

LYNX PARDINUS: PAST, PRESENT AND FUTURE



INTRODUCTION

The Iberian lynx (*Lynx pardinus*) is considered the most endangered feline in the world. Only two subpopulations remain isolated in southern Spain, at the National Park of Doñana and at the east of the Natural Park of Sierra Morena (Guzman et al 2004). Archaeological data show that feline was distributed along the southwest of the Iberian Peninsula (Rodríguez and Delibes 1990). Since the nineteenth century populations were reduced (Rodríguez and Delibes 2002) to critically endangered levels. Currently conservations programs have been implemented to halt the decline of lynxes, and to reintroduce them elsewhere.

PAST

ORIGIN

Phylogeographic analyses have supported the North American origin of the lynx lineage. Between 1.6 and 1.2 million years ago the ancestors of *L. pardinus* and *L. lynx* went to Eurasia through the Bering Strait.



Estimated maximum historical range of the Iberian lynx and rabbit according to Rodríguez and Delibes (2002) during the maximum glacial period (LGM), before human expansion. *L. lynx* occupied northern Iberia while *L. pardinus* would have displaced to the south as a result of cold and adverse conditions.

HISTORICAL DISTRIBUTION

Jose Maria Gil-Sánchez in 2011 rebuild the former area of distribution of the Iberian lynx by using information on the background of the lynx (skins, bones skulls and preserved specimens). By using a geographic information system each individual was geographically locate.



Lynx pardinus distribution in 1960 (Rodríguez & Delibes 1991)



Lynx pardinus distribution in 1990 (Rodríguez & Delibes 1991)



Lynx pardinus distribution actually (Guzmán et al 2004)

In total, between 1940 and 2000, the global amount of lynx decreased by 74.6% of the occupied territory and 87.5% of subpopulations disappeared.

CAUSES OF DECLINE

- **Loss of mediterranean scrub** could have contributed to the reduction of some subpopulations.
- Hunting and direct persecution by humans: **bonds, stocks, cash traps and poisons**. Many of these practices are nonselective still threatening the survival of the lynx.
- The rabbit populations (*Oryctolagus cuniculus*) dropped by **myxomatosis** and the **Rabbit Haemorrhagic Disease** (RHD). These diseases affected the availability of prey for lynx.
- **The habitat loss:** Mediterranean shrubland. For the construction of infrastructure such as roads.



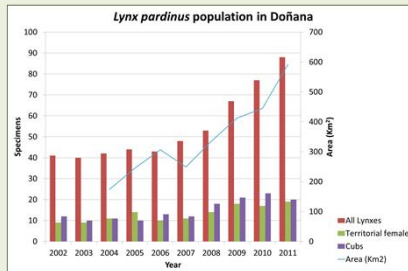
Myxoma virus



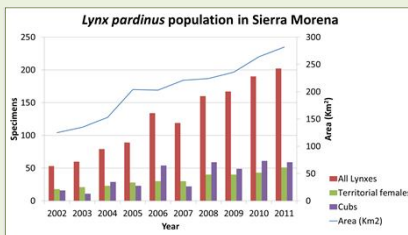
The Duke of Tarifa with a lynx caught in Doñana, in 1920

PRESENT

Currently, only remain two *Lynx pardinus* subpopulations, isolated in southern Spain. Censuses of lynx are taken annually by the Junta de Andalucía to know the state of populations and carry out an assessment of the conservation actions.

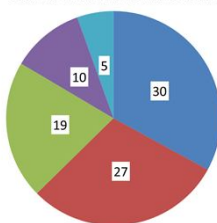


The Doñana is a metapopulation with several populated areas. These nucleus do not remain isolated, but there are movements among the nuclei. Comparing the area where Iberian lynx is, between 2004 and 2011, it has increased by 240%. The total population has increased by 115%, in territorial females by 111%, and in cubs by 67%.



Comparing the area where *Lynx pardinus* is in the Natural Park of Sierra Morena, between 2004 and 2011, it has increased by 84%, allowing the union of the two subpopulations. The total population has increased by 281%, territorial females, by 183% and the cubs, by 269%.

Causes of death between 2002 and 2012



The main cause of death in 10 years of *Lynx pardinus* has been run over on roads that go through National Parks (33%). There has been a clear reduction in mortality due to anything specific.

REINTRODUCTION AREAS

Following the guidelines of the IUCN, two areas were selected for the reintroduction of the Iberian lynx. Guadalmellato and Guarrizas were considered the most appropriate areas taking into account the variables related to the Lynx pardinus.

