northern Argentina in Formosa (Population 5 in 10Pop / Population 3 in 5Pop) that is estimated to have low human-related mortality is therefore of high conservation interest. It may even act as a potential source of individuals for other maned wolf populations. This population is of high conservation priority and appears to be the most viable in the long term.

Due to the lack of information, habitat loss, which is considered a major threat throughout maned wolf distribution, was not modeled here but poses another potential threat to maned wolves in Argentina.

Recently a new small population of maned wolves has been discovered in Argentina through camera traps (Soler, pers. comm.). It was represented as population 11 on the map. It is thought this small population may contain 10-20 more maned wolves that could be connected to Population 3 (pop10 model). These exciting new discoveries illustrate the importance of updating the models created during the workshops as new information is made available.

For this reason, the sensibilization campaigns and the formal education must be necessarily followed by continued application of laws that protect the species. Meetings for

the adults of local communities and the local authorities and institutions should be done. The adults in rural areas are the ones that eliminate the animals so the educative enforces should not be directed just to children. The rural communities must be involved in a way that they express their opinions, so that it becomes possible to work with them and to determine the real causes of the direct elimination on the species.

Besides, parallel negotiation with governmental authorities must be done in order to increase the number of research projects, specially the ones to determine the presence, absence, quality and connectivity of habitats.

However, by the actual information, there are in Argentina maps of eco-regions that can be used to negotiate short and long term direct actions to the conservation of important habitats to the maned wolf. On example is the recent Alianza para la Conservación de los Pastizales del Cono Sur (Alliance for the Conservation of the Grasslands of South Cone), which has been generating a detailed map of the international distribution of the grasslands.

BRAZIL

Baseline Model

A baseline model for all Brazilian maned wolf populations was developed during the PHVA workshop. Parameter input values entered in the Brazilian baseline model are presented in Table 19, and details for other parameters are given below.

When modeling the Brazilian population some choices were made by the participants for the purpose of this exercise. Populations were separated in to 9 main populations even though as shown in Figure 14, populations of maned wolves can occur outside these areas. The Southern cone populations shown in Figure 5 in the south of Brazil were not included in the model. This only reflects the choice of the participants and not the importance of the populations.

Table 19. Parameters entered in the model.

Parameter	Baseline	Brazil
Number of populations	1	Changed*
Initial population size	100	21745*
Carrying capacity	100	21745*
Dispersal among populations	none	yes*
Inbreeding depression? %	3.14 LE	3.14 LE
% of the inbreeding effects due to recessive lethal alleles	50	100
Breeding system	long-term monogamy	long-term monogamy
Age of first reproduction (♀ / ♂)	2 years	2 years
Maximum age of reproduction	10 years	10 years
Annual % adult females reproducing (SD)	60 (10)	60 (10)
Density dependent reproduction?	no	no
Maximum litter size	5	5
Distribution of offspring per female per year (given in %)		
1 Offspring	21	21
2 Offspring	24	24
3 Offspring	28	28
4 Offspring	19	19
5 Offspring	8	8
Overall offspring sex ratio	50:50	50:50
% adult males in breeding pool	90	90
% mortality from age 0-1 (SD)	60 (10)	60 (10)
% mortality from age 1-2 (SD)	20 (5)	changed *
% mortality from age after 2 (SD)	10 (2)	10 (2)
Catastrophe	none	none
Harvest	none	yes*
Supplementation	none	none

* parameters have been modeled for different values from baseline model.

Initial Population Size

A map produced by Conservation International of the distribution of *cerrado* was used to map and estimate population numbers of maned wolves. Nine main populations of maned wolves were identified. The populations from São Paulo State or from the south of Brazil were considered isolated and very small; therefore we did not include them in this modeling exercise. This choice was made for practical reasons, and does not mean those populations are not important. The viability of these smaller populations can be assessed based on results from the initial baseline model and the sensitivity analysis results.

To estimate initial population size we visually estimated areas of *cerrado* habitat available to maned wolves by overlaying a rough grid over the CI map. By counting the number of cells of *cerrado* available in each state and estimating cell size, we were able to estimate the area available to maned wolves in the different areas.

Density estimates for each area were based on the literature and the experience of workshop participants, and were used to calculate a 'best guess' population estimate for maned wolves in Brazil (presented in Table 20). Alternative estimates of population size of maned wolves were made by using a high density estimate of 0.1 individuals/km^2 and a low population density of 0.02 individuals/km^2 to calculate high and low population estimates, respectively.

In the following models the best guess population estimates were used unless specified otherwise. Populations 6 and 6a are considered to be one population, but were separated into two areas to obtain initial population figures since the density of maned wolves in these areas were different.

The results of the population estimates are presented in Table 20 and a map of the populations is presented in Figure 14. Because the initial population size relies on habitat availability and density, carrying capacity was assumed to be equal to the initial population.

Table 20. Population estimates for maned wolves in Brazil.

	Population										
	1	**2**	**3**	**4**	**5**	**6**	**6a**	**7**	**8**	**9**	**Metapop**
Area available to MW (in km^2)	26134	1268	44112	35289	27088	133180	35364	27167	12880	51519	394000
Density estimate (best guess)	0.03	0.10	0.04	0.04	0.06	0.07	0.03	0.08	0.03	0.06	
Pop. estimate (best guess)	784	127	1764	1412	1625	9323	1061	2173	386	3091	21746
Pop. estimate (high estimate)	2613	127	4411	3529	2709	13318	3536	2717	1288	5152	39400
Pop. estimate (low estimate)	523	25	882	706	542	2664	707	543	258	1030	7880

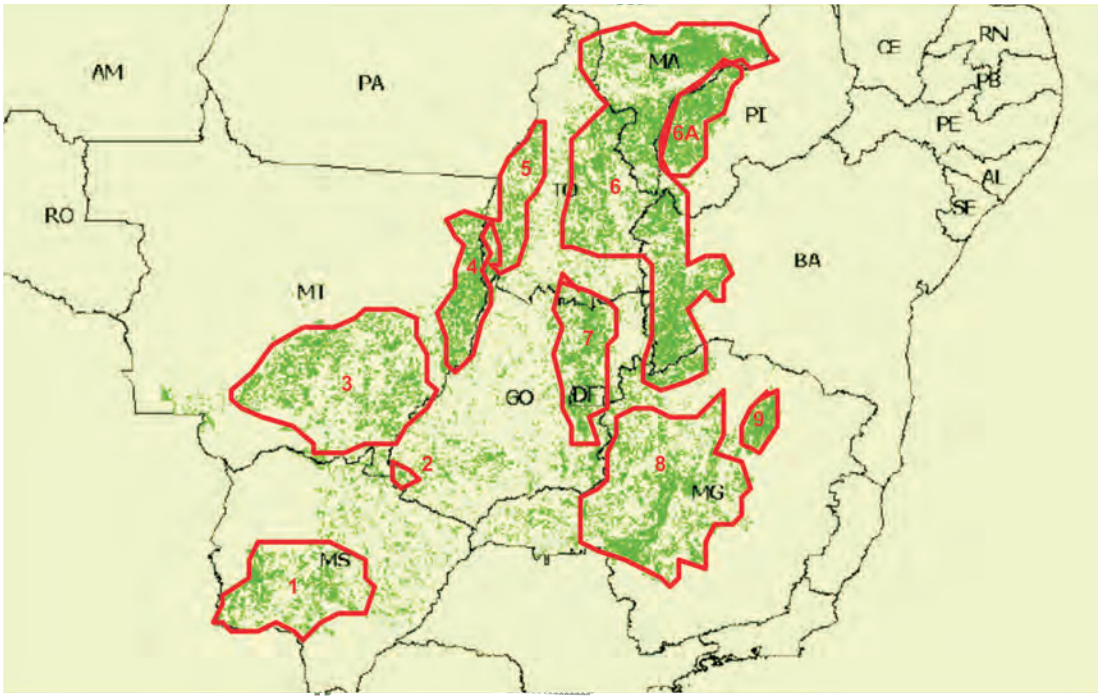


Figure 14. Map of the distribution of populations of maned wolves in Brazil.

Dispersal Rates

It was estimated that some connectivity exists between the different populations shown in the Figure 14. It was considered that some wolves could disperse between populations as shown in Table 21. In the model both sub-adult males and sub-adult females could disperse and had a 50% survival rate during dispersal.

Table 21. Dispersal estimates among populations of maned wolves in Brazil. Values indicate the probability of an individual wolf moving from one population to another in a given year, independently of other individuals in either the source (row) or recipient (column) populations.

	Pop 1	Pop 2	Pop 3	Pop 4	Pop 5	Pop 6	Pop 7	Pop 8	Pop 9
Pop 1	99	1	0	0	0	0	0	0	0
Pop 2	1	98	1	0	0	0	0	0	0
Pop 3	0	1	98	1	0	0	0	0	0
Pop 4	0	0	1	99	0	0	0	0	0
Pop 5	0	0	0	0	100	0	0	0	0
Pop 6	0	0	0	0	0	98	1	0	1
Pop 7	0	0	0	0	0	1	98	0	1
Pop 8	0	0	0	0	0	0	0	99	1
Pop 9	0	0	0	0	0	1	1	1	97

Mortality Rates

Sub-adult mortality due to road kill increased the estimated mortality rates from those used in the baseline model. The impact of road kill varied between populations and is presented in Table 22.

Table 22. Mortality rates of maned wolves from different populations of Brazil.

	Baseline single pop	Pop 1	Pop 2	Pop 3	Pop 4	Pop 5	Pop 6	Pop 7	Pop 8	Pop 9
% mortality from age 0-1 (SD)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)	60 (10)
% mortality from age 1-2 (SD)	20 (5)	40 (5)	40 (5)	40 (5)	24 (5)	40 (5)	36 (5)	40 (5)	24 (5)	40 (5)
% mortality from age after 2+ (SD)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)	10 (2)

Harvest

Maned wolves are not really persecuted in Brazil. Therefore, harvest was modeled as only 2% of the sub-adults and adults (male and female) removed each year for 100 years from each population. However this will vary within regions and populations. Some participants thought this value was too low.

Brazil Baseline Model Results

The mean stochastic rate of population growth (or decline), the probability of population extinction, the mean population size after 100 years, and the remaining gene diversity are presented for the three different scenarios in Table 23. The mean population size of maned wolves (across all iterations) for each population under the different scenarios is presented in Figure 15.

The estimated initial population size of maned wolves was 21,746. After 100 years, model projections indicate that, on average, 18,168 maned wolves still survive. However, this does not include factors such as habitat loss that were modeled separately nor any catastrophes or diseases.

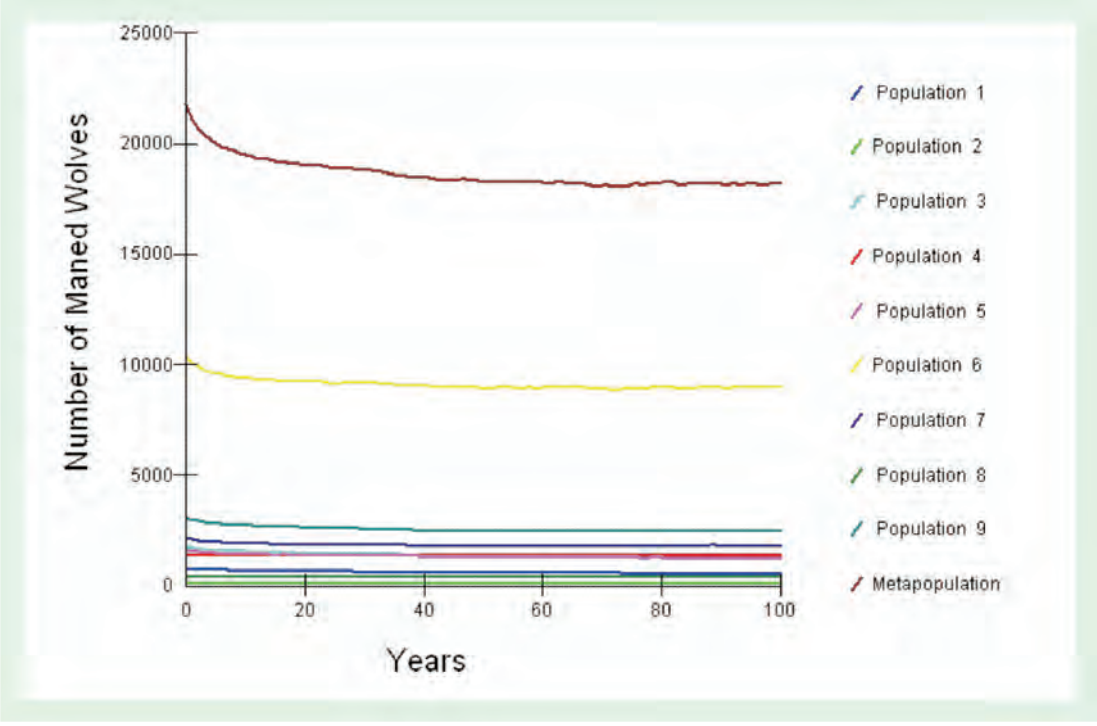


Figure 15. Mean population size (across all iterations) for the 9 populations of maned wolves in Brazil over 100 years.

Table 23. Results of the baseline model after 100 years for maned wolf populations in Brazil.

Brazil baseline	N_{init}	r_{stoch}	$SD(r_{stoch})$	$P(E)_{100}$	MTE	N_{100}	$SD(N_{100})$	GD_{100}
Population 1	784	0.011	0.131	0	--	534	203.1	0.963
Population 2	127	0.017	0.140	0	--	98	26.0	0.947
Population 3	1764	0.013	0.130	0	--	1328	400.0	0.986
Population 4	1412	0.065	0.123	0	--	1349	106.5	0.987
Population 5	1625	0.016	0.131	0	--	1224	353.7	0.984
Population 6	10383	0.027	0.127	0	--	8985	1646.3	0.998
Population 7	2173	0.020	0.130	0	--	1801	381.7	0.994
Population 8	386	0.066	0.124	0	--	370	28.9	0.971
Population 9	3091	0.017	0.129	0	--	2481	568.6	0.995
Metapopulation	21745	0.030	0.088	0	--	18168	2329.0	0.999

Alternative Futures: Testing Different Scenarios

Revision of Initial Population Estimates

Estimating the initial population of maned wolves in Brazil was difficult. Scenarios were developed based on the best guess population estimates, as well as scenarios based on the lowest and highest population estimates (Table 24). The probability of population extinction and the mean population size at 100 years are given in Table 25.

