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Abstract: The Iberian lynx is the most endangered feline on Earth, being the only species of this family classified by the IUCN as "critically endangered". Currently there are only two populations with verified reproduction, one in the area of the Doñana National Park and the other one in the Natural Parks of Andújar and Cardena Montoro (eastern Sierra Morena). It is estimated that fewer than 200 individuals survive. Historically this has been a globally rare specie because of its peninsular endemic nature, and its significant vulnerability derived from an absolute dependence on a single prey-specie, wild rabbit. Rabbit appears in between 85 and 99% of lynx scats, and the lynx requires at least 1 to 5 rabbits / hectare to settle down in a territory and breed. The decline of this specie is due to different causes, although human persecution has played a major part in this negative trend, as already pointed out by Ángel Cabrera at the turn of the 20th century and Jose Antonio Valverde in 1963. In fact, the last lynx populations detected in different areas with a high rabbit density in Sierra Morena and Montes de Toledo became extinct between the 80s and 90s of the 20th Century for this reason. The poor situation of this species already described in the mid 20th Century, was aggravated by the rabbit catastrophe of myxomatosis in the 50s. It is estimated that this viral disease wiped out 90% of rabbit numbers. And if this was not enough, in the early 90s, a new epidemic, the hemorrhagic-viral disease struck the already limited rabbit populations once more, severely aggravating the situation of the lynx. Another factor that favoured this regression was the loss of habitat, the Mediterranean mountain and scrubland, specially due to the expansion of agricultural and forest crops, the elimination of river vegetation and excessive clearings, essentially for cattle and farming purposes.



STATUS OF THE IBERIAN LYNX POPULATIONS IN ANDÚJAR-CARDEÑA AND DOÑANA

PROGRESS MADE IN CONSERVATION PROJECTS IN SITU SINCE THE I SEMINAR IN ANDÚJAR.

ISSUES, CHALLENGES AND FUTURE OF CURRENT CONSERVATION EFFORTS

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INTRODUCTION

The Iberian lynx is the most endangered feline on Earth, being the only species of this family classified by the IUCN as “critically endangered”. Currently there are only two populations with verified reproduction, one in the area of the Doñana National Park and the other one in the Natural Parks of Andújar and Cardena-Montoro (eastern Sierra Morena). It is estimated that fewer than 200 individuals survive. Historically this has been a globally rare species because of its peninsular endemic nature, and its significant vulnerability derived from an absolute dependence on a single prey-specie, wild rabbit. Rabbit appears in between 85 and 99% of lynx scats, and the lynx requires at least 1 to 5 rabbits / hectare to settle down in a territory and breed.

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In light of this bleak outlook, in 2001 the Environment Department of the Government of Andalusia, as the body in charge of the last Iberian lynx, began designing and executing a recovery programme for

the Iberian lynx. This programme was endorsed in the year 2002 by a Life-Nature Project (LIFE02NAT/E/8609): "Recovery of the Iberian lynx populations in Andalusia", of which the Environment Department is the beneficiary, partnering with the CBD-Habitat Foundation, APROCA, ATECA, the Andalusian Hunting Federation and Ecologists In Action. The MIMAN (national environmental agency) participates as a co-financing body through the CBD Foundation and several other organisations and institutions provide some sort of collaboration or support: IUCN, WWF, Radio Televisión Andaluza, EBD, Universidad de Córdoba and SECEM.

There is a description below of the development and preliminary results of the recovery programme, some of which were previously presented at the I Conference in Andújar. These will be the basis to inform of the problems encountered throughout the project, and what the challenges are for the future conservation of the Iberian lynx.

OBJETIVES

The conservation programme objectives established have been based on: (a) a detailed analysis of the situation and recent evolution of the species, (b) the reasons for this trend and biological limitations of such a peculiar specie (c) our own financial and technical limitations. Thus, the specific objectives were the following:

- 1 To establish precisely the situation of the lynx and to develop a monitoring programme.
- 2 To establish relations between private owners and the administration. This objective is essential as most lynx live on private lands.
- 3 To conserve current numbers and achieve a population increase through the creation of new breeding territories for each population located.
- 4 To establish the bases for future recovery projects of extinct populations.
- 5 To enhance and maximize the connection between populations.
- 6 To create a genetic reserve representative of the species
- 7 To increase social sensibility towards its conservation.

