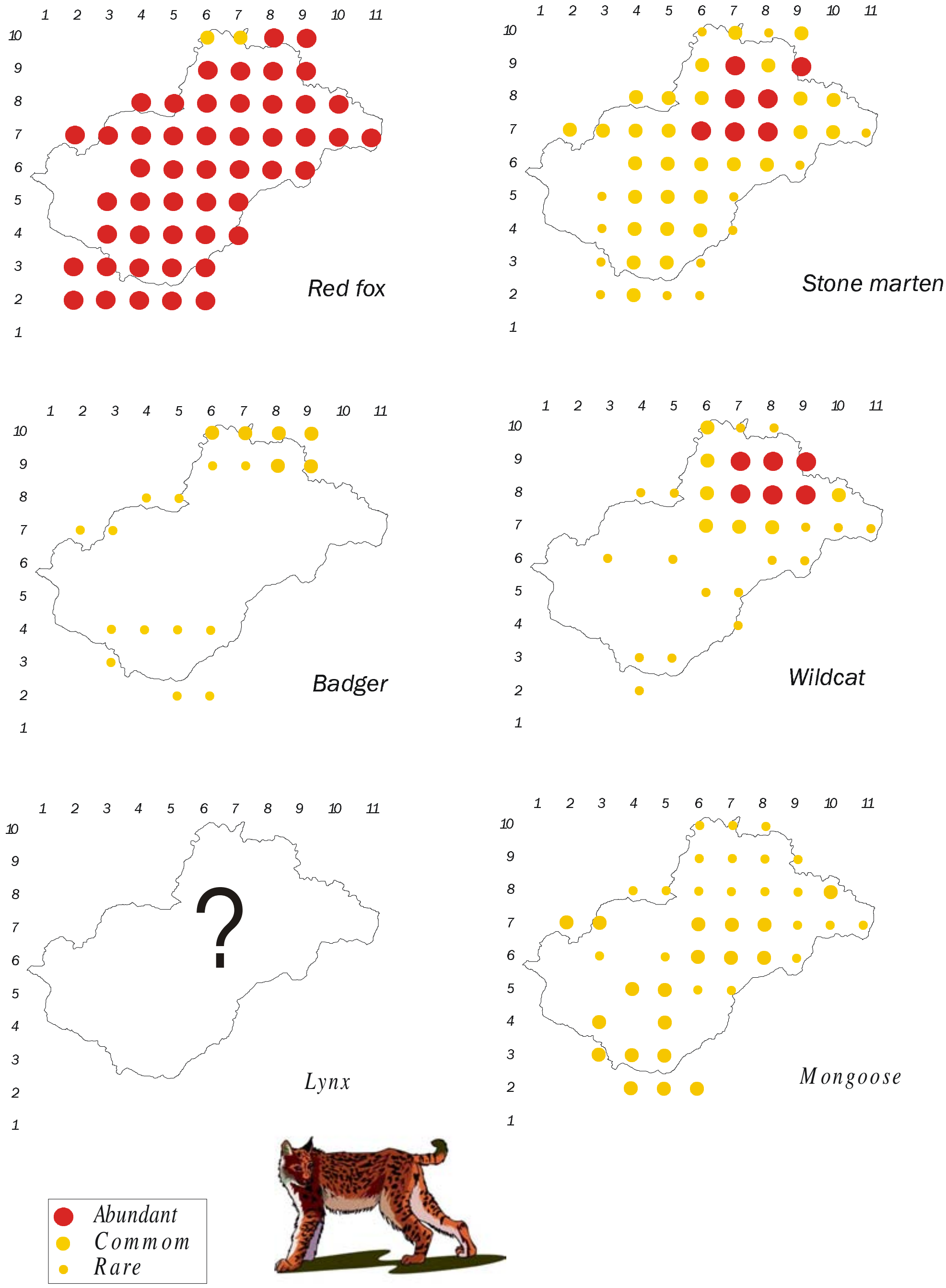

Figure 16 – Spatial distribution and abundance of Malcata carnivores.