These results show how different estimates in initial population size can affect the projected number of maned wolf remaining in 100 years, since there are six times more maned wolves in the high population estimate after 100 years than in the low population estimate (Table 25). However, in all scenarios, maned wolf populations did not go extinct in Brazil.

Table 24. Estimates of maned wolf populations for Brazil.

Population size	1	2	3	4	5	6	6a	7	8	9	Total
Estimated N_{init}	784	127	1764	1412	1625	9323	1061	2173	386	3091	21746
Maximum N_{init}	2613	127	4411	3529	2709	13318	3536	2717	1288	5152	39400
Minimum N_{init}	523	25	882	706	542	2664	707	543	258	1030	7880

Table 25. Impact of initial population size estimates on mean population size and probability of survival over 100 years.

	$P(E)_{100}$	N_{100}
Minimum population estimate	0	5152
Best guess population estimate	0	18168
Maximum population estimate	0	30983

Elimination of Road Kill and Harvest

The impact of atropelamentos and illegal hunting of wolves-guará were evaluated by comparing the average population sizes, the end of 100 years, when:

- When there is harvest and road kill as estimated in the Brazil baseline model.
- There is no harvest, but there is road kill.
- There is no road kill, but there is harvest.

The model confirmed the suspicions of the workshop participants: road kill is of higher conservation concern than harvest in Brazil. Table 26 and Figure 16 present the model results. Mean population size is highest after elimination of road kill. However, eliminating this source of mortality may be much more difficult than campaigning to decrease harvest.

It must also be cautioned that some participants felt that the harvest estimates were low and in some regions these may be higher. However, these results encouraged us to analyze the impact of road kill more closely.

Table 26. Impact of harvest and road kill on mean population size and probability of survival.

	$P(E)_{100}$	N_{100}
Brazilian Baseline Model	0	18168
No Harvest	0	19918
No Road Kill	0	21039

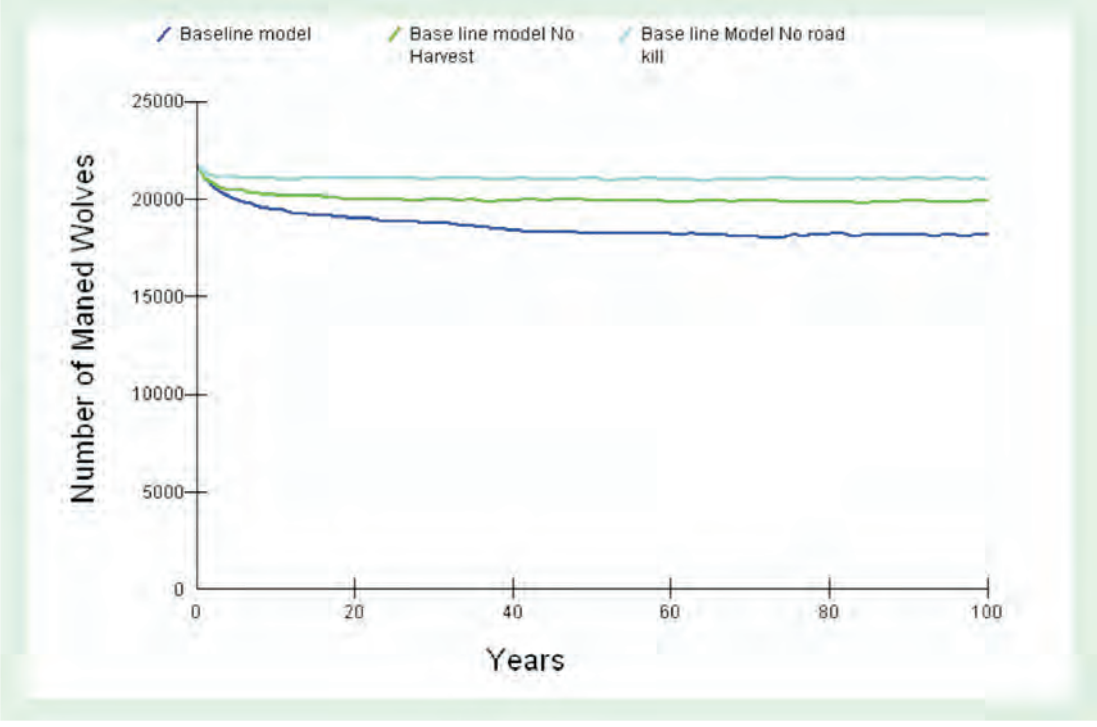


Figure 16. Mean population size (across all iterations) for maned wolf populations in Brazil over 100 years with no harvest or no road kill mortality.

Impact of Road Kill

As habitats become more fragmented and density of roads increase, the mortality of maned wolves due to road kill will likely also increase. We therefore tested what would happen if we increased mortality of sub-adult maned wolves by 20% in the different populations. This 20% increase is due to road kill death of dispersing sub-adults.

It is difficult to say whether our assumptions are realistic or not. However, it can be concluded that as road density increases and more maned wolves are killed, the higher the risk of extinction of local maned wolf populations. The mean population size of maned

wolves greatly decreased when sub-adult mortality due to road kill increased. The Brazilian metapopulation has a very low probability of extinction in 100 years even with increased road kill, but this level of increased mortality will cause individual populations throughout Brazil to go extinct and dramatically reduce the remaining number of wolves by 95%.

Table 27. Impact road kill on mean population size and probability of extinction.

	$P(E)_{100}$	N_{100}
High road kill estimates	0.002	893
Current road kill estimates	0	18168
No road kill	0	21039

Table 28. Impact road kill on mean population size and probability of extinction of the different maned wolf populations

	$P(E)_{100}$	N_{100}
Population 1	0.984	0
Population 2	0.994	0
Population 3	0.358	9
Population 4	0.010	597
Population 5	0.886	2
Population 6	0.100	158
Population 7	0.574	8
Population 8	0.106	107
Population 9	0.472	10
Metapopulation	0.020	891

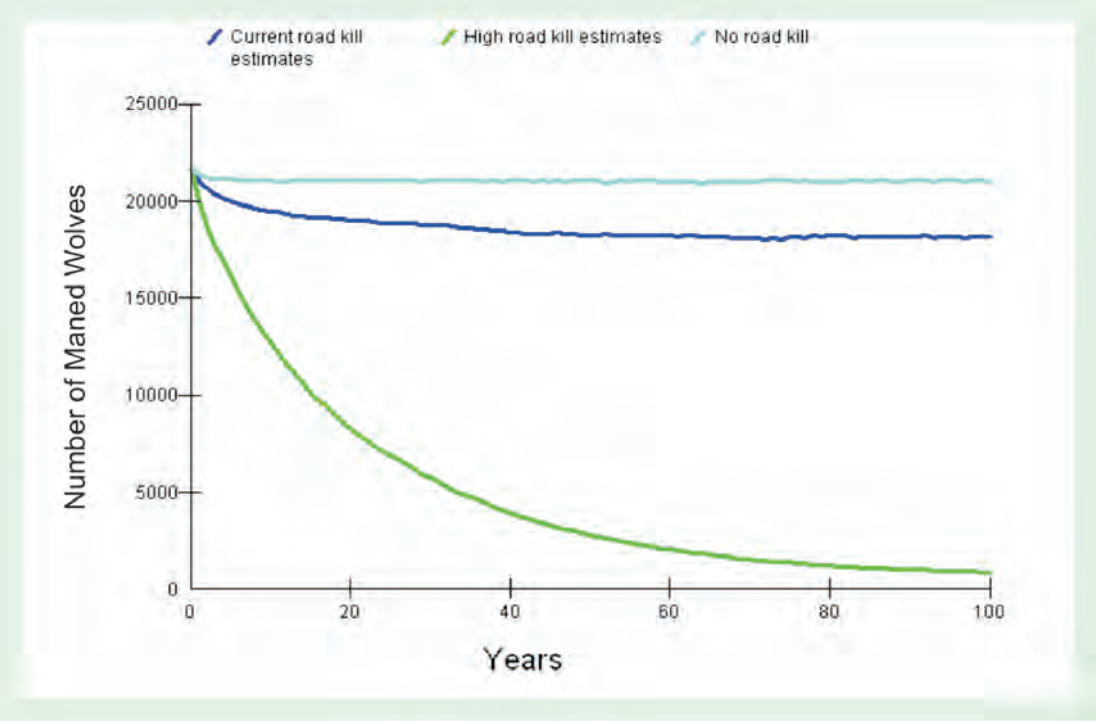


Figure 17. Mean population size (across all iterations) for maned wolf populations in Brazil over 100 years under different rates of sub-adult mortality due to road kill.

Habitat Loss

The *cerrado* of Brazil is one of the most endangered habitats, and habitat loss continues every year. The impact of habitat loss rates as presented in Table 35 over the next 30 years was modeled to evaluate the potential effect on maned wolf populations.

Predictably, habitat loss had a high impact on maned wolf populations, with the mean number of maned wolves decreasing proportionally to the amount of habitat loss as shown in Figures 18 and Table 30.

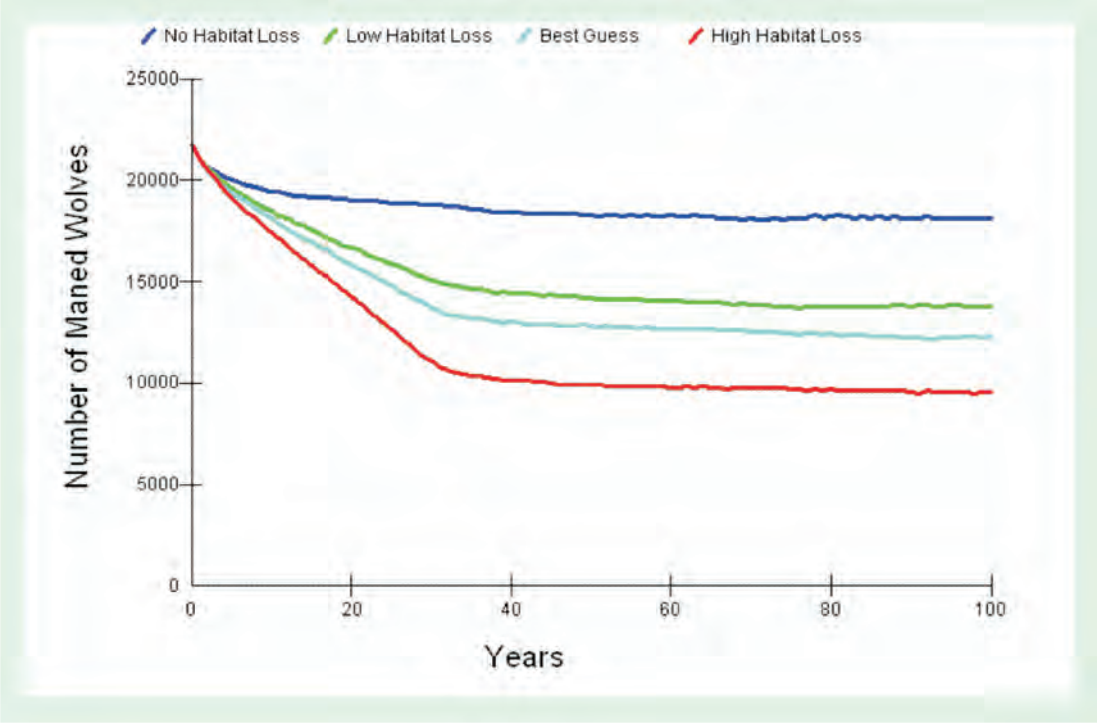


Figure 18. Mean population size (across all iterations) for maned wolf populations in Brazil over 100 years under different habitat loss pressures during the next 30 years (low, high, best guess and no habitat loss)

Table 29. Habitat loss estimates for maned wolves in Brazil.

Population	Low Habitat Loss	Best Guess	High Habitat Loss
Population 1	0.7%	1%	1.4%
Population 2	none	none	none
Population 3	1%	1.5%	2%
Population 4	0.5%	1%	0.5%
Population 5	1%	1%	2%
Population 6	0.8%	1%	1.6%
Population 7	0.7%	1%	1.4%
Population 8	1%	1.5%	2%
Population 9	0.7%	1%	1.4%

Table 30. Impact of habitat loss on mean population size and probability of survival.

	$P(E)_{100}$	N_{100}
No Habitat Loss	0	18168
Low Habitat Loss	0	13803
Best Guess	0	12299
High Habitat Loss	0	9573

Conclusions

During the PHVA the decision was made to create a general metapopulation model for Brazil and not detailed individual population models. The purpose of this model was to examine the viability of maned wolves in Brazil as a whole and therefore build a baseline model that best reflected this. Therefore parameters had to be an average best guess for the population. Models for individual, well-studied populations can and should be adapted from the baseline model. From this exercise participants could identify populations that were most in need of research and conservation action.

The fact that populations from the southern cone were not modeled was a choice of the participants and does not reflect their conservation importance. Since these populations are isolated, results from the sensitivity analysis could be used to interpret these populations.

It appeared from this exercise that the main current threats to maned wolves were increased mortality due to road kill and reduction in carrying capacity due to habitat loss. Although the model results indicate that these threats are not likely to lead to the extirpation of maned wolves from Brazil, given the estimated mortality rates modeled, road kill and habitat loss may lead to significantly fewer wolves and to their local extinction in some areas of the country.