- Guadalmellato (Córdoba): in 2009 six pairs of *Lynx pardinus* were released, and in 2010 also 3 males and 2 females were released.
- Guarrizas (Jaén): two Iberian lynx cubs bred in captivity were released, as three specimens of the Sierra Morena.

OBJECTIVES

The objective of this study was to review the existence of the Iberian lynx since its speciation, its historical distribution, the causes of its decline and the current status of existing populations. The changes had also analyzed of survival of these populations nowadays and the possibility of reintroducing *Lynx pardinus* elsewhere into Iberian Peninsula. It is done to give a broad view of the critical situation of the Iberian lynx and the possible future that the species has at short, medium and long term.

FUTURE

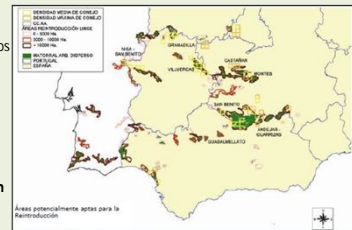
GENETIC VARIABILITY

In 2011, Ricardo Rodríguez extracted mtDNA fragments from Iberian lynxes from different parts of the Iberian Peninsula, covering a time period from the late Pleistocene in the twentieth century. Radiometric methods (^{14}C) indicate a lack of diversity of the mtDNA over time, with the same haplotypes observed in the sample for at least the last 50,000 years, and suggests an unusually low mutation rate, and it was not caused by demographic decline. The lack of genetic diversity indicates that it isn't a threat to the long-term viability of the Iberian lynx and should not prevent conservation activities.

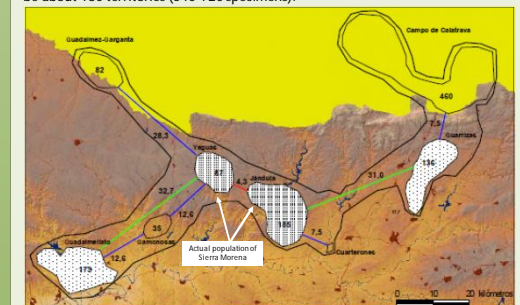
FUTURE POPULATIONS

J.M. Gil-Sánchez assessed the peninsula to select areas for the reintroduction of *Lynx pardinus*. We select the best areas in the landscape scale, with five key factors of suitable habitat:

- **Optimal habitat** (mediterranean shrubs with *Pinus* and *Quercus*)
- **Optimal food resources** (*O. cuniculus*)
- **The size of the area**
- **Legal protection**
- **The possible link with existing populations** through dispersal of individuals.



It is essential to recover previously Guadalmellato in order to obtain metapopulation cohesion of the population of Sierra Morena. The capacity would be about 180 territories (540-720 specimens).



Assessments of the viability of the Doñana metapopulation far indicates that under current demographic conditions, the probability of extinction in 100 years is very high mainly due to the small number of reproductive specimens, the spatial structure of the subpopulations, and the high mortality suffered during dispersal. As for the population of Sierra Morena, was determined to be able to survive, and has established itself as a source of individuals for lynx in Doñana and areas of potential reintroduction of new populations.

REDUCE THE MORTALITY

The National Commission for Protection of Nature applied several measures to reduce mortality in populations of *Lynx pardinus*:

- **Recover *Oryctolagus cuniculus* populations**
- Measures to **prevent the facing poaching, trapping methods not authorized or poisons**. Campaigns and environmental education.
- Should **not build new road infrastructure** in the areas of current and potential distribution of the lynx, and installing **wildlife crossing**.
- **Stop the elimination and fragmentation of the territory** of actual and potential lynx.



GLOBAL WARMING

Rabbits period depend on the production of grass there. If climate change shortens the rain and the reproduction, things will get worse. The biggest problem for the Iberian lynx would be the possible effects on the rabbit population. Loss environments such as woodland and scrub will make it harder dispersion lynx in establishing new populations or pairing.

CONCLUSIONS

Currently lynx populations increase because of the lack of genetic variability, which have not been an impediment to the existence of Iberian lynx and also due to efforts made in recent years. This means that populations of *Lynx pardinus* are insured in short-term. However, the lack of land, the absence of its main prey and human's pressure are not very encouraging in medium and long term. In addition, global warming affects the distribution territory of the Iberian lynx and the European rabbit, preventing further spread of the species. And even more directly to the people of Doñana by the geographical conditions of the land. This effect is difficult to avoid, and if humans do not reduce more pressures on populations and territories of the Iberian lynx, the future of *Lynx pardinus* seems to be destined to extinction.

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