The species reaches higher densities in the central parts of the Nature Reserve which are dominated by intensive pine plantations and scrubs. This fact can be related with the low habitat quality which prevents higher densities of other carnivores and so reduces competition. Is a confirmed fact that this canid reaches higher densities in areas were ecological diversity is lower (Casanovas & Virgós, 1993). The generalist habits of the red fox, allow that this species can be present in an wide spectrum of habitats and consuming different types of preys. Villafuerte (1994) demonstrated that the fox can produce a significant predatory impact on rabbit populations, not only because it can consume all the age classes, but also because presents high predation rates upon juveniles, what can reduce the reproductive potential of the species.

According to Loyd (1980), maximum estimated density of foxes in optimal environments are about 3.3 individuals per km^2. The obtained data, with camera trapping, allow us to conclude that the estimated red fox population levels in Malcata are significantly above what can be considered an abnormal density for Mediterranean environments (Palomares *et al.*, 1995). If we analyse the potential impact of foxes upon rabbit populations, we verify that annually one fox consumes, in average, 71 rabbits and that the impact on the entire rabbit population is the consumption of 5624 rabbits, which corresponds to 0.03 consumed rabbits per hectare. In terms of management implications we can assume that fox numbers do not justify any measure of control, since the density of the species is not high and predatory impact upon rabbits is low.

Wildcat

The wildcat is present in about 50% of the area, being more heavily concentrated in the north part, due to habitat characteristic and small mammals abundance. During our camera-trapping survey we were unable to detected wildcats since it was not possible to concentrate cameras in the high density areas, due to human presence. Using the McLellan (1998) method, which relates the proportion of home ranges inside a trapping polygon, we estimated an average density of 0.16 cats per km^2, occupying an area of about 100 km^2, which corresponds to a population of 16 cats.

Previous studies on the impact of this species upon rabbit populations assumed that the entire wildcat population of Malcata is responsible for preying 4450 rabbits/year, which corresponds to 0.02 consumed rabbits per hectare.

According to Stahl (1991), wildcat density varies from 0.30 to 4.50 cats/km2. Comparing this data to Malcata, we can see that the density and population levels are low, although the wildcat detection level as increased in the last years.

Mongoose

The Egyptian mongoose, a potential predator of lagomorphs, is a common species on the Nature Reserve, being detected in a total 78% of the sampled 2x2 km UTM squares. The northern range of its geographic distribution matches the mountainous area of Malcata-Gata, which is probably the main reason for the species higher abundance in the central and southern range of Malcata.

Several authors assume that the Iberian lynx disappearance in a natural community can provoke the increase of generalist predators population levels, that will augment the predatory pressure upon rabbits, which will conduct to a decrease of this lagomorph (Raú *et al.*, 1985, Palomares *et al.*, 1995). There are strong evidences that areas with high densities of generalist predators do not support resident lynxes (Guzmán *et al.*, 2002).

Iberian lynx

Malcata has been pointed out as a lynx occurrence area since the 19th century (Lopes, 1899). The 1998 census (Ceia *et al*., 1998) classified this territory with high importance for lynx conservation, being estimated a Portuguese sub-population of 7 to 9 animals, which occupied approximately 450 km^2 (medium density of 1.8 lynxes/100 km^2). According to Delibes *et al.* (2000) this sub-population was integrated in the Gata-Malcata-San Pedro-S. Mamede meta-population, composed by 75 to 95 individuals distributed throughout 2 050 km^2. Bessa-Gomes (2000), in her viability analysis of lynx Portuguese populations, stated that although Malcata had low lynx effectives, this population could persist as a sink of nearest Spanish nucleus, even considering the most pessimists scenarios.

Despite the relative optimistically perspective pointed above, several studies, conducting since the mid-1990s, described an incompatible situation with previous described data (Sarmento & Cruz, 1998; Eira, 1999; Sarmento *el al.*, 2001). The species is not detected, with reliable methods, since 1997 and in Spain the most recent data describes a possible extinction of historical lynx nucleus of Sierra da Gata and Hurdes (Guzmán *et al.*, 2002). During the time frame of the project we were unable to detect any reliable proof of lynx existence, only sighting data was obtained with a total of seven probable observations collected.