PARAGUAY

Baseline Model

Most of the input values were retained from the general maned wolf baseline model, as no data were available for demographic rates of wolves in Paraguay. The number and size of populations were estimated, and mortality rates were adjusted to include harvest. Parameters changed from the general baseline model for the Paraguay model are presented in Table 31 and discussed in further detail below.

Table 31. Parameter values used for the Paraguay model that differ from the baseline model.

Parameter	Baseline	Paraguay
Number of populations	1	4
Initial population size / Carrying capacity	100	830
Dispersal among populations	none	yes
Harvest	none	yes

Population Structure

Little is known about the status and distribution of maned wolves in Paraguay. Areas in the northwest portion of the country are not well protected and are not believed to currently support maned wolf populations. Discussions among workshop participants from Paraguay led to the identification of four potential wolf populations in the central and southern areas of the country, as depicted in Figure 19. Description of these areas and estimates of maned wolf density and potential anthropogenic threats to wolves are given below and summarized in Table 32.

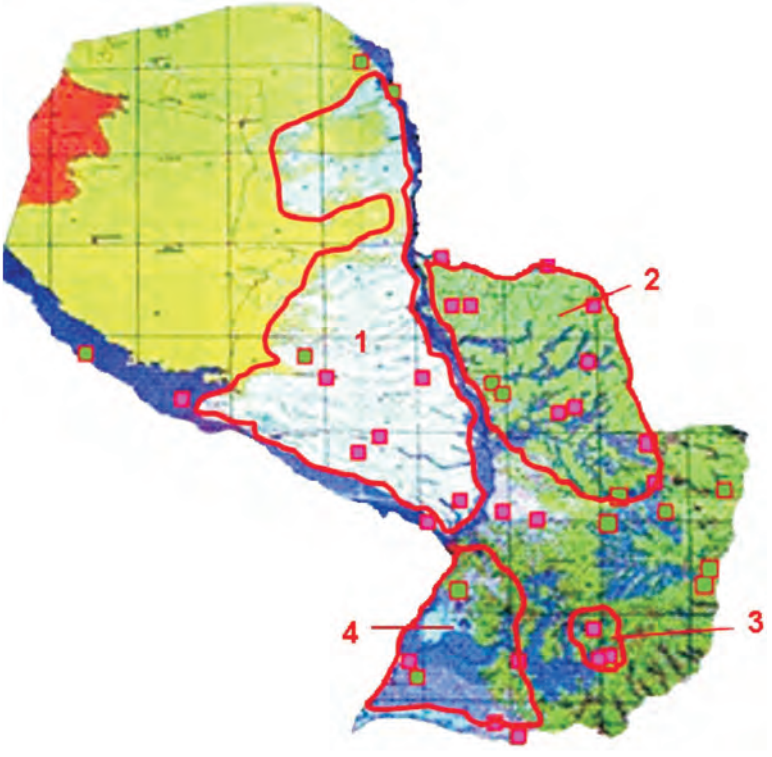


Figure 19. Four estimated populations of maned wolves in Paraguay.

Population 1:

This area is comprised of flood plains of the Pantanal with some areas of *cerrado* and is separated from Argentina, Brazil and eastern Paraguay by large rivers. This area is not protected, but provides good habitat for wildlife with little human development. Wolf mortality due to conflicts with humans or road kill is estimated to be low.

Population 2:

Wolves may inhabit the 12-20 patches of cerrado dispersed throughout this area, some of which are protected as national parks or reserves. These patches were combined in the model to form one interacting wolf population. These populations are likely isolated from Brazil by ranches and agricultural development near the border, and from populations to the south by agriculture. Road kill is low, but wolves are occasionally killed due to beliefs of the local people.

Population 3:

This small population lives in the grasslands of San Rafael National Park and adjacent unprotected areas, and may have some connectivity with the wolf population to the west (Population 4). Conflicts between wildlife and humans are high here, and many wolves are killed in this area.

Population 4:

These wetlands include good habitat in proposed or paper parks and refuges. Wolf density here is estimated to be low. This population is likely isolated from Argentina by rivers but may have some connectivity to the east with Population 3. Some wolves are killed each year due to conflicts, and road kill also contributes to wolf mortality.

Table 32. Characteristics of areas in Paraguay that may support maned wolf populations.

Parameter	Population 1	Population 2	Population 3	Population 4
Habitat	Flood plains	*Cerrado* patches	Grasslands	Wetlands
Area (km^2)	50,000	5,000	1,000	15,000
Protected status of area	Not protected	Some protected areas	Some protected areas	Some proposed protected areas
Connectivity	Isolated	Isolated	Connected to 4	Connected to 3
Wolf density	Low	High	Low?	Low
Estimated N (= K)	500	150	30	150
Human-related threats	Low	Occasional kills (5/yr)	High conflict (10/yr killed)	Conflict (5/yr) Road kill (5/yr)

Population Size and Carrying Capacity

Approximate estimates of population size and carrying capacity were made based on relative density of wolves in each area and extrapolating from wolf densities in Argentina (0.01 – 0.03 wolves/km^2) multiplied by approximate area of wolf habitat. These resulting estimates were used both for initial population size and carrying capacity.

Dispersal

Some dispersal is estimated to occur between Populations 3 and 4. In the model, one-year-old males and females in these two populations have a 1% probability of dispersing to the adjacent population, with 50% of the dispersing animals surviving. Dispersal estimates among populations of maned wolves in Paraguay are presented in Table 32.

Table 33. Dispersal estimates among populations of maned wolves in Paraguay. Values indicate the probability of an individual wolf moving from one population to another in a given year, independently of other individuals in either the source (row) or recipient (column) populations.

	Population 1	Population 2	Population 3	Population 4
Population 1	100	0	0	0
Population 2	0	100	0	0
Population 3	0	0	99	1
Population 4	0	0	1	99

Human-Caused Mortality

All maned wolf populations in Paraguay were estimated to experience direct harvest (due to conflicts) and/or increased mortality due to road kills. These human-related sources of mortality were estimated to affect males and females equally and to impact wolves age one year and older. This additional mortality was modeled as a population-specific increase in mortality rates for these age classes as shown in Table 34. EV values were retained from the general baseline model.

Table 34. Population-specific mortality rates (in %) for mortality from the general maned wolf baseline model, plus additional mortality due to harvest and road kills, by age class. Total indicates the mortality rates used in the Paraguay baseline (best guess) model.

Mortality source	Population 1		Population 2		Population 3		Population 4	
	Age 1	Age 2+	Age 1	Age 2+	Age 1	Age 2+	Age 1	Age 2+
Natural (general baseline)	20	10	20	10	20	10	20	10
Harvest	2	2	5	5	27	30	5	5
Road kill	0	0	0	0	0	0	5	5
Total	22	12	25	15	47	40	30	20

Paraguay Baseline Model Results

Deterministic Results

Since each population was estimated to have different mortality rates, the deterministic growth rate (r_{det}) based on model input values differed among the four populations. As expected, populations with higher mortality rates have less potential to grow and experience lower deterministic (and stochastic) growth rates (Table 35). While the general baseline model input values (without harvest or road kill) resulted in $r_{det} = 0.091$, growth rates for Paraguay populations that experience human-caused mortality are lower. For Populations 1 and 2, reproduction on average is still greater than mortality, resulting in positive deterministic grow, with $r_{det} = 0.073$ for Population 1 and $r_{det} = 0.045$ for Population 2. Increasing annual mortality to 30% for sub-adults and 20% for adults results in slight population decline ($r_{det} = - 0.005$) for Population 4. The high mortality rates estimated for Population 3 result in rapid population decline ($r_{det} = - 0.226$), even in the absence of stochastic processes that are likely to negatively affect this population. These results suggest that even in the absence of threats such as small population size, future habitat loss and fragmentation, populations in the southern region of Paraguay may be subject to intense anthropogenic risks that may drive these populations to extinction. This emphasizes the value of securing a more accurate assessment of these threats and in developing conservation management actions to reduce these causes of mortality.

Stochastic Simulation Results

Population growth rates are slightly lower when stochastic processes are added (Table 35), but the results show the same general trend of population decline for Populations 4 and particularly 3. These two populations have a high probability of extinction over 100 years, while Population 2 has a relatively small risk (4.4%). Population 1 showed no risk of extinction, likely due to its relatively large size and lower mortality rates. Therefore, the Paraguay metapopulation is projected to persist over 100 years due to the persistence of Population 1, but maned wolves are likely to decline in numbers (mean metapopulation size = 580) and disappear from the southern regions of the country.

The mean (and standard deviation) stochastic rate of population growth, probability of population extinction, mean time to extinction (in years), mean (and standard deviation) population size at 100 years, and percent of gene diversity retained are presented in Table 41. The mean population of maned wolves (across all iterations) for each population is presented in Figure 20.

Table 35. Results of the baseline model after 100 years for maned wolf populations in Paraguay.

Population	r_{det}	r_{stoch}	SD (r_{stoch})	PE_{100}	MTE	N_{100}	SD(N_{100})	GD_{100}
Population 1	0.073	0.068	0.123	0.000	--	479	37	0.960
Population 2	0.045	0.021	0.135	0.044	81	100	45	0.840
Population 3	-0.226	-0.240	0.313	1.000	9	0	--	--
Population 4	-0.005	-0.049	0.179	0.904	64	2	7	0.657
Metapopulation		0.055	0.104	0.000	--	580	59	0.968

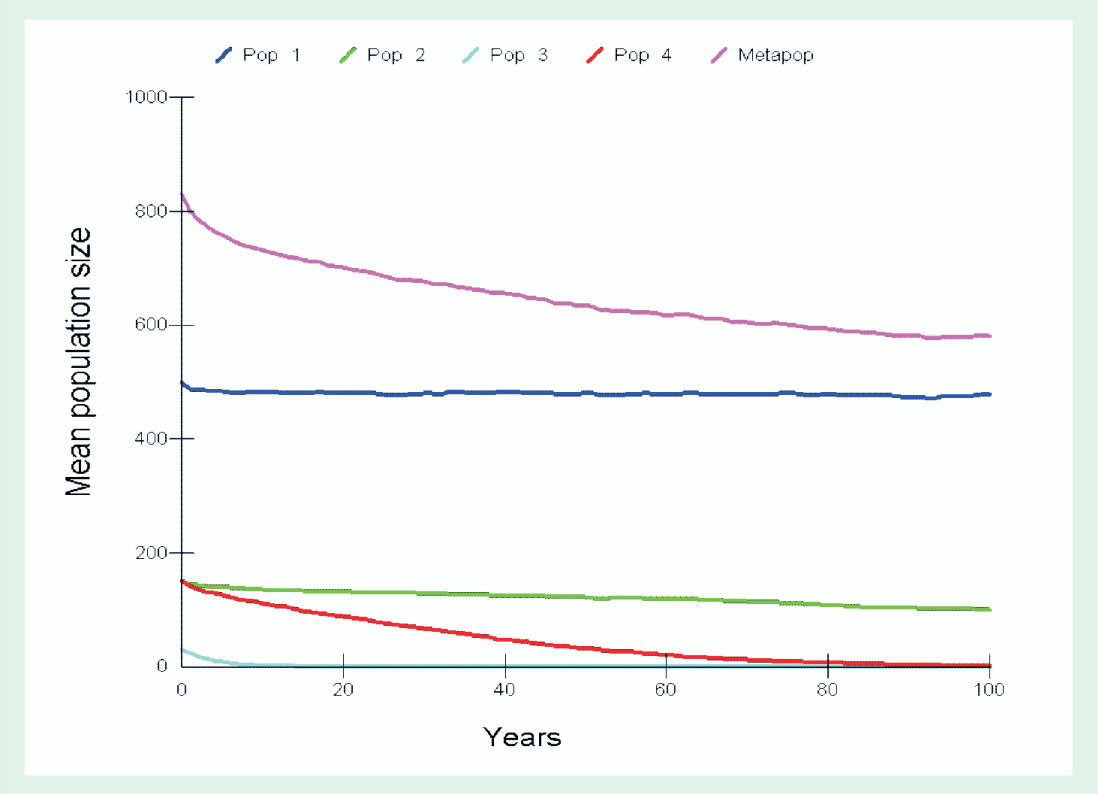


Figure 20. Mean population size (across all iterations) for 4 populations of maned wolves in Paraguay over 100 years.

Alternative Futures: Impact of Habitat Loss, Harvest and Road Kill

Habitat loss and direct persecution are thought to likely impact all four maned wolf populations in Paraguay. The impact of each of these threats was evaluated for each population as well as the Paraguay metapopulation. A summary of all scenario results is presented at the end of this section.

Habitat Loss

The continued loss of maned wolf habitat is anticipated in each of the four areas in which wolves are thought to occur. Habitat loss was estimated to be gradual but constant for the next 30 to 100 years, depending upon the area. This impact was modeled as a constant and linear reduction in carrying capacity using the population-specific estimates given in Table 36.

Table 36. Habitat loss projections for each maned wolf population (modeled as a reduction in K).

	Population 1	Population 2	Population 3	Population 4
Years of loss	100	50	30	30
Annual change in K	- 0.1	- 0.3	- 0.5	- 0.3
Total reduction in K	10%	15%	15%	9%
Current K / Final K	500 / 450	150 / 127	30 / 25	150 / 136

The projected extent of habitat loss (total of 11% across Paraguay maned wolf metapopulation) does not significantly impact the viability of maned wolves in Paraguay. As expected, mean population size is slightly lower, but risk of extinction remains at zero. Habitat loss does not alter the fate of Population 1 (which persists at a slightly smaller size) or Populations 3 and 4 (which have a high risk of extinction in both cases), but does slightly increase the PE for Population 2, from 4% to 7% over 100 years.

Road Kill

Road kill was only included in mortality rates for Population 4; therefore, the elimination of road kill has its greatest impact on this population. Eliminating road kill reduces annual sub-adult mortality from 30% to 25%, and adult mortality from 20% to 15% for wolves in this area. This is enough to move the population from decline (r_{stoch}= -0.049) to positive growth (r_{stoch}= 0.016), reducing the risk of extinction from 90% to 6%. The increased viability of Population 4 has a marginal positive effect on the adjacent Population 3, but not enough to rescue it. The viability of the Paraguay metapopulation remains high, but with the persistence of wolves in Population 4, the mean metapopulation size is relatively larger (N_{100}= 669, vs N_{100}= 580 with road kill).