PLANNING AND ACTIONS

To achieve every one of the objectives a plan of action has been designed, with some actions subject to the finishing of others, although the urgency of the situation has generally forced us to carry them out simultaneously.

A LYNX AND RABBIT MONITORING

Methods

The current situation of the lynx had to be established, for which intensive field work was carried out. Firstly between 2001 and 2002 a probe of evidence in UTM 5x5 squares covering all potential zones in Andalusia was conducted. With the populations detected, in 2001 we simultaneously initiated (since this was known previously) a monitoring programme based on camera traps (at least a campaign per estate a year with 1 camera/1.5 Km. of sampled surface area - 288 photograph posts in total) and searching for evidence (scats in Sierra Morena and footprints in Doñana).

As rabbits are a key element for the recovery of the lynx, in 2002 a monitoring programme was initiated for the lynx populations. For this census of absolute abundance and relative abundance estimated were carried out by the counting of scats (1077 points in Doñana), counting of droppings in 2.5x2.5 km UTM grids (42 grids in Andújar-Cardeña) and IKAs on vehicles. The probes were undertaken at least twice a year, in June and October coinciding with the critical moments of the rabbit annual cycle (maximum and minimum respectively). Likewise, the field teams are watchful of any epidemiological event, specially of VHD (with probes of dead rabbits between February and April) and myxomatosis, with laboratory assistance provided by the University of Córdoba.

Results

The probe of 366 5x5 squares only rendered 55 positive ones, divided into 15 for S. Morena and 40 for Doñana. The population of Sierra Morena is divided into two cores (R. Yeguas and R. Jándula) separated by 5 Km. of an area with few rabbits but existing habitat. In Doñana, lynx are found in territories scattered among a big area, which would explain why there are fewer individuals despite its greater extension. The figures obtained from the continuous monitoring programmes of the lynx populations are the following:

| ANDÚJAR-CARDEÑA | Nº TERRITORIES WITH PRESENCE OF ADULTS | Nº TERRITORIES WITH REPRODUCTIVE FEMALES (litters controlled) | Nº ADULTS and SUBADULTS photoidentified | Nº CUBS |
|------------------------|--|---|---|---------|
| YEAR 2002 | 18 | 11 | 34 | 24 |
| YEAR 2003 | 20 | 8 | 41* | 15 |
| YEAR 2004 | 21 | 17 | 27 | 31 |

| DOÑANA | Nº TERRITORIES WITH PRESENCE OF ADULTS | Nº TERRITORIES WITH REPRODUCTIVE FEMALES (litters controlled) | Nº ADULTS and SUBADULTS photoidentified | Nº CUBS |
|---------------|--|---|---|---------|
| YEAR 2002 | 12-14 | 10 | 34 | 15-17 |
| YEAR 2003 | 12* | 7 | 41* | 12 |
| YEAR 2004 | 16 | 9 | 27 | 11** |

* Estimate of footprint census.

** 13 cubs born, although only 11 have survived.

In 2004, 80 lynx in Andújar-Cardeña and 38 in Doñana (118 in total) were identified with camera traps. As for the number of territories, the trend is slightly rising in Andújar and stable in Doñana. The total number of individuals is estimated at 50 for Doñana and 110 for

Andújar-Cardeña.

The rabbit population in Sierra Morena has followed a stable trend and even slightly rising in the valley of the river Yeguas. It appears that its recovery is conditioned by the regulation of the viral hemor-



Iberian lynx distribution in Andalusia. 2004

rhagic disease, occurring between February and April. In Doñana figures for 2001-2004 indicate a slight decrease, but any clear causes have been identified.

B AGREEMENTS

Methods

Relations between owners and the Administration have been formally established with the signing of collaboration agreements, starting in 2001.