Table 7 – Data obtained with the application of mammalian carnivore population surveying methods. STI – snow tracking abundance index (number of individuals foot-prints per km); LTI – Line transect abundance index; NSC –total number of collected scats; NSQ – number of squares were the species was detected; %SQ – percentage of squares were the species was detected; NC/100 n-c - number of individualised carnivores per 100 days-cameras; NPS – number of positive stations; %NPS – percentage of positive stations; NC – total number of captures; NR – total number o re-captures; NC/100 t.n – number of captures per 100 trap-nights; NVHS/100 t-n- number of visits to hair snare stations per 100 trap-nights. – snow tracking; – line transects; - camera-trapping; - box-trapping; - Hair snares

	Mm	Mf	Vv	Lp	Fs	Gg	Hi	Total effort
STI (n/km)	0.01	0.07	0.85	0.00	0.03	0.01	0.02	125 km
LTI (n/km)	0.16	0.53	7.49	0.00	0.60		0.52	416 km
NSC	67	220	3114	0	247		215	416 km
NSQ	19	42	52	0	30		41	52 squares
%SQ	36.54	80.77	100	0	57.69	0	78.85	
nv/100 n-c	0	0.48	1.17	0	0	0.62	0.76	1455 n-c
NPS								
% NPS								
NC	0	9	4	0	3	5	10	2861 t-n
NR	0	4	5	0	0	0	0	2861 t-n
NC/100 t-n	0.00	0.34	0.15	0.00	0.11	0.19	0.34	2861 t-n
NVHS/100 t.n	-							1350 t-n

Analysis on the lynx information and its evolution (1992-2001)

In order to analyse the temporal evolution of the Iberian lynx status, we compiled the available information of the last 12 years and applied a credibility index to it. A credibility level, varying between 0 and 10, was applied to each data type according to the collected information (Table 8). At the same time, a probability index, representing the probability of the species presence in the study area, was associated. This factor only reflects the lynx probability associated to the most credible data, and does not depend on the quantitative information level collected. So, it cannot be assumed as a density-dependent factor as it only reflects the probability of lynx existence in the area.

The credibility levels of each collected data were added for each year. The annual lynx occurrence probability was calculated by averaging the probability of each year with the previous one, in order to analyse the influence of past data on the current probability of occurrence. If, in a given year, a maximum probability was obtained, this value was assumed as the probability of occurrence for that year and the mean with the previous year was not calculated.

We analysed the data collected since 1992, using the studies of the current project and the data from Castro (1992), Castro & Palma (1994), Sarmento & Cruz (1998) and Eira (1999) (Table 8 and Figure 16).

Table 8 – Iberian lynx presence collected data types and respective credibility coefficient and probability of occurrence.

	Data type	Credibility level	Probability of occurrence
Capture	Direct proof	10	100%
Photography	Direct proof	10	100%
Confirmed observation	Direct/Indirect proof	10/9.5	100/95%
Probable observation	Indirect proof	0.05	5%
Doubtful observation	Indirect proof	0.025	2.5%
Scat confirmed by DNA analysis	Indirect proof	9.5	95%
Scat identify by visual analysis	Indirect proof	0.025	2.5%
Foot print	Indirect proof	2.5	25%

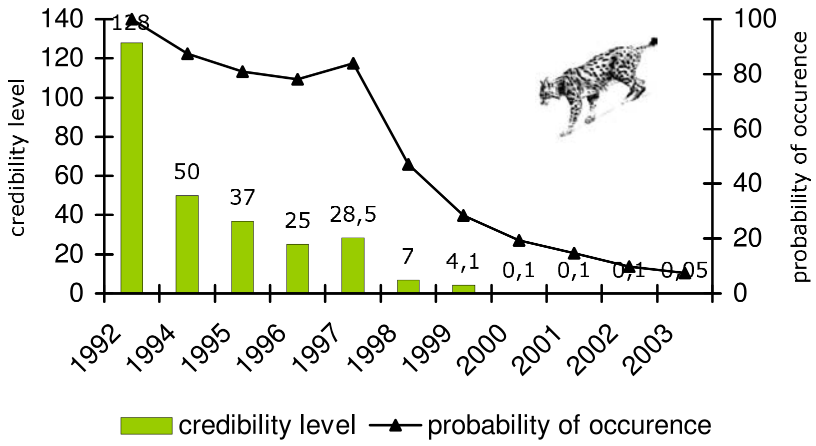

Figure 16 – Annual variation, since 1992, of credibility level of collected data on the presence of the Iberian lynx and respective probability of occurrence**.**

One verifies a pronounced decrease in the credibility level of the collected information since 1992, with significant low levels being reached in the last years (Figure 16). The last direct proof of maximum credibility was obtained in 1992 and corresponds to a capture of an adult female (Castro 1992). The last lynx scats, confirmed by DNA analysis, were obtained in 1997 and since then the credibility level decreased profoundly (Figure 16).