Harvest

The term harvest includes the direct removal or killing of maned wolves by humans through methods other than road collisions. This may include hunting or trapping, and is estimated to affect all maned wolf populations in Paraguay.

Elimination of harvest has a positive impact on all populations, increasing growth rate and mean population size. Population 2 remains near carrying capacity with no risk of extinction. Population 4 shows similar benefits as with the removal of road kill, which is expected as road kill and harvest are estimated to contribute equally to mortality in this area. Removing harvest also results in a positive growth rate for Population 3 and a significant reduction in risk of extinction (from 100% to 33%). Mean metapopulation size is also larger ((N_{100}= 735, vs N_{100}= 580 with harvest).

Elimination of both harvest and road kill primarily impacts Population 4, bringing the population size close to carrying capacity and bringing PE to 0%. This slightly improves the

viability of Population 3, through connections with Population 4, and also increases the mean metapopulation size to 783.

Table 37. Vortex model results for each population under various alternate future scenarios.

Threat	Population 1			Population 2			Population 3			Population 4			Metapopulation		
	r_{stoch}	PE	N	r_{stoch}	PE	N	r_{stoch}	PE	N	r_{stoch}	PE	N	r_{stoch}	PE	N
Habitat Loss & Harvest & Road Kill	0.068	0	427	0.016	0.07	74	-0.241	1.00	0	-0.049	0.92	2	0.055	0.00	503
Harvest & Road Kill	0.068	0	479	0.021	0.04	100	-0.240	1.00	0	-0.049	0.90	2	0.055	0.00	580
Harvest Only	0.068	0	478	0.019	0.04	99	-0.209	0.99	0	0.016	0.06	92	0.055	0.00	669
Road Kill only	0.087	0	485	0.072	0.00	143	0.021	0.33	12	0.017	0.05	94	0.076	0.00	735
No Harvest No Road Kill	0.087	0	484	0.072	0.00	143	0.024	0.28	14	0.071	0.00	142	0.083	0.00	783

Comparison of Threat Across Populations

Figure 21 depicts the mean metapopulation size over time under different threat scenarios involving habitat loss, harvest and road kill. The effects of all three threats appear to be cumulative, each contributing some risk to maned wolf populations. These risks differ among the various populations. Population 1 is relative robust against all three threats, Population 2 is impacted by both habitat loss and harvest, Population 3 is most sensitive to harvest, and Population 4 is equally impacted by harvest and road kill (Figure 22). Overall, conditions that increase annual mortality above 25% for sub-adults and 15% for adults threaten the ability of the population to sustain itself; however, this is given the model conditions, which do not include density-dependent reproduction that might allow wolves to compensate for higher mortality.

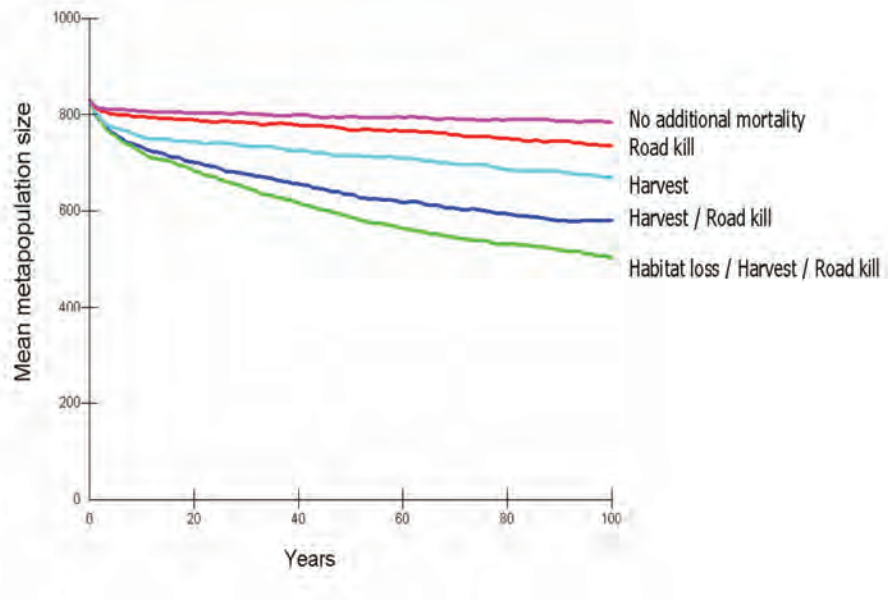


Figure 21. Mean population size (across all iterations) for the maned wolf metapopulation in Paraguay under different threat scenarios.

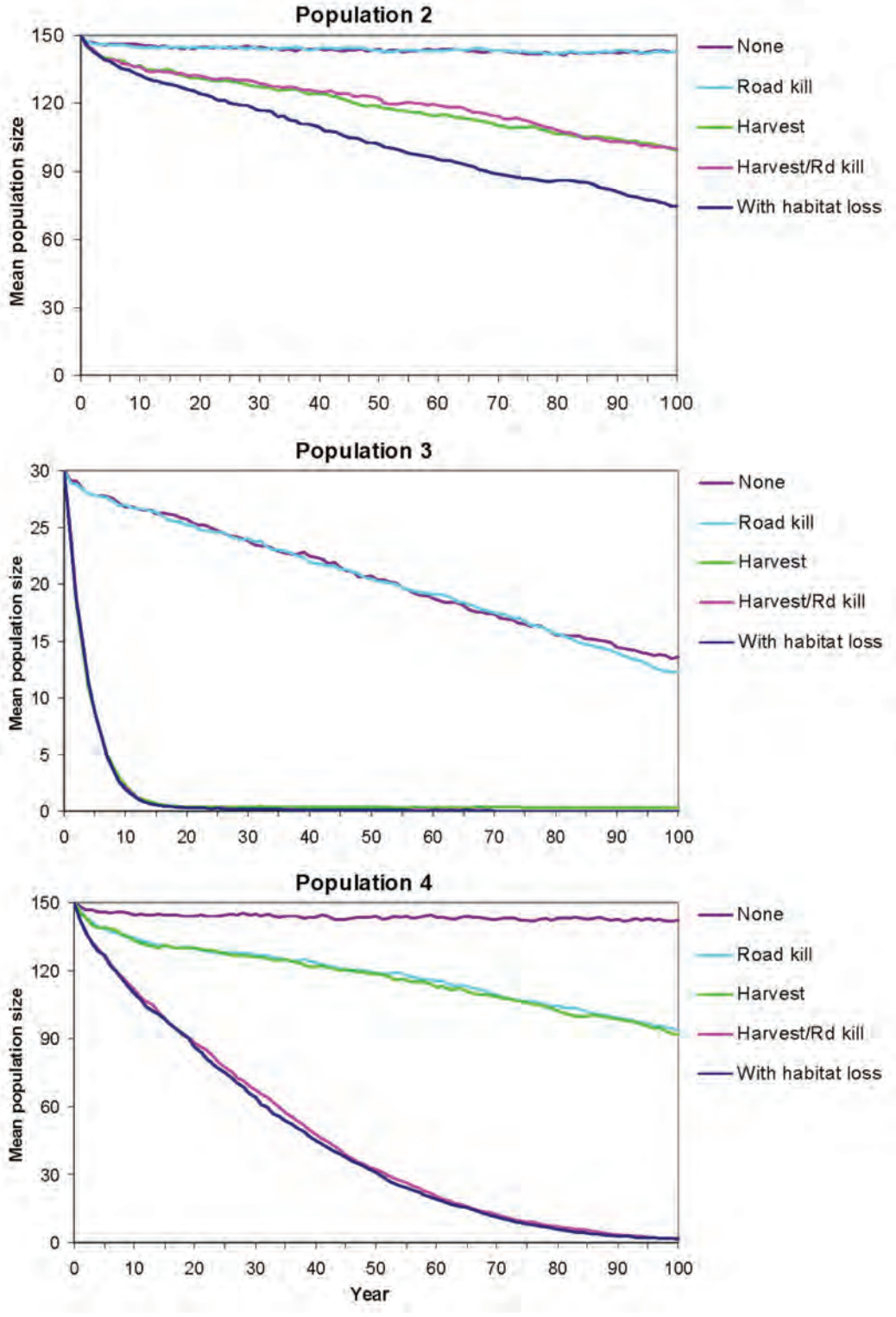


Figure 22. Mean population size for individual maned wolf populations under different threats.

Conclusion

Based on the current estimates of demographic rates, population size, carrying capacity and human-related threats, maned wolf populations are likely to persist in the central floodplains of Paraguay over the next 100 years. The probability of survival is also high in the central fragmented *cerrado* patches if fragmentation is low enough that wolves function as one population in this region; if fragmentation isolates habitat patches, then viability would be expected to be significantly lower. Potential high levels of harvest and road kill threaten the viability of maned wolf populations in southern Paraguay. Under current estimates of population size and mortality, a reduction in human-caused mortality is necessary for wolves to persist in this region. The estimated levels of projected habitat loss, harvest and road kill suggest that harvest may have the greatest negative impact on maned wolf populations in Paraguay.

The results described for Paraguay in this report are based on expert opinion but involve a substantial degree of uncertainty regarding population size, fragmentation, carrying capacity, and natural and human-caused mortality rates. The resulting population projections should be viewed with caution, but may serve as a guide to identify important data gaps and to suggest areas to target for conservation measures to minimize further habitat loss and fragmentation and reduce human-wolf conflict and associated anthropogenic sources of mortality.

General Country Model Conclusion

The population models developed for the different countries are based on best guesses and should be viewed as an exercise to further our understanding of maned wolves. These models should be considered as a framework for later integration of more accurate data from field research results. Most importantly, the creation and exploration of these models helped the workshop participants from each country assess the current situation of maned wolf populations and the threats to these populations.

From the discussions with participants it appears that habitat loss is a threat to all maned wolf populations. The loss of maned wolves through persecution and hunting may be a major threat in Argentina, Bolivia and Paraguay, while in Brazil mortality due to road kill potentially is a bigger threat. Under current estimates of population size and mortality, a reduction in human-caused mortality is necessary for wolves to persist throughout many parts of Argentina, Bolivia and Paraguay. An analysis of the different populations throughout Brazil is necessary to formulate more specific recommendations for that country. The potential effects of human-caused mortality on the viability of maned wolf populations can be significant, emphasizing the importance of obtaining better estimates of these threats and developing conservation management actions that focus on reducing these sources of mortality.

Some threats that were discussed during the workshop, such as disease, but that were not modeled could have a serious impact on maned wolf populations throughout their range. Future research in this field is needed and it already has being conducted in Brazil and Bolivia.

Recently, a new small population of maned wolves has been discovered in Argentina through camera traps (Soler, pers. comm.). Exciting new discoveries such as this illustrate the importance of updating the models created during the workshop as new information is made available. In this instance, the impact of an increase in initial population size can be estimated from the sensitivity analysis results.

Appendix

Tabular results for sensitivity analysis

Table I Results of sensitivity analysis for all parameters. L and H refer to the lower and the higher input values used, respectively. Baseline is provided for comparison.

Parameter	Level	stoc-r	SD(r)	PE_{100}	N_{100}	$SD(N_{100})$	GD_{100}	SD(GD)	MTE
Baseline		0.061	0.109	0	94	9.6	0.822	0.058	--
FM1	L	0.104	0.092	0	99	4.6	0.820	0.053	--
FM1	H	0.008	0.146	0.718	8	17.2	0.644	0.200	68
FM2	L	0.078	0.102	0	97	6.0	0.827	0.052	--
FM2	H	0.002	0.112	0	90	15.5	0.815	0.067	--
FM3	L	0.084	0.099	0	98	5.0	0.836	0.049	--
FM3	H	-0.025	0.113	0.004	89	16.8	0.812	0.058	72
MM1	L	0.065	0.101	0.004	92	14.8	0.779	0.066	78
MM1	H	0.033	0.124	0.260	35	33.3	0.760	0.131	78
MM2	L	0.066	0.104	0	95	8.5	0.818	0.059	--
MM2	H	0.032	0.110	0	93	11.0	0.820	0.051	--
MM3	L	0.067	0.101	0	96	8.1	0.829	0.047	--
MM3	H	0.023	0.111	0	92	12.0	0.820	0.054	--
FBR	H	0.091	0.109	0	97	6.1	0.828	0.055	--
FBR	L	0.028	0.120	0.034	74	27.7	0.797	0.081	83
MBP	H	0.064	0.111	0	94	10.4	0.819	0.054	--
MBP	L	0.058	0.108	0	94	11.5	0.819	0.061	--
A1OF	L	0.056	0.121	0.012	85	21.4	0.782	0.080	85
A1OF	H	0.027	0.108	0.010	80	22.0	0.824	0.062	94
A1OM	L	0.061	0.120	0.002	91	12.9	0.793	0.066	76
A1OM	H	0.045	0.104	0	91	13.7	0.833	0.053	--
MAR	H	0.078	0.107	0	97	6.8	0.834	0.051	--
MAR	L	0.030	0.118	0.022	74	27.2	0.782	0.091	77
INB	L	0.081	0.112	0	97	6.3	0.819	0.049	--
INB	H	0.043	0.109	0.012	82	21.8	0.816	0.058	93

Table II. Results for N_{init} vs. harvesting. Baseline is provided for comparison.