Results

Currently, all estates where lynx are present and the surrounding ones are under an agreement. By organisations, the distribution of agreements is as follows:

- Junta de Andalucía (Regional Government of Andalusia): 77 agreements, 128,280 private hectares plus 3,334 hectares of public woodland
- National Park Administration: 10,000 hectares in Andújar plus Doñana National Park
- ADENA /WWF: 3 agreements, 5,756 hectares
- CBD Foundation: 14 agreements, 13,887 hectares



Collaborations
agreements distribution

C ACTIONS TO IMPROVE THE HABITAT

Methods

This comprises a block of actions aimed at achieving objectives 3 and 4. Above all they are targeted at increasing the rabbit population, for which the following has been undertaken:

- Leasing of rabbit hunting or establishment of reserve areas where no hunting is allowed.
- Creation of pastures for rabbits through clearings, fertilising and sowing (600 hectares in 2004). Clearings were conducted in areas with dense serial scrubland (eg. rockrose patches) and designed irregularly to favour the border effect.
- Creation of rabbit havens: artificial warrens (of five different types) and frameworks (accumulation of branches with pruning waste; 500 artificial warrens in 2004).
- Restocking of rabbits in country breeding enclosures of 1-7 hectares (150 enclosures in 2004). The site is selected by looking for areas with sufficient natural shelter (dense scrubland), pasture and land easily dug. Artificial warrens are placed within and these can be supported by the management of pastures and the creation of outside shel-

ters. The load released averages 25 rabbits /hectare. Rabbits are brought from high-density nearby populations, of the genetic type A, they are vaccinated against myxomatosis and VHD, and before being released are placed in quarantine.

- Rabbit restocking in fixed or temporary 100 m² enclosures (100 units in 2004). These are normally used as a backup for large enclosures. The average load released is of 8 rabbits /enclosure.
- Supplementary feeding with enclosures in territories with rabbit scarcity (10 units). This is undertaken in accordance to the guidelines of a protocol approved by the Work Group. With three objectives: to ensure reproduction, to fix individuals in adjacent zones to the sources and to decrease the risk of specific animals.
- Control of general predators (foxes and boars).
- Naturalisation of pine forests and prevention of forest fires.

These actions were carried out in two blocks. The first one corresponds to the current lynx territories that we estimate require intervention (all those in Doñana and approximately 50% in Sierra Morena). For each territory, limitations are established previously and based upon this, specific actions are planned, which include some of the measures outlined above.

The second block is related to the recovery of lost territories. In this case, Lynx Territory Recovery Units (URT) are set up, which are areas adjusted to the spatial needs of the lynx (about 500 hectares), where the objective is recovering a reproductive territory. These are basic management units to recover lost space, and are located in territories where the lynx was historically present, where there is currently little food and, therefore, adequate rabbit levels are to be achieved. Within each UTR rabbit restocking is carried out in country breeding enclosures, of about 5-6 (the number changes depending on the natural rabbit supply), and these may be backed up by 100m² enclosures; also habitat improvements are conducted related to the pastures and rabbit shelters. In Sierra Morena 14 URT have been established, 6 in R. Yeguas, 7 in R. Jándula and 1 in the area between. It is estimated



Management habitat in Doñana area

that this population lost about 15-20 territories after the outbreak of VHD in the early 90s, so that initially the number of URT is adequate, although it should be noticed that in the area between the two population cores the amount of actions conducted are clearly insufficient. This is especially serious if we take into account that to recover this population it is essential to join both cores, divided in the early 90s, after the outbreak of VHD.

Another measure targeted, specially to the lynx of Doñana, is the creation of artificial shelters for the reproduction of lynx.

Results

Information related to results is provisional for obvious reasons, however some data can be advanced:

- Leasing of rabbit hunting or establishment of reserve zones where no hunting is allowed: an estate in Andújar has been controlled and there are significantly more rabbits than when hunting was previously allowed without leasing arrangements.
- Creation of pastures for rabbits through clearings, fertili-

sing and sowing: results are very irregular depending on the zone controlled; however they have been very useful to create a good climate with hunting managers, since pasture is mutually beneficial for both parties.

- Creation of rabbit havens: results in general have been good with regard to their occupation by wild rabbits; we still need to evaluate the effect on the size of the population.
- Restocking of rabbits in country breeding enclosures: in general in a short-term small high-density nuclei of rabbit are appearing, and these are frequently used by lynx and therefore, although these should be managed through restocking, they seem to be a useful tool (see URT results)
- Rabbit restocking in fixed or temporary 100 m² enclosures: fixed enclosures have led to self-sufficient warrens, at least in a short-term (1-2 years). Mobile enclosures have had more irregular results, although for the time being they are working well in Doñana.