Over the last years, the lynx probability of occurrence dropped drastically and, in 2003, the lowest value of 7.40 % was obtained, which points towards a high probability of absence of the Iberian lynx from the study area.

3.4.1.2 Changes on Habitat suitability

In this study, we developed a rule-based Habitat Suitability Model for Iberian lynx which synthesize current knowledge about the species and predict the distribution of its potential habitat. We then applied this model within a geographic information system (GIS) and addressed the following questions related to conservation planning for the Iberian lynx in Malcata: (1) What is the extent and arrangement of potentially suitable habitat for lynxes in

Malcata? (2) Are potential habitat patches connected to one another? (3) Are there barriers separating potential habitat locations? and (4) Did the project contributed for restoring habitats in order to make possible applying a lynx reintroduction program?

Habitat requirements

The rules applied to our model were based on current knowledge of the species' biology, especially in Doñana, with information derived from telemetry studies (Palomares et al, 1999; Palomares, 2001; Palomares at al., 2001).

An average home range of the adult lynx in Doñana has ideal 40% cover of understorey vegetation and should have the presence of isolated trees (Palomares, 2001). Rabbits should also be abundant, with densities of a minimum 4.6 rabbits per hectare in spring (lynx reproduction season) and about 1.0 rabbits per hectare in autumn.

The minimum space requirements of a viable lynx (or other feline) population are unknown. If we estimate the minimum viable population size to be at least 20 resident adult lynxes and assuming a density of 1 adult lynx per 10 km^2 (medium home-range size), 20 resident lynx would require ;200 km^2. Therefore, we estimate that a functionally connected patch of suitable habitat of 200 km^2 could sustain a viable lynx population. This estimated area is roughly higher than the Malcata Nature Reserve what will force to work in adjacent areas in order to achieve a large enough area for a viable population.

According to Palomares *et al.* (1999) several habitat types are suitable for lynx dispersion, namely: 1) Mediterranean scrubland, 2) eucalyptus plantations and 3) pine plantations. Other sorts of habitat such as open areas with no vegetation, crop fields or olive trees landscapes, could constitute a barrier depending on its extension. However in this last case, it was possible to verify that areas with extensions less than 5 km, between suitable patches could be used by lynxes, and, in one case, an animal crossed a theoretical barrier with, approximately 16 km of extension. Based on this information Palomares *et al.* (1999) gave the following definition for a lynx dispersing habitat:

1- Areas covered by Mediterranean scrubland or by industrial plantations are suitable for lynx dispersion;
2- Areas of open habitat of less than 5 km of extension, between suitable areas, could be used for dispersion;
3- Areas between 5 to 16 km of extension, could be crossed, although with difficulty and potential risks;
4- Areas with more than 16 km of extension are considered impenetrable barriers.

The Habitat model

We used GIS rule based habitat suitability model to determine the location and size of suitable lynx habitat. Patches of suitable habitat were identified using set of rules that describe lynx habitat preferences n relation to the shape and structure of different habitat types derived from a GIS database.

Habitat preference information was summarized into the following rules:

Rule 1: Cover habitat.—we defined an optimal cover habitat at 40% of understory cover;

***Rule 2: Hunting habitat*.—**we defined an optimal hunting habitat at 60% of open areas.

Rule 3: Minimum patch size.—A patch of suitable habitat should allow females and males to establish a home range. Because home ranges of males and females overlap, minimum patch size was determined by the spatial needs of a male (10 km^2).

***Rule 4: Core areas*.—**A home range should include at least one nonfragmented scrubland patch of more 300 m in any of their main axes.