N_{init}	Level of Harvesting	r-stoc	SD(r)	PE_{100}	N_{100}	$SD(N_{100})$	GD	SD(GD)	MTE
15	0	-0.008	0.213	0.998	0	0.3	0.278	0	35.1
15	2	-0.163	0.258	1	0	0	--	--	7.8
15	4	-0.358	0.294	1	0	0	--	--	4
15	6	-0.559	0.335	1	0	0	--	--	2.8
15	10	-0.973	0.397	1	0	0	--	--	2
15	20	-1.213	0.445	1	0	0	--	--	1.6

continue

N_{init}	Level of Harvesting	r-stoc	SD(r)	PE_{100}	N_{100}	$SD(N_{100})$	GD	SD(GD)	MTE
25	0	-0.001	0.183	0.846	2	4.6	0.353	0.226	56.9
25	2	-0.100	0.220	1	0	0	--	--	14.6
25	4	-0.226	0.264	1	0	0	--	--	7.3
25	6	-0.354	0.312	1	0	0	--	--	4.9
25	10	-0.599	0.387	1	0	0	--	--	3.2
25	20	-1.181	0.480	1	0	0	--	--	2
50	0	0.033	0.132	0.110	33	16.8	0.656	0.127	79.7
50	2	-0.029	0.169	0.988	0	3.0	0.628	0.073	44.9
50	4	-0.094	0.208	1	0	0	--	--	19.6
50	6	-0.168	0.246	1	0	0	--	--	11.8
50	10	-0.334	0.326	1	0	0	--	--	6.3
50	20	-0.727	0.470	1	0	0	--	--	3.4
100	0	0.061	0.110	0	91	12.2	0.821	0.052	--
100	2	0.036	0.117	0.094	75	32.1	0.802	0.070	79.6
100	4	-0.005	0.147	0.764	15	31.1	0.791	0.072	63
100	6	-0.047	0.180	0.994	0	4.8	0.747	0.069	40.6
100	10	-0.129	0.238	1	0	0	--	--	17.9
100	20	-0.380	0.407	1	0	0	--	--	7.1
250	0	0.079	0.101	0	244	12.0	0.925	0.015	--
250	2	0.072	0.101	0	243	13.3	0.923	0.017	--
250	4	0.062	0.102	0.002	240	20.0	0.922	0.017	86
250	6	0.054	0.103	0.006	232	32.5	0.920	0.017	77.3
250	10	0.029	0.116	0.170	174	92.5	0.916	0.019	70.4
250	20	-0.083	0.239	0.996	0	5.7	0.870	0.062	33.1
500	0	0.085	0.099	0	493	16.2	0.961	0.006	--
500	2	0.081	0.099	0	492	19.5	0.961	0.006	--
500	4	0.077	0.099	0	489	21.9	0.960	0.007	--
500	6	0.073	0.100	0	487	25.5	0.960	0.006	--
500	10	0.065	0.100	0	485	30.3	0.960	0.006	--
500	20	0.040	0.108	0.058	424	130.0	0.957	0.007	76.1
1000	0	0.088	0.097	0	985	33.1	0.980	0.002	--
1000	2	0.087	0.098	0	986	33.3	0.980	0.002	--
1000	4	0.084	0.098	0	987	29.8	0.980	0.002	--
1000	6	0.083	0.098	0	985	35.1	0.980	0.002	--
1000	10	0.079	0.098	0	983	36.1	0.980	0.002	--
1000	20	0.068	0.099	0	969	61.0	0.980	0.002	--

Table III. Results for N_{init} vs. habitat loss. Baseline is provided for comparison.

N_{init}	Percent Habitat Loss	stoc-r	SD(r)	PE_{100}	N_{100}	$SD(N_{100})$	GD_{100}	SD(GD)	MTE
		0.061	0.109	0	94	9.6	0.822	0.058	--
15	5	-0.005	0.211	1	0	0	--	--	35
25	5	0.000	0.184	0.844	2	5.1	0.360	0.227	56

continue

N_{init}	Percent Habitat Loss	stoc-r	SD(r)	PE_{100}	N_{100}	$SD(N_{100})$	GD_{100}	SD(GD)	MTE
50	5	0.033	0.132	0.094	32	15.4	0.641	0.141	79
100	5	0.061	0.110	0	89	9.1	0.818	0.054	--
250	5	0.078	0.101	0	232	11.5	0.923	0.016	--
500	5	0.085	0.099	0	467	18.6	0.960	0.006	--
1000	5	0.088	0.098	0	939	27.5	0.980	0.002	--
15	25	-0.007	0.216	0.996	0	0.4	0	0	34
25	25	-0.002	0.186	0.932	0	2.4	0.274	0.229	58
50	25	0.028	0.140	0.192	21	13.7	0.598	0.164	82
100	25	0.058	0.112	0	69	8.9	0.797	0.062	--
250	25	0.077	0.101	0	183	9.3	0.912	0.019	--
500	25	0.084	0.099	0	368	14.3	0.954	0.009	--
1000	25	0.088	0.098	0	742	21.9	0.977	0.003	--
15	50	-0.006	0.220	1	0	0.0	--	--	34
25	50	0.000	0.191	0.980	0	0.9	0.246	0.247	55
50	50	0.023	0.150	0.342	11	9.3	0.542	0.178	83
100	50	0.053	0.116	0.002	44	8.6	0.760	0.076	75
250	50	0.075	0.103	0	122	7.8	0.895	0.026	--
500	50	0.084	0.099	0	246	10.0	0.946	0.009	--
1000	50	0.088	0.098	0	493	17.3	0.973	0.004	--

Table IV. Results for harvesting vs. habitat loss. Baseline values provided for comparison. N_{initi} and K were set at 100 at the start of all models.

Level of Harvesting	Percent Habitat Loss	stoc-r	SD(r)	PE_{100}	N_{100}	$SD(N_{100})$	GD_{100}	SD(GD)	MTE
Baseline	Baseline	0.061	0.109	0	94	9.6	0.822	0.058	--
2	5	0.034	0.118	0.142	70	35.7	0.807	0.058	767
4	5	-0.004	0.144	0.744	17	32.4	0.800	0.066	64
6	5	-0.044	0.178	0.992	0	6.6	0.809	0.048	42
10	5	-0.135	0.248	1	0	0	--	--	18
20	5	-0.382	0.397	1	0	0	--	--	7
2	25	0.034	0.118	0.116	72	33.4	0.808	0.059	76
4	25	-0.002	0.145	0.706	20	34.1	0.791	0.066	66
6	25	-0.044	0.176	0.982	1	5.8	0.767	0.084	41
10	25	-0.138	0.244	1	0	0	--	--	17
20	25	-0.381	0.392	1	0	0	--	--	7
2	50	0.034	0.117	0.108	72	32.7	0.811	0.056	78
4	50	-0.004	0.147	0.732	19	33.7	0.787	0.098	63
6	50	-0.042	0.176	0.986	1	9.0	0.839	0.039	42
10	50	-0.134	0.246	1	0	0	--	--	18
20	50	-0.382	0.394	1	0	0	--	--	7

List of acronyms

Acen – Fundación para la Conservación y el Estudio de la Naturaleza

AZA – American Zoo and Aquarium Association (Associação Americana de Zoológicos e Aquários), Estados Unidos

AAZK – American Association of Zoo Keppers (Associação Americana de Tratadores de Zoológicos), Estados Unidos

APP – Área de Preservação Permanente

Azara – Fundación de História Natural "Felix de Azara", Argentina

CBMM – Companhia Brasileira de Metalurgia e Mineração

CBSG – Conservation Breeding Specialist Group (Grupo Especialista para a Conservação e Reprodução em Cativeiro), Estados Unidos e Redes Regionais

Cenap – Centro Nacional de Pesquisas para a Conservação de Predadores Naturais, Brasil

Cenargen – Embrapa Recursos Genéticos e Biotecnologia

Cetas – Centro de Triagem de Animais Silvestres (Ibama), Brasil

CI – Conservation International (Conservação Internacional)

Coefa – Coordenação de Gestão do Uso de Espécies da Fauna (Ibama), Brasil

Cofau – Coordenação de Proteção de Espécies da Fauna (Ibama), Brasil

CPB – Centro de Proteção dos Primatas Brasileiros (Ibama), Brasil

CRC – Conservation and Research Center (Centro de Conservação e Pesquisa), Estados Unidos

CSG – Canid Specialist Group (Grupo Especialista de Canídeos)

Dinama – Dirección Nacional de Medio Ambiente, Uruguai

DNIT – Departamento Nacional de Infra-Estrutura de Transporte, Brasil

EA – Educação Ambiental

Embrapa – Empresa Brasileira de Pesquisa Agropecuária, Brasil

FMVZUSP – Faculdade de Medicina Veterinária e Zootecnia – Universidade de São Paulo

GAAG – Grupo Argentino Aguará Guazú, Argentina

GECM – Grupo de Ecología Comportamental de Mamíferos, Argentina

Ibama – Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis, Brasil

Inpe –Instituto Nacional de Pesquisas Espaciais, Brasil

IPÊ –Instituto de Pesquisas Ecológicas, Brasil

IUCN – International Union for the Conservation of Nature and Natural Resources (União Mundial para a Conservação da Natureza e Recursos Naturais)

MGAP – Ministério de Ganaderia, Agricultura y Pesca, Uruguai

MMA – Ministério do Meio Ambiente, Brasil

ONG – Organização Não-Governamental

PHVA – Population and Habitat Viability Assessment (Análise de Viabilidade Populacional e de Habitat)

PVA – Population Viability Analysis (Análise de Viabilidade Populacional)

PN – Parque Nacional

PUC – Pontifícia Universidade Católica, Brasil

RPPN – Reserva Particular do Patrimônio Natural

Seam – Secretaría del Ambiente, Paraguai

SIG – Sistema de Informações Geográficas

Siscom – Sistema Compartilhado sobre Licenciamento Ambiental em Propriedades Rurais

SPZ – Sociedade Paulista de Zoológicos, Brasil

SSC – Species Survival Commission (Comissão de Sobrevivência de Espécies)

SSP – Species Survival Plan (Plano de Sobrevivência de Espécie)

SZB – Sociedade de Zoológicos do Brasil

UBA – Universidad de Buenos Aires, Argentina

UC – Unidade de Conservação

UFMG – Universidade Federal de Minas Gerais, Brasil

UFPR – Universidade Federal do Paraná, Brasil

UFSCAR – Universidade Federal de São Carlos, Brasil

UnB – Universidade de Brasília, Brasil

Unesp – Universidade Estadual de São Paulo, Brasil

USP – Universidade de São Paulo, Brasil

WWF – World Wildlife Fund

Bibliography

Threats & Habitat Management

ALMEIDA, A. S.; CARVALHO, M. A. Dieta alimentar de *Chrysocyon brachyurus* no período de estiagem na área do Parque Nacional de Chapada dos Guimarães. In: CONGRESSO BRASILEIRO DE ZOOLOGIA, 19., 1992, Belém. **Anais...** Belém: Sociedade Brasileira de Zoologia, 1992. p. 245.

APARECIDO, E. O.; BRANCO, M. B. C.; MOTTA JÚNIOR, J. C. O lobo-guará *Chrysocyon brachyurus* como dispersor de sementes na região central do Estado de São Paulo. In: SIMPÓSIO DE INICIAÇÃO CIENTÍFICA DA UNIVERSIDADE DE SÃO PAULO, 6., 1998, Ribeirão Preto. **Anais...** v. 1. Ribeirão Preto: USP, Pró-reitoria de Pesquisa, 1998. p. 58.

ARAGONA, M. **Ecologia alimentar de lobo-guará *Chrysocyon brachyurus* (Illiger, 1811) no Parque Nacional da Chapada dos Guimarães**. Cuiabá, 2001. 66 p. Dissertação (Mestrado em Ecologia e Conservação da Biodiversidade) – Universidade Federal de Mato Grosso.

ARAGONA, M. **Hábito alimentar do lobo-guará *Chrysocyon brachyurus* (Illiger, 1811) nas estações seca e chuvosa, no Parque Estadual de Ibitipoca, MG**. Rio Claro, 1997. 40 p. Monografia (Bacharelado em Ciências Biológicas) – Instituto de Biosciências, Universidade Estadual Paulista.

ARAGONA, M.; SETZ, E. Z. F. Diet of maned wolf, *Chrysocyon brachyurus* (Mammalia: Canidae), during wet and dry seasons at Ibitipoca State Park, Brazil. **Journal of Zoology**, v. 254, n. 1, p. 131-136, 2001.

AZEVEDO, E. C.; GASTAL, M. L. A. Análises dos hábitos alimentares de lobo-guará *Chrysocyon brachyurus* na APA do Gama/Cabeça de Veado, DF. In: **Contribuição ao conhecimento ecológico do cerrado**. Departamento de ecologia. Brasília: Universidade de Brasília, 1997. p. 238-240.

AZEVEDO, F. C. **Nicho alimentar do lobo-guará *Chrysocyon brachyurus* (Illiger, 1811) ocorrente nas nascentes do Rio Tibagi, Campos Gerais, Paraná, Brasil**. Curitiba, 2000. 19 p. Monografia (Bacharelado em Ciências Biológicas) – Pontifícia Universidade Católica do Paraná.

BACHEGA, I. Dieta de *Chrysocyon brachyurus* na RPPN do SESC Pantanal, município de Barão de Melgaço, MT. In: CONGRESSO BRASILEIRO DE MASTOZOOLOGIA, 2., 2003, Belo Horizonte. **Resumos...** Belo Horizonte: Pontifícia Universidade Católica de Minas Gerais, 2003. p. 19.

BECCACECI, M. D. **El aguará guazú *Chrysocyon brachyurus* en la provincia de Santa Fé** – status populacional del aguará guazú en la Argentina. Fundación Vida Silvestre Argentina, 1996. 52 p.

BECCACECI, M. D. El aguará guazú *Chrysocyon brachyurus* en la provincia de Corrientes. **Facena**, n. 10, p. 19-31, 1993.

BECCACECI, M. D. The maned wolf *Chrysocyon brachyurus* in Argentina. In: REUNION CONJUNTA DE LA SAREM Y LA ASM, 1990. **Libro de resúmenes...** 1990. p. 36-37.

BELENTANI, S. C. S. **Ecologia alimentar do lobo-guará *Chrysocyon brachyurus* (Mammalia: Canidae) no Parque Florestal Salto e Ponte, município de Prata, MG**. São José do Rio Preto, 2001. 71 p. Dissertação (Mestrado em Ecologia) – Universidade de São Paulo.