Management habitat in Sierra Morena, Andújar-Cardena area

- Supplementary feeding: in Sierra Morena three females with initial litters of 2, 3, and 4 cubs, benefited from a supplementary feeding programme in 2004. In all cases the cubs have reached almost 7 months, an exceptional figure for lynx in the case of triple and quadruple litters. Females with 3 cubs are subjected to continuous supplementary feeding since 2003: in 2001 and 2002 no cubs were delivered and between 2003 and 2004 two litters with 2 and 3 cubs were delivered. Two of the 2004 cubs with SF have been removed for the genetic reserve. In Doñana supplementary feeding is monitored by the EBD in two territories of the Biological Reserve.
- Naturalisation of pine forests and prevention of forest fires: it is assumed that results as a preventive method must be optimum (three outbreaks were quickly put out in Andújar).
- Artificial shelters of Doñana: no preliminary results.

Regarding the URT, lynx are using the enclosures of 7 of the 14 installed in S. Morena, and although it is still too soon to consider them recovered territories, preliminary results are most promising.

D GENETIC RESERVE

Methods

The maintenance of the Iberian lynx genetic reserve is an essential measure for the conservation of the species, specially if we consider the significant vulnerability of the two surviving wild populations. For this, individuals are removed annually and sent to captive breeding centres (Acebuche, Jerez Zoo and shortly La Aliseda). The guidelines followed are those of a study on the impact of the extraction of individuals from the donor population, done by the EBD at the Junta de Andalucía's request. Captures are normally conducted by extracting cubs from triple or quadruple litters, or with trapping of youths in autumn. Some individuals were captured for incidental reasons (eg. wounded) and an adult male in Sierra Morena was specifically removed from the wild for the breeding programme.

Results

The following table summarises the captures conducted for the genetic reserve. Since 2001 a total of 12 lynx have been captured, 3 in Doñana and the rest in Andújar. With the female there was already in the Acebuche Centre (coming from Andújar), this means 8 females and 5 males.

| ORIGIN | SEX | YEAR CAPTURED | AGE | CAPTURED |
|----------------------|--------|---------------|--------|-----------------|
| Encinarejo (Andújar) | female | 1990 | 14 | Private |
| Doñana | female | 2001 | 3 | EDB |
| Encinarejo (Andújar) | female | 2002 | 2 | Junta Andalucía |
| Doñana | female | 2002 | 2 | EBD |
| Encinarejo (Andújar) | male | 2003 | 3 | Junta Andalucía |
| Encinarejo (Andújar) | male | 2003 | ¿?(4) | Junta Andalucía |
| Encinarejo (Andújar) | male | 2003 | 1 | Junta Andalucía |
| Encinarejo (Andújar) | male | 2003 | ¿? (5) | F CBD |
| Yeguas (Andújar) | female | 2004 | 1 | Junta Andalucía |
| Yeguas (Andújar) | female | 2004 | 1 | Junta Andalucía |
| Encinarejo (Andújar) | female | 2004 | 1 | Junta Andalucía |
| Doñana | male | 2004 | 1 | Junta Andalucía |
| Encinarejo (Andújar) | female | 2004 | 1 | Junta Andalucía |