***Rule 5: Rabbit density*.—**A home range should comprise an optimal density of 4.6 rabbits per hectare during spring and 1.0 rabbits per hectare during autumn.

Corridors and barriers were not considered in the model, since Malcata habitat patches are extremely homogeneous and according to the definitions of Palomares (1999) there are no significant barriers.

The model was developed using the MF works software package and it was applied in a pre-project and post-project situation.

Results

From the analysis of Figure 17 is possible to observed an increase on habitat suitability for lynx during the project time frame. In 1999 medium HIS was estimated in 0.11.and by the end of the project this value increased considerably reaching a value of 0.31. This increase, specially noted on the target intervention areas, was due to the increase on rabbit density and the augment of open areas, that, by generating a mosaic landscape, favoured lynx by providing potential hunting areas. For 2003, we estimated that lynxes could occupy a total area of 3 525 hectares and reproduction could occur in 13% of this area (1966 hectares). We estimated the final carrying capacity of Serra da Malcata in 4 adult individuals, what emphasises the need of the continuation and amplification of the management actions.

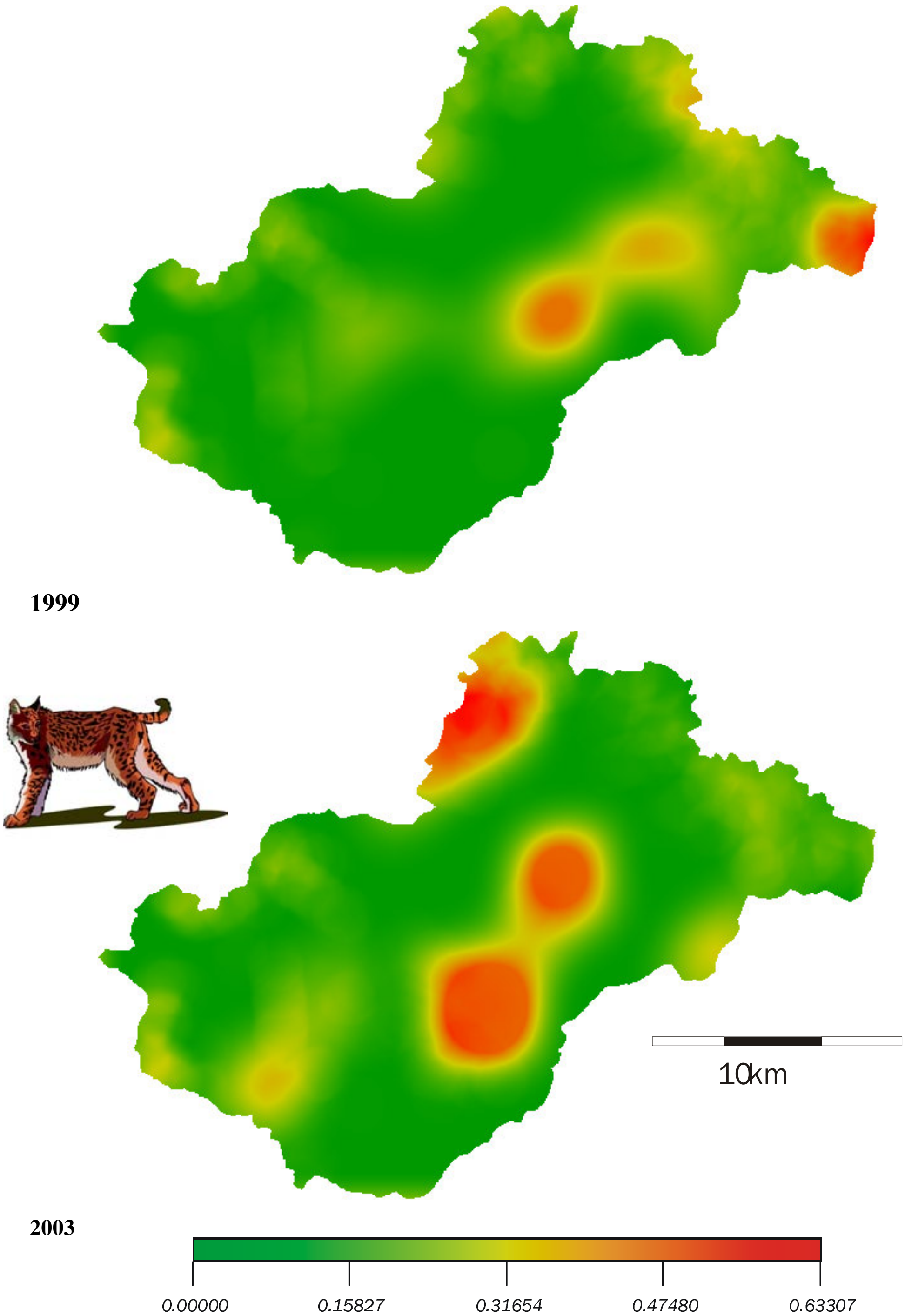

Figure 17 – Evolution of Habitat suitability for lynx from 1999 to 2003.

3.4.2 Study of ecological parameters of rabbit populations

3.4.2.1 Abundance and spatial distribution

One of the main restrictions to the lynx recovery process is the low abundance of preys, specially of rabbits (Rodriguez & Delibes 1990). In order to properly evaluate the effects of the project actions upon rabbit density, we developed a method to analyse the availability of this species.

Methodology

Rabbit abundance was estimated by sampling latrines in 1 km line transect carried out in 2x2 km UTM squares, and applying the results in a exponential equation we determined the number of animals per hectare. The latrines found were divided into three groups classified according to the numbers of pellets in the latrines.