BELENTANI, S. C. S.; MOTTA JÚNIOR, J. C. Dieta de *Chrysocyon brachyurus* (Canidae) no triângulo mineiro. In: ENCONTRO DE BIÓLOGOS DO CRB-1, 10., São Carlos. **Anais...** São Carlos: CRB-1, 1999. p. 91.

BELENTANI, S. C. S.; MOTTA JÚNIOR, J. C. Estacionalidade y selección de presas en la dieta de *Chrysocyon brachyurus* (Mammalia: Canidae) en el Brasil central. Em: CONGRESO IBEROAMERICANO DE BIODIVERSIDAD Y ZOOLOGÍA DE VERTEBRADOS, 9. **Libro de resúmenes...** 2000. Buenos Aires: Museo Argentino de Ciências Naturales Bernandino Rivadavia, 2000. p. 124-125.

BESTELMEYER, S. V.; WESTBROOK, C. Maned wolf *Chrysocyon brachyurus* predation on Pampa Deer (*Ozotoceros bezoarticus*) in Central Brazil. **Mammalia**, v. 62, n. 4, p. 591-595, 1998.

BRANCO, M. D. C.; APARECIDO, E. O.; MOTTA JÚNIOR, J. C. Dieta do lobo-guará *Chrysocyon brachyurus* (Mammalia: Canidae) na região central do estado de São Paulo. In: SIMPÓSIO DE INICIAÇÃO CIENTÍFICA DA UNIVESIDADE DE SÃO PAULO, 6., 1998, Ribeirão Preto. **Anais...** v. 1. Ribeirão Preto: USP, Pró-reitoria de Pesquisa, 1998. p. 55.

BREYER, F. R. S. **O guará no Rio Grande do Sul (Mammalia, Canidae)**. Brasília: IBDF/FBCN, 1979. 36 p.

BUENO, A. A.; MOTTA JÚNIOR, J. C. Estudo dos hábitos alimentares do lobo-guará *Chrysocyon brachyurus* na Estação Experimental de Itapetinga, São Paulo. In: SEMANA TEMÁTICA DE BIOLOGIA, 2., 1999, São Paulo. **Caderno de Resumos**. São Paulo: USP, 1999.

BUENO, A. A.; MOTTA JÚNIOR, J. C. Hábitos alimentares de *Chrysocyon brachyurus* (Mammalia: Canidae) na estação experimental de Itapetinga. In: CONGRESSO BRASILEIRO DE ZOOLOGIA, 23., 2000. **Programa e Resumos**. Cuiabá: Sociedade Brasileira de Zoologia, p.537.

BUENO, A. A.; MOTTA JÚNIOR, J. C. Seleção de pequenos mamíferos na dieta do lobo-guará *Chrysocyon brachyurus* (Mammalia: Canidae) na Estação Ecológica de Itirapina, SP. In: CONGRESSO BRASILEIRO DE MASTOZOOLOGIA, 2., 2003, Belo Horizonte. **Resumos...** Belo Horizonte: Pontifícia Universiade Católica de Minas Gerais, 2003. p. 13.

CAMPUSANO, M. D. L.; BACHERER, L. A. S. Determinación de la dieta del aguara guazú *Chrysocyon brachyurus* en el Parque Nacional Noel Kempff Mercado. Em: CONGRESSO INTERNACIONAL SOBRE MANEJO DA FAUNA SILVESTRE DE LA AMAZONIA, 3., 1997, Santa Cruz de La Sierra. **Libro de resúmenes...** 1997. p. 21.

CAMPUSANO, M. D. L.; BACHERER, L. A. S. Determinácion de la dieta del aguara guazú *Chrysocyon brachyurus* en el Parque Nacional Noel Kempff Mercado. Em: MANEJO Y CONSERVACION DA FAUNA SILVETRE EN AMERICA LATINA. **Libro de resúmenes...** 1999. p. 397-399.

CÂNDIDO JUNIOR, J. F.; D'AMICO, A. R.; QUADROS, J. Registro de lobo-guará *Chrysocyon brachyurus* (Carnivora: Canidae) no sudoeste do Paraná e análise de seu conteúdo estomocal. In: CONGRESSO BRASILEIRO DE MASTOZOOLOGIA, 2., 2003, Belo Horizonte. **Resumos...** Belo Horizonte: Pontifícia Universidade Católica de Minas Gerais, 2003. p. 30.

CERUTI, C. Sitio Arroyo Las Mulas I (Departamento La Paz. Pcia. De Entre Rios): Aportes para un estúdio del ecosistema. **Revista de Antropologia**, v. 9, p. 60-76, 1990.

CHEBEZ, J. C. **Los que se van**. Espécies Argentinas en peligro. Buenos Aires: Editorial Albatroz, 1994. 604 p.

CLÍNICA VETERINÁRIA. O lobo-guará no Parque do Caraça, MG. **Clínica Veterinária**, n. 37, p. 18-20, 2002.

CONTRERAS, A. O. Alguns comentarios acerca del aguara guazú *Chrysocyon brachyurus* (Illiger, 1815) en la provinecia de Corrientes, Argentina (Mammalia: Carnivora: Canidae). **Historia Natural**, v. 5, n. 14, p. 119-120, 1985.

FIGUEIRA, C. J. M. **Ocorrência, relações com residentes e comportamento alimentar do lobo-guará *Chrysocyon brachyurus* em zona rural do sul do Estado de Minas Gerais**. Rio Claro, 1995. 35 p. Monografia (Bacharelado em Ecologia) – Instituto de Biosciências, Universidade Estadual Paulista.

FIGUEIRA, C. J. M. Relações entre residentes e ecologia alimentar do lobo-guará *Chrysocyon brachyurus* em zona rural do sul do Estado de Minas Gerais. **Pesq. Foco**, v. 6, n. 7, p. 109-123, 1998.

FILHO, A. P. et al. (COMPLETAR OS NOMES DOS AUTORES) Projeto lobo-guará – contribuição à conservação ambiental dos campos gerais do Paraná, Brasil. In: CONGRESSO BRASILEIRO DE UNIDADES DE CONSERVAÇÃO, **Anais...** Curitiba, 1997.

HANDOCA, L. New protection for the maned wolf in Argentina. **Canid News**, n. 2, p. 21, 1994.

HARO, J. G.; TORRES, R. M.; BISTONI, M. Presencia del aguará guazu *Chrysocyon brachyurus* em em Sistema de Humedales Laguna Mar Chiquita – Bañados del Rio Dulce, **facena**, v. 17, p. 95-98, 2001.

HOFFMANN, R. K.; DEL PRADO, C. F. P.; OTEE, K. C. Registro de nuevas espécies de mamíferos para el Peru, *Odoicoelus dichotomus* (Illiger, 1811) y *Chrysocyon brachyurus* (Illiger, 1811), com notas sobre su habitat. **Revista Florestal del Peru**, n. 6, p. 61-81, 1975. REPETIDO

HOFMANN, R. K.; PONCE DEL PRADO, C. F.; OTTE, K. C. Registro de dos nuevos especies de mamiferos para del peru, *Odocoileus dichotomus* (Illiger, 1811) y *Chrysocyon brachyurus* (Illiger, 1811) con notas sobre su hábitat. **Revista Florestal del Peru**, n. 6, p. 61-81, 1975-1976. REPETIDO

INDRUSIAK, C.; EIZIRIK, E. Carnívoros. In: FONTANA, C. S.; BENCKE, G. A.; HEIS, H. E. **Livro vermelho da fauna ameaçada de extinção no Rio Grande do Sul**. Porto Alegre: Edipucrs, 2003. p. 507-533.

JÁCOMO, A. T. A. **Nicho alimentar do lobo-guará *Chrysocyon brachyurus* no Parque Nacional das Emas, Goiás**. Goiânia, 1995. 57 p. Monografia (Bacharelado em Ecologia) – Departamento de Ciências Biológicas e Biomédicas da Universidade Católica de Goiás.

JÁCOMO, A. T. A. **Nicho alimentar do lobo-guará *Chrysocyon brachyurus* (Illiger, 1811) no Parque Nacional das Emas-GO**. Goiânia, 1999. 30 p. Dissertação (Mestrado em Ecologia) – Instituto de Ciências Biológicas, Universidade Federal de Goiás.

JÁCOMO, A. T. A.; LEANDRO, S.; DINIZ-FILHO, J. A. F. Niche separation between the maned-wolf *Chrysocyon brachyurus*, crab-eating fox *Dusicyon thous* and the hoary-fox *Dusicyon vetulus* in the Cerrado of central Brazil. **Journal of Zoology**, 2003. In press.

JUAREZ, K. M. **Dieta, uso de hábitat e atividades de três espécies de canídeos simpátricas do Cerrado**. Brasília, 1997. 59 p. Dissertação (Mestrado em Ecologia) – Departamento de Ecologia, Universidade de Brasília.

JUAREZ, K. M. et al. (COMPLETAR OS NOMES DOS AUTORES) Dieta do lobo-guará numa área de cerrado do Brasil central. In: CONGRESSO DE ECOLOGIA DO BRASIL MANEJO DE ECOSSISTEMAS E MUDANÇAS GLOBAIS, Brasília, 1996. **Resumos...** Brasília: UnB, Departamento de Ecologia, 1996.

LESSA, G. et al. (COMPLETAR OS NOMES DOS AUTORES) O registro de *Attalea dubia* (Palmae) na dieta de *Chrysocyon brachyurus* (Carnivora, Mammalia) em Viçosa, MG. In: CONGRESSO BRASILEIRO DE ZOOLOGIA, 21., 1992, Belém. **Anais...** Belém: Sociedade de Zoologia do Brasil, 1992. p. 245.

LILIENFELD, C. M. Dieta del berochi *Chrysocyon brachyurus* en el distrito los Fierros Del Parque Nacional Noél Kempff Mercado. In: JORNADAS ARGENTINAS DE MASTOZOOLOGIA, 13., 1998, Porto Iguazú. **Anais...** 1998. p. 100-101.

MANTOVANI, J. E. **Telemetria convencional e via satélite na determinação das áreas de vida de três espécies de carnívoros da região nordeste do estado de São Paulo**. São Carlos, 2001. 101 p. Tese (Doutorado em Ecologia e Recursos Naturais) – Centro de Ciências Biológicas e da Saúde, Universidade Federal de São Carlos.

MATTOS, P. S. R. **Estudos de genética de populações e de sanidade do lobo-guará *Chrysocyon brachyurus* na Estação Ecológica do Jataí (município de Luís Antônio, SP) e em áreas vizinhas**. Tese (Doutorado em Ecologia e Recursos Naturais) – Centro de Ciências Biológicas e da Saúde, Universidade Federal de São Carlos, São Carlos.

MERITT, D. A. Some observations on the maned wolf *Chrysocyon brachyurus* in Paraguay. **Zoologica**, n. 58, p. 53, 1973.

MONES, A.; OLAZARRI, J. Confirmacion de la existencia de *Chrysocyon brachyurus* (Illiger) en el Uruguay (Mammalia: Carnivora: Canidae). **Comunicaciones del Museo de História Natural de Montevideo**, n. 12, p. 1-6, 1990.

MONTE, S. C. El aguará guazú. **Fauna Argentina**, v. 62, p. 1-32, 1984.

MORATÓ, D. Q. **Seletividade e sazonalidade das presas consumidas pelo lobo-guará *Chrysocyon brachyurus* no Parque Nacional da Serra da Canastra, Minas Gerais**. São Paulo, 2001. 86 p. Dissertação (Mestrado em Ecologia) – Instituto de Biociências, Universidade de São Paulo.

MOTTA JÚNIOR, J. C. et al. (COMPLETAR OS NOMES DOS AUTORES) Ecología trófica del aguará guazú *Chrysocyon brachyurus* en el sudeste del Brasil. In: CONGRESO IBEROAMERICANO DE BIODIVERSIDAD Y ZOOLOGÍA DE VERTEBRADOS, 9., **Libro de resúmenes...** Buenos Aires: Museo Argentino de Ciências Naturales Bernandino Rivadavia, 2000. p. 167.

MOTTA JÚNIOR, J. C. Predação de *Micropygia schomburgkii* (Aves: Rallidae) por *Chrysocyon brachyurus* (Mammalia: Canidae) no Distrito Federal, Brasil. **Ararajuba**, n. 2, p. 87-89, 1991.

MOTTA JÚNIOR, J. C. Variação temporal e seleção de presas na dieta de lobo-guará, *Chrysocyon brachyurus* (Mammalia: Canidae), na Estação Ecológica do Jataí, Luís Antônio, SP. In: SANTOS, J. E.; PIRES, J. S. R. (Ed.). **Estudos integrados em ecossistemas. Estação Ecológica de Jataí**. São Carlos: Rima Editora, 2000. v. 1. p. 331-346

MUNDIM, M. J. S. et al. (COMPLETAR OS NOMES DOS AUTORES) Ocorrência e identificação de Ancilostomatideos em lobo-guará *Chrysocyon brachyurus* (Illiger, 1811) da região do

Triângulo Mineiro, Minas Gerais, Brasil. **Braz. Journ. Vet. Res. Anim. Scien.**, v. 28, n. 1, p. 39-43, 1991.

PAULA, R. C., SANTOS, J. P. Efeitos da presença humana na ecologia e comportamento do lobo-guará *Chrysocyon brachyurus* no Parque Nacional da Serra da Canastra, MG: Resultados preliminares. In: CONGRESSO BRASILEIRO DE MASTOZOOLOGIA, 2., 2003, Belo Horizonte. **Resumos...** Belo Horizonte: Pontifícia Universidade Católica de Minas Gerais, 2003. p. 22.

QUADROS, J.; WANGLER, M. S. Observações sobre a dieta do lobo-guará *Chrysocyon brachyurus* em uma área do município de Telêmaco Borba, Paraná, Brasil. In: JORNADAS ARGENTINAS DE MASTOZOOLOGIA, 13., 1998, Porto Iguazú. **Anais...** 1998. p. 107.