E MORTALITY CAUSES' DECREASE

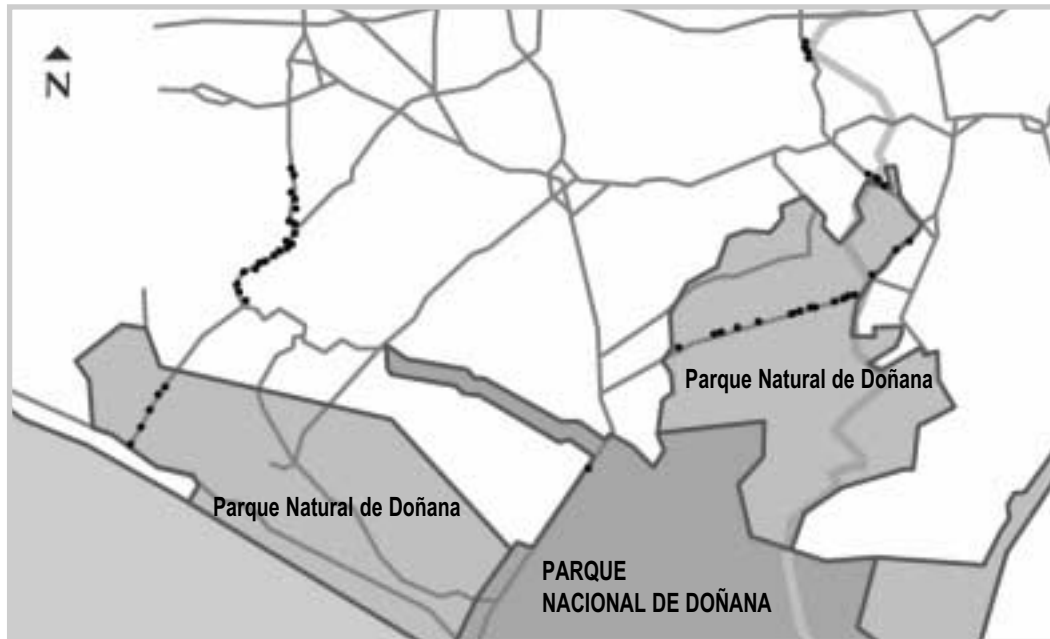
Methods

We try to decrease or eliminate the causes of unnatural mortality, for which we will carry out the following actions:

- Permanent control of poaching (snares, traps) in collaboration with police forces.
- Management of wounded individuals.
- Signalling and improvement of roads.
- Inventory and correction of dangerous wells (61 units).
- Veterinary control and screening of diseases on other mammals, to prevent diseases.

One of the major causes of unnatural death of lynx is being run over, specially in Doñana, which is why special attention has been devoted to this. The measures taken are:

- Signalling of areas of frequent lynx crossing.
- Building of speed bumps.
- Building of exclusion fences and associated fauna crossings.
- Longitudinal scrubland clearings, to improve visibility and eliminate dangerous shelters



Activities for mortality reduction make in road of Doñana area

Results

Poaching has traditionally been very detrimental for the lynx in the surroundings of Andújar. In this area two lynx were lost between 2001 and 2003 for this reason (trap and gunshot). In 2004, after hiring permanent guards, no more cases have been recorded, and a notable decrease in the use of illegal methods (snares and traps) has been observed, these being reduced to practically isolated cases connected to rabbit and boar poaching. In the most difficult areas of Doñana, the poaching of lynx also appears to have decreased. In fact, most current reproduction territories are located in areas previously considered as drains.

Since 2001, five wounded individuals have been handled in Sierra Morena, three due to fights with other lynx and two due to wounds from a trap and a snare, respectively. The first three are currently part of the genetic reserve, and the other two died.

It is difficult to evaluate the effect of the measures to prevent animals being run over. In Sierra Morena these accidents are not frequent, with three cases between 2001 and 2003, before signalling was installed on the roads and longitudinal clearings were carried out. Later in 2004 there have been no animals run over, although it is not possi-

ble to credit the prevention programme entirely for this. In Doñana since 2001, 7 lynx have been run over, although the rate of accidents seems to have decreased in the last two years on the roads managed under the prevention programme.

With regards to wells, no deaths have been recorded for this reason. Veterinary control for the time being has not provided any relevant results for the conservation of the lynx, which is good news.

F ANALYSIS OF ADEQUATE HABITATS FOR THE LYNX

Methods

Evidently the future of the Iberian lynx cannot rely on two small, unconnected populations. Therefore it is essential to initiate management programmes of adequate areas, to increase the number of populations through reintroductions. For this, a lynx habitat analysis has been carried out, with a method of evaluation based on multiple criteria, integrated in a geographical information system. The phases of the processes have been:

- A Identification of suitability factors for accommodating lynx.
- B Gathering information on these factors.
- C Integration of the information in a S.I.G. and multiple criteria evaluation.

uation.

- D Evaluation of the two resulting models: on the field assessment of rabbit supply, with a probing of droppings in UTM 2.5x2.5 Km grids.