QUEIROLO, D.; MOTTA JÚNIOR, J. C. Observaciones sobre la dieta aguara guazú *Chrysocyon brachyurus* en la parte este del Parque Nacional da Serra da Canastra, sudeste del Brasil. In: CONGRESSO LATINO-AMERICANO DE ECOLOGIA, 4., 1998, Arequipa. **Libro de resúmenes...** Arequipa, 1998. p. 1-9.

QUEIROLO, D.; MOTTA JÚNIOR, J. C. Oportunismo temporal en la dieta del aguará guazú *Chrysocyon brachyurus* en el Parque Nacional da Serra da Canastra, región sudeste del Brasil. Em: CONGRESO IBEROAMERICANO DE BIODIVERSIDAD Y ZOOLOGÍA DE VERTEBRADOS, 9., **Libro de resúmenes...** Buenos Aires: Museo Argentino de Ciências Naturales Bernandino Rivadavia, 2000. p. 183.

QUEIROLO, D.; MOTTA JÚNIOR, J. C. Possível influência das mudanças de paisagem no Parque Nacional da Serra da Canastra-MG na dieta do lobo-guará *Chrysocyon brachyurus*. In: CONGRESSO BRASILEIRO DE UNIDADES DE CONSERVAÇÃO, 2., 2000, Campo Grande. **Anais...** Campo Grande: Rede Nacional Pró-Unidades de Conservação, v. 2, 2000. p. 706-714.

RICHARD, E.; GIRAUDO, A.; ABDALA, C. Confirmación de la presencia del aguará guazú *Chrysocyon brachyurus* en la Provincia de Santiago Del Estero, Argentina. In: JORNADAS ARGENTINAS DE MASTOZOOLOGIA, 13., 1998, Porto Iguazú. **Anais...** 1998. p. 78-79.

RODRIGUES, F. H. G. **Biologia e conservação do lobo-guará na Estação Ecológica de Águas Emendadas, DF**. 2002. 105 p. Tese (Doutorado em Ecologia) – Instituto de Biologia, Universidade Estadual de Campinas, Campinas, 2002.

SANTOS, E. F. **Ecologia alimentar e dispersão de sementes pelo lobo-guará *Chrysocyon brachyurus* (Illiger, 1811) em uma área rural no sudeste do Brasil (Carnivora: Canidae)**. Rio Claro, 1999. 68 p. Dissertação (Mestrado em Ciências Biológicas) – Instituto de Biosciências, Universidade Estadual Paulista.

SANTOS, E. F. Ecologia alimentar e dispersão de sementes realizadas por *Chrysocyon brachyurus* em uma região rural do sudeste do Brasil (Carnivora – Canidae). In: WORKSHOP DO LOBO-GUARÁ, 3., 1998, São Bernardo do Campo. **Protocolo de manejo do lobo-guará mantidos em cativeiro**. Sorocaba: Sociedade de Zoológicos do Brasil, 2000. p. 42.

SILVA, C. B. X. et al. (COMPLETAR OS NOMES DOS AUTORES) Atropelamentos de lobos guarás *Chrysocyon brachyurus* nas rodovias dos Campos Gerais, Palmeira – Ponta Grossa, Paraná. In: REUNIÃO ANUAL DA SBPN, 8., 2000.

SILVA, C. B. X. **Hábito alimentar do lobo-guará *Chrysocyon brachyurus* (Illiger, 1811) em três localidades dos Campos Gerais, Paraná, Brasil**. Curitiba, 1996. 54 p. Monografia (Bacharelado em Ciências Biológicas) – Centro de Ciências Biológicas e da Saúde, Pontifícia Universidade Católica do Paraná.

SILVA, C. B. X. Projeto lobo-guará - uma contribuição à conservação dos Campos Gerais no Paraná, Brasil. In: WORKSHOP DO LOBO-GUARÁ, 3., 1998, São Bernardo do Campo.

Protocolo de manejo do lobo-guará mantidos em cativeiro. Sorocaba: Sociedade de Zoológicos do Brasil, 2000. p. 43-49.

SILVA, C. B. X.; NICOLA, P. A. Observações sobre o lobo-guará *Chrysocyon brachyurus* no Parque Estadual do Cerrado, Jaguariaíva, Paraná, Brasil. In: CONGRESSO BRASILEIRO DE CONSERVAÇÃO E MANEJO DA BIODIVERSIDADE, 23, 1999, Ribeirão Preto. **Anais...** 1999.

SILVA, C. B. X.; NICOLA, P. A.; PONTES-FILHO, A. Áreas de uso do lobo-guará *Chrysocyon brachyurus* na micro bacia do Rio Tibagi, Palmeira - Ponta Grossa, Paraná, Brasil. In: CONGRESSO BRASILEIRO DE CONSERVAÇÃO E MANEJO DA BIODIVERSIDADE, 23., 1999, Ribeirão Preto. **Anais...** 1999.

SILVA, E. Análises escatológicas de lobo-guarás na Chapada dos Guimarães. In: CONGRESSO BRASILEIRO DE ZOOLOGIA, 15, **Anais...** 1988.

SILVA, E.; DALPONTE, J. C. Nota sobre os hábitos alimentares do lobo-guará *Chrysocyon brachyurus* na Chapada do Guimarães, MT. In: CONGRESSO BRASILEIRO DE ZOOLOGIA, 14, **Anais...** p. 536, 1987.

SILVA, J.; TALAMONI, S. A. Diet adjustments of maned wolves *Chrysocyon brachyurus* (Illiger) (Mammalia, Canidade) subjected to supplemental feeding in a private natural reserve, Southeastern Brazil. **Revista Brasileira de Zoologia**, v. 20, n. 2, p. 339-345, 2003.

SILVA, J. A.; TALAMONI, S. A. Diet of the maned wolf *Chrysocyon brachyurus* in a private natural reserve in South-eastern Brazil. In: CANID BIOLOGY AND CONSERVATION, 2001, Oxford. **Abstracts...** Oxford: Canid Specialist Group – IUCN, 2001. p. 71.

SILVEIRA, L. **Ecologia e conservação dos mamíferos carnívoros do Parque Nacional das Emas, Goiás**. Goiânia, 1999. 117 p. Dissertação (Mestrado em Ecologia) – Instituto de Ciências Biológicas, Universidade Federal de Goiás.

SILVEIRA, L. et al. (COMPLETAR OS NOMES DOS AUTORES) Hunting association between the Aplomado Falcon *Falco femoralis* and the maned wolf *Chrysocyon brachyurus* in Emas National Park, central Brazil. **Condor**, v. 99, n. 1, p. 201-202, 1997.

SILVEIRA, L.; JÁCOMO, A. T. A. **Ecologia e conservação de mamíferos carnívoros do Parque Nacional das Emas, GO**. Relatório Técnico. Brasília: Ibama/Direc/Deuc, 1998.

SOARES, L. F. G. **Aspectos comportamentais de *Chrysocyon brachyurus* (Illiger, 1815) (Mammalia, Carnívora) visando a sua reintrodução em ambiente natural, na Fazenda Monte Alegre no município de Telêmaco Borba, no Estado do Paraná, Brasil**. Curitiba, 1991. 141 p. Monografia (Bacharelado em Ciências Biológicas) – Centro de Ciências Biológicas e da Saúde, Pontifícia Universidade Católica do Paraná.

STEIMAN, L. M. **Litiasis renal por cisteina el aguará gauzú *Chrysocyon brachyurus***. Report realizado en la direccion de fauna y ecologia de la Estacion Experimental, Provincia de Santa Fé. informe inédito.

STEIMAN, L. M. Propuesta para el diseno de un area protegida para el aguará gauzú *Chrysocyon brachyurus* en el chaco Argentino. In: CONGRESSO INTERNACIONAL SOBRE MANEJO DA FAUNA SILVESTRE DE LA AMAZONIA, 3., 1997, Santa Cruz de La Sierra. **Libro de resúmenes...** 1997. p. 18-19.

TALAMONI, J. A.; MOTTA JÚNIOR, J. C. Presas consumidas pelo lobo-guará *Chrysocyon brachyurus* (Mammalia: Canidae) na Estação Ecológica de Jataí, município de Luiz Antônio, SP. In: CONGRESSO BRASILEIRO DE ZOOLOGIA, 20., 1994, Rio de Janeiro. **Anais...** Rio de Janeiro: Sociedade Brasileira de Zoologia, 1994.

Environmental Education

ANIC, C. C. **Conhecimentos e crenças de algumas populações rurais do sudeste do Brasil frente ao lobo-guará Chrysocyon brachyurus, Illiger, 1815, (Mammalia; Canidae)**. Dissertação (Mestrado) – Instituto de Biociências da Universidade de São Paulo, Departamento de Ecologia, 2002. 73 p.

BIZERRIL, M. X. A. Children perception of Brazilian Cerrado landscapes and biodiversity. **The Journal of Environmental Education**, v. 35, n. 4, p. 47-58, 2004.

BIZERRIL, M. X. A. O Cerrado nos livros didáticos de geografia e ciências. **Ciência Hoje**, v. 32, n. 192, p. 56-60, 2003.

COSTA, W. C. S. O. O papel da difusão científica no processo da educação ambiental e no incremento da alfabetização científica: aspectos gerais de uma pesquisa. In: COSTA, W. C. S. O. (Org.). **Comunicação da ciência e educação ambiental**: resultados do workshop internacional., Belém: Museu Paraense Emílio Goeldi, 1998. p. 19-32.

CASTILLO, A. La educacíon ambiental y las instituciones de investigacíon ecológica: hacia una ciencia com responsabilidad social. **Tópicos en educacíon ambiental**, v. 1, n. 1, p. 35-46, 1999.

DIAS, G. F. **Populações marginais em ecossistemas urbanos**. Brasília: Ed. Ibama, 1994.

DIEGUES, A. C. **O mito moderno da natureza intocada**. São Paulo: Ed. Hucitec, 1996. 169 p.

FARIA, D. S.; CARNEIRO, K. S. Sustentabilidade ecológica no turismo. Brasília: EdUnB, 2001.

INDRUSIAK, C. B.; PÁDUA, S. M. Levantamento do perfil dos diferentes grupos relacionados ao Parque Estadual do Turvo, RS. In: PÁDUA, S. M.; TABANEZ, M. F. (Org.). **Educação Ambiental**: caminhos trilhados no Brasil. Nazaré Paulista, SP: IPÊ, 1997. p. 103-117.

KLINK, C. A.; MACHADO, R. B. A conservação do cerrado brasileiro. **Megadiversidade**, v. 1, n. 1, p. 147-155, 2005.

LUTTERBACH, A. (personal communication)

MAY JÚNIOR, J.; DE PAULA, R. C. (personal communication)

ROSSO, M. S. (personal communication)

MOTTA-JÚNIOR, J. C.; QUEIROLO, D.; BUENO, A.; BELETANI, S. Fama Injusta. **Ciência Hoje**, v. 31, n. 185, p. 71- 73.

NEWMARK, W. D.; MANYANZA, D. N.; GAMASSA, D. M.; SARIKO, H. I. The conflict between wildlife and local people living adjacent to protected areas in Tanzania: human density as a predictor. **Conservation Biology**, v. 8, n. 1, p. 249-255, 1994.

RATTER, J. A.; RIBEIRO, J. F.; BRIDGEWATER, S. The Brazilian Cerrado vegetation and threats to its biodiversity. **Annals of Botany**, v. 80, p. 223–230, 1997.

RODRIGUES, F. H. G. **Biologia e Conservação do lobo-guará na Estação Ecológica de Águas Emendadas, DF**. Campinas, SP. 96 p. 2002. Tese (Doutorado) - Universidade Estadual de Campinas – Unicamp.

RODRIGUES, F.H.G. et al. (COMPLETAR OS NOMES DOS AUTORES) **Plano de Manejo do lobo-guará**. (Falta informação da publicação)

SATO, M. **Educação para o ambiente amazônico**. São Carlos, SP, 1997. 227 p. Tese (Doutorado) - Universidade Federal de São Carlos.

VIEZZER, M. L.; OVALLES, O. **Manual latino-americano de educação ambiental**. São Paulo: Ed. Gaia, 1995. 192 p.

Population Viability

BEISSINGER, S. R.; MCCULLOUGH, D. R. **Population viability analysis**. Chicago: Chicago University Press, 2002.

DEEM, S. L.; EMMONS, L. H. Exposure of free-ranging maned wolves (*Chrysocyon brachyurus*) to infectious and parasitic disease agents in the Noel Kempff Mercado National Park, Bolivia. **Journal of Zoo and Wildlife Medicine**, v. 36, p. 198-197, 2005.

DIETZ, J. M. *Chrysocyon brachyurus*. **Mammalian Species**, v. 234, p. 1-4, 1985.

ELLNER, S. P.; FIEBERG, J.; LUDWIG, D.; WILCOX, C. Precision of population viability analysis. **Conservation Biology**, v. 16, p. 258-261, 2002.

LACY, R. C. Vortex: A computer simulation model for population viability analysis. **Wildlife Research**, v. 20, p. 45-65, 1993.

LACY, R. C. Structure of the Vortex simulation model for population viability analysis. **Ecological Bulletins**, v. 48, p. 191-203, 2000.

LOTTS, K. C.; WAITE, T. A.; VUCETICH, J. A. Reliability of absolute and relative predictions of population persistence based on time series. **Conservation Biology**, v. 18, p. 1224-1232, 2004.

LUDWIG, D. Is it meaningful to estimate a probability of extinction? **Ecology**, v. 80, p. 298-310, 1999.

MAIA, O. B.; GOUVEIA, A. M. G. Birth and mortality of maned wolves *Chrysocyon brachyurus* (Illiger, 1811) in captivity. **Brazilian Journal of Biology**, v. 62, p. 25-32, 2002.

MILLER, P. S.; LACY, R. C. **Vortex**: A Stochastic Simulation of the Extinction Process. Version 9 User's Manual. Conservation Breeding Specialist Group (SSC/IUCN), Apple Valley, MN, 2003.

RALLS, K.; BALLOU, J. D.; TEMPLETON, A. R. Estimates of lethal equivalents and the cost of inbreeding in mammals. **Conservation Biology**, v. 10, p. 769-775, 1988.

REED, J. M.; MILLS, P. S.; J.B., D.J.; MENGES, E. S.; MCKELVEY, K. S.; FRYE, R.; BEISSINGER, S. R.; ANSTETT, M.; MILLER, P. S. Emerging issues in population viability analysis. **Conservation Biology**, v. 16, p. 7-19, 2002. CONFIRMAR OS NOMES DOS AUTORES

VEADO, B. V. Parental behaviour in maned wolf *Chrysocyon brachyurus* at Belo Horizonte Zoo. **International Zoo Year Book**, v. 35, p. 279-286, 1997.

Participants

ARGENTINA

Abel Fleita
Huellas ONG
Julio A. Roca, 866 – Bº40, V. Mburucuyá (3427), Corrientes, Argentina
+54 (3782)15 471129
huellasdifusion@yahoo.com.ar

Lucia Soler
Huellas ONG
Caronti, 108, 6to 2do (8000), Bahia Blanca, Argentina
GECM - Universidad Nacional del Sur
San Juan 670 – Dpto Biologia, Bahia Blanca, Argentina
+ 54 (3783)15 608838
huellas@aguara-guazu.com.ar / smilodon09gmail.com

Marcela Orozco
Universidad de Buenos Aires – Facultad de Ciencias Exactas y Naturales
Ciudad Universitaria – Piso 2, Pab II, Lab. Ecoepidemiologia, Buenos Aires, Argentina
+ 54 (11) 4576-3318 / 47063774/ 15-5051-3104 cel /Fax. 4576-3384
marceloarozco.vet@gmail.com

María de la Cruz Pino
Jardín Zoológico de la Ciudad de Buenos Aires
República de la India, 2900, CP 1425, Buenos Aires, Argentina
+54 (11) 4011-9918
cruzpino@yahoo.com.ar

Maria Soledad Rosso
Jardin Zoologico de la Ciudad de Buenos Aires / Proyecto Ñangarekó Aguará Guazú
República de la India 2900-CP 1425 - Capital Federal, Argentina
+54 (11) 4011-9920 / 4423-7583
srosso@cieargentina.com.ar

Pablo Andrés Cuello
Huellas ONG
Buenos Aires 251, Sampacho (C.P 5800), Córdoba, Argentina
+54 (358) 15 4187195
pabloacuell@yahoo.com.ar

Viviana Quse
Fundación Temaiken
Ruta 25, km 0,700 (CP 1625- Escobar), Buenos Aires, Argentina
+54 (3488) 436805
vquse@tamaiken.com.ar / vquse@fibertel.com.ar

BRAZIL

Ana Maria Beresca
Fundação Parque Zoológico de São Paulo
Av. Miguel Stefano, 4.241, São Paulo, SP – 04310-905, Brasil
+55 (11) 5073-0811
aberesca@sp.gov.br

Angela Alves Lutterbach
Fundação Zoo-Botânica de Belo Horizonte
Av. Otacílio Negrão de Lima, 8.000, Belo Horizonte, MG – 31365-450, Brasil
+55 (31) 3277-7101
fzbeduc@pbh.gov.br

Carlyle Mendes Coelho
Fundação Zoo-Botânica de Belo Horizonte
Av. Otacílio Negrão de Lima, 8.000, Belo Horizonte, MG – 31365-450, Brasil
+55 (31) 3277-7259
fzbzoo@pbh.gov.br

Cecília Pessutti
Parque Zoológico Municipal Quinzonho de Barros
R. Teodoro Kaizel, 883, Sorocaba, SP – 18021-020, Brasil
Telefone+55 (15) 32275454 r.26
cpessutti@ig.com.br

Cleyde Chieregatto
Sociedade Paulista de Zoológicos
R. Jorge Hagge,344, Praia Grande, SP - 11702-390, Brasil
+ 55 (13) 3481-1390
cleydecheregatto@ig.com.br

Cosette Silva
Núcleo de Fauna – Ibama/Gerência Executiva PR
Rua General Carneiro, 481, Curitiba, PR – 80060-150, Brasil
+55 (41) 3363-2525
cosette.silva@ibama.gov.br

Daniela Salim
Universidade de Brasília
SHIS QL 14, Conj. 10, casa 02, Brasília, DF – 716400-105, Brasil
+55 (61) 3248-3423
danielasalim@hotmail.com

Diego Queirolo
Depto. Ecologia - Universidade de São Paulo
R. do Matão, 321, Travessa 14, São Paulo, SP – 05508-900, Brasil
+55 (11) 3617-3804
diqueirolo@yahoo.com.br

Eduardo Eizirik
PUC-RS/Instituto Pró-Carnívoros
Av. Ipiranga, 6.681, prédio 12, Porto Alegre, RS – 70617-700, Brasil
+55 (51) 3320-3500, r.4685
eduardo.eizirik@pucrs.br

Fernanda Cavalcanti de Azevedo
Projeto Lobos da Canastra - Instituto Pró-Carnívoros
R. José Avelino G. de Carvalho, 132, São Roque de Minas, MG, 37928-000, Brasil
+55 (37) 3433-1898
cavalcantifer@yahoo.com

Fernando Bonillo
Ibama – Escritório Regional de Pouso Alegre, MG
R. Mário Gonçalves Campos, 255, Pouso Alegre, MG, 37550-000, Brasil
+55 (35) 3423-4969
bonillofernandes@uol.com.br

Flávio Henrique Guimarães Rodrigues
Universidade Federal de Minas Gerais/Instituto Pró-Carnívoros
Av. Antonio Carlos, 6.627, CP 486 Dept. Biol.Geral, Belo Horizonte, MG, 31270-901, Brasil
+55 (31) 3499-2586
rodrigues@procarnivoros.org.br

Francisco Rogério Paschoal
Sociedade de Zoológicos do Brasil/Parque Ecológico de São Carlos
R. São Joaquim, 979, São Carlos, SP – 13560-161, Brasil
+55 (16) 3361-4456
roger@pesc.org.br

Jean Carlos Ramos da Silva
Instituto Brasileiro para a Medicina da Conservação – Tríade
R. Prof. Elisabeth Rolim, 116, São Paulo, SP – 05514-080, Brasil
+55 (11) 9508-0568
jean@triade.org.br

Jean Pierre Santos
Projeto Lobos da Canastra - Instituto Pró-Carnívoros
R. José Avelino G. de Carvalho, 132, São Roque de Minas, MG, 37928-000, Brasil
+55 (37) 3433-1205
canastra.jean@procarnivoros.org.br

Joaquim de Araújo Silva
Biotrópicos – Instituto de Pesquisa em Vida Silvestre
R. Zito Soares 22, Belo Horizonte, MG, 30532-260, Brasil
+55 (31) 3362-1763
quincas@biotropicos.org.br

Joares May Junior
Projeto Lobos da Canastra - Instituto Pró-Carnívoros
R. José Avelino G. de Carvalho, 132, São Roque de Minas, MG, 37928-000, Brasil
+55 (37) 3433-1898
joaresmay@ig.com.br

José Roberto Moreira
Cenargen-Embrapa
Pq. EB, final W5, Asa Norte, Brasília, DF, Brasil
+55 (61) 3448-4605
jmoreira@cenargen.embrapa.br

Laura Teodoro Fernandes
CDA - CBMM
Córrego da Mata, s/n, CP 08, Araxá, MG – 338183-970, Brasil
+55 (34) 3669-3511
laura@cbmm.com,br

Marcelo Ximenes Bizerril
Universidade de Brasília
Faculdade de Planaltina, Universidade de Brasília, Área Universitária 1,
Bairro Nossa Senhora Aparecida, Planaltina, DF, Brasil
+55 (61) 3347-1376
marcelo_bizerril@yahoo.com.br

Marco Aurélio Lima Sábato
Fundação Zoo-Botânica de Belo Horizonte
Av. Otacílio Negrão de Lima, 8.000, Belo Horizonte, MG, 31365-450, Brasil
+55 (31) 3277-7259
fzbzoo@pbh.gov.br

Marcelo Lima Reis
DIBIO/ICMBio
ICMBio EQSW 103/104 Bloco C, Setor Oeste, Brasília-DF, 70670-350, Brasil
+55 (61) 3316-1270
mukirabsb@yahoo.com.br

Otávio Borges Maia
DIBIO/ICMBio
ICMBio EQSW 103/104 Bloco C, Setor Oeste, Brasília-DF, 70670-350, Brasil
+55 (61) 3341-9388
otavio.maia@icmbio.gov.br

Paulo Sérgio Mattos
Fundação Estadual Meio Ambiente, Ciência e Tecnologia/RR
+55 (16) 3306-8448
pmattos@iris.ufscar.br

Rodrigo Silva Pinto Jorge
Cenap-ICMBio/Instituto Brasileiro para a Medicina da Conservação-Tríade/VPS-FMVZ-USP
Av. dos Bandeirantes s/n, Balneário Municipal, Atibaia, SP, 12941-680, Brasil
+55 (11) 4411-6744
rspjorge@gmail.com

Rogério Cunha de Paula
Cenap-ICMBio/Instituto Pró-Carnívoros
Av. dos Bandeirantes s/n, Balneário Municipal, Atibaia, SP, 12941-680, Brasil
+55 (11) 4411-6744
rogerio.paula@icmbio.gov.br

Ronaldo Gonçalves Morato
Cenap-ICMBio
Av. dos Bandeirantes s/n, Balneário Municipal, Atibaia, SP, 12941-680, Brasil
+55 (11) 4411-6744
ronaldo.morato@icmbio.gov.br

Rosana Nogueira de Morais
Universidade Federal do Paraná
R. Major Heitor Guimarães, 978, Curitiba, PR, 80740-340, Brasil
moraisrn@bio.ufpr.br

Rose Lilian Gasparini Morato
Cenap-ICMBio
Av. dos Bandeirantes s/n, Balneário Municipal, Atibaia, SP, 12941-680, Brasil
+55 (11) 4411-6744
rose.morato@icmbio.gov.br

Valéria do Socorro Pereira
Fundação Zoo-Botânica de Belo Horizonte
Av. Otacílio Negrão de Lima, 8.000, Belo Horizonte, MG, 31365-450, Brasil
+55 (31) 3277-7144
vpereira@pbh.gov.br

PARAGUAY

José Luis Cartes
Asociación Guyra Paraguay
Cnel. Rafael Franco, 381,C.C. 1132, Asunción, Paraguay
+595 (21) 227-777
jlcartes@guyra.org.py

Maria Luisa Ortiz
Asociación Guyra Paraguay
Ezequiel D. Gonzales, 250, Asunción, Paraguay
+595 (21) 331-183
malukinha_82@yahoo.com.br

Marianela Velilla Fernandez
Asociación Guyra Paraguay
Guido Spano, 2.820, Asunción, Paraguay
+595 (21) 660-920
mvelilla87@hotmail.com

URUGUAY

Diego Queirolo
Depto. Ecologia - Universidade de São Paulo
R. do Matão, 321, Travessa 14, São Paulo, SP – 05508-900, Brasil
+55 (11) 3617-3804
diqueirolo@yahoo.com.br

USA

Devra Kleiman
National Zoo/Smithsonian Institution
7.216 Delfield St., Chevy Chase, MD 20815, USA
+1 (301) 652-0647
dgkleiman@aol.com

Gerald Post
Veterinary Oncology and Hematology Center
252 7th Ave, New York, NY 10001, USA
+1 (212) 706-1365
gposto@oncovet.com

Melissa Rodden
CRC - National Zoo - Smithsonian Institution/AZA
1.500 Remount Rd, Front Royal, VA 22630, USA
+1 (540) 635-6550
roddenm@crc.si.edu

Nucharin Songsasen
CRC - National Zoo - Smithsonian Institution/AZA
1.500 Remount Rd, Front Royal, VA 22630, USA
+1 (540) 622-8415
songsasenn@crc.si.edu

CBSG - FACILITATORS & MODELERS

Anders Gonçalves da Silva
Columbia University/Instituto de Pesquisas Ecológicas
IUCN/SSC Conservation Breeding Specialist Group (CBSG) - Rede Brasil
540 W 122nd st., #36, New York, NY 10027, USA
ag2057@columbia.edu

Arnaud Desbiez
Durrell Institute of Conservation and Ecology (DICE), University of Kent at Canterbury
IUCN/SSC Conservation Breeding Specialist Group (CBSG) - Rede Brasil
Canterbury, Kent, CT2 7NS, United Kingdom
+44-1227-823-233
adesbiez@hotmail.com

Kathy Traylor-Holzer
IUCN/SSC Conservation Breeding Specialist Group (CBSG)
12.101 Johnny Cake Ridge Rd, Apple Valley, MN 55124, USA
+1 (952) 997-9800
kathy@cbsg.org

Leandro Jerusalinsky
Centro de Proteção de Primatas Brasileiros - ICMBio
IUCN/SSC Conservation Breeding Specialist Group (CBSG) - Rede Brasil
Praça Antenor Navarro, 05, João Pessoa, PB – CEP 58010-480, Brasil
+55 (83) 3214-3070
leandro.jerusalinsky@icmbio.gov.br

Patrícia Medici
IPÊ - Instituto de Pesquisas Ecológicas
IUCN/SSC Conservation Breeding Specialist Group (CBSG) - Rede Brasil
Av. Perdizes, 285, Vila São Paulo, Teodoro Sampaio, SP – CEP 19280-000, Brasil
+55 (18) 3282-4690
epemedici@uol.com.br

Philip Miller
IUCN/SSC Conservation Breeding Specialist Group (CBSG)
12.101 Johnny Cake Ridge Rd, Apple Valley, MN 55124, USA
+1 (952) 997-9800
pmiller@cbsg.org

SUPPORT

PRÓ CARNÍVOROS

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