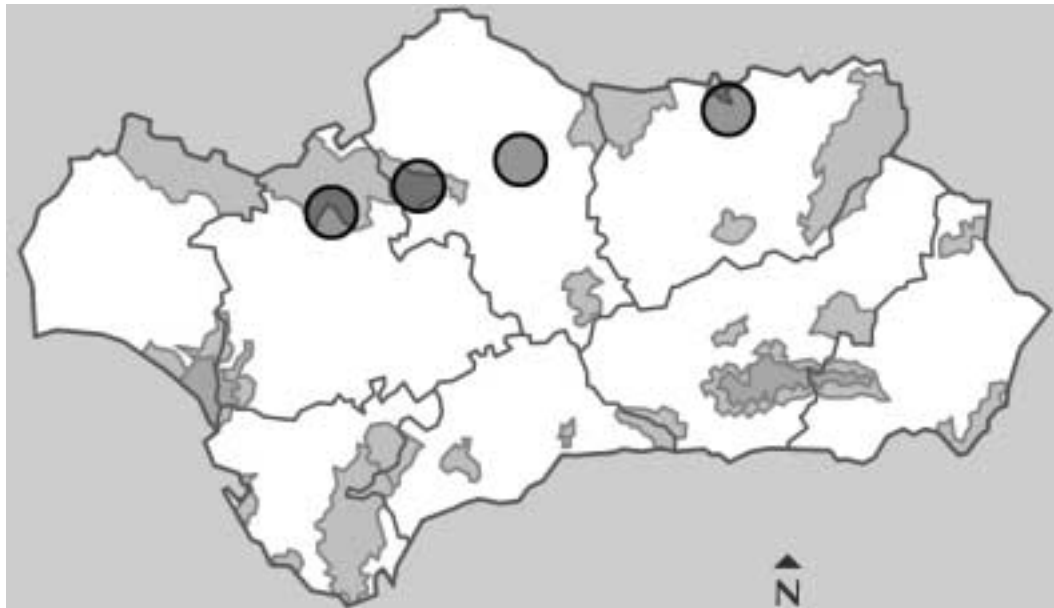
Results

The multiple criteria analysis has selected six potentially adequate areas included in Natural Parks and LIC., distributed along Sierra Morena from Huelva to Jaén. On the other hand, preliminary field work has allowed limiting the selection to four of them, with adequate rabbit populations to undertake a viable reintroduction programme.

G PUBLIC AWARENESS AND COMMUNICATIONS

The environmental education programme has significant impact on the Iberian lynx conservation project. The actions undertaken are the following:

- 1 General awareness campaign on the situation of the specie:
 - Travelling exhibit, with information panels
 - Media coverage (specially audiovisual).
 - Communications with specific materials (10000 leaflets, 7000 posters, 5000 pins and 5000 stickers).



Possible area
for reintroduction

- Contests aimed at school children (171 activities in educational centres and 34 awards in 2003/04).
- 2** Awareness campaign on responsible hunting.
- Information and communication activities
 - Awareness “In situ”.
 - Management manual (in development).
 - System of public reward and recognition for lynx conservation.
- 3** Communication, awareness and participation events with other administrations and regional governments: ANDALUSIAN PACT FOR THE IBERIAN LYNX:
- Signees of the pact: Government Council of the Junta de Andalucía; delegating in the departments of Agriculture, Public Works, Innovation, Science and Business, and Environment.
 - Commitments:
 - To establish partnerships between administrations, society and private parties to ensure the survival of the lynx.
 - Provide financial, social and institutional support to all actions aimed at making the conservation of this species possible.
 - Join the efforts of all administrations, society and private parties.
 - 50,000 signatures have been obtained to date.
- 4** Maintenance of a Web site and production and publication of a newsletter on the project.

CONCLUSIONS

- The Life Nature project includes all stakeholders.
- Hunting associations and private owners have joined the project through agreements.
- Habitat improvements are beginning to bear fruit.

Can we stop the lynx from being in “critical danger of extinction”? Yes, but:

- We must enhance coordination...
- We must work more to control threats: animals run over, shot...
- It is necessary to create new population nuclei: reintroduction
- It is necessary to exchange individuals: translocation
- Rabbit diseases are not controlled: VHD
- There is not an efficient rabbit restocking method to ensure an increase of their populations in large surfaces.