The data obtained is converted in an abundance index (Sarmento & Cruz, 1998) :

$$IA = \frac{12.1\ NI + 5.1NII + NIII}{EP}$$

Being: NI – number of latrines of type I; NII – number of latrines of type II; NIII – number of latrines of type III; EP – covered space (km)

Afterwards, the following formula is applied to the data obtained and the number of animals per hectare is obtained:

$$\text{Density (rabbits/ha)} = -3.76 + 3.918 \log (IA)$$
$$r^2 = 0.84;\ p<0.005$$

Results and Discussion

The results obtained during the project four-year period (summer 1999 till summer 2003), are represented in Figure 18. We can observe that the distribution of this prey species is patchy and in some areas rabbit was absent during the entire project but in certain areas, mainly in the centre of Serra da Malcata, the density was high.

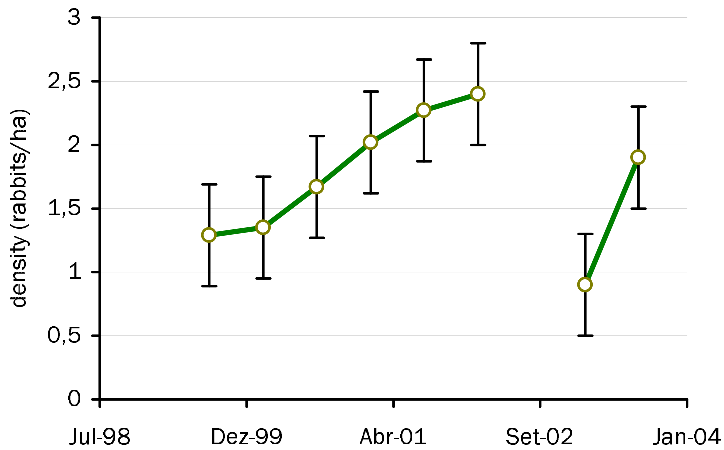

Figure 18 – Variation of the estimated rabbit density in the total Malcata area.

During the monitoring period, the medium rabbit density oscillated between 0.62 (Winter 2003) and 1.91 animals per hectare (winter of 2002). These values are very low and are not sufficient to maintain a viable lynx population. The number of squares UTM 2x2 km, with a density above 5 rabbits/hectare can vary from 1 in winter of 2003 and 7 in winter of 2002 (Figure 19). These differences are hard to explain since the number of squares with higher values increase since the beginning of the project till Winter 2002 and then the decrease is very pronounced (Winter 2003) and it seems the rabbit population is recuperating, but to levels that are not yet acceptable for the Iberian lynx reproduction (Figure 19). The rabbit hemorrhagic disease could be one possible explanation for this decrease. When rabbits reaches certain densities the disease outbreaks can cause high mortality and it may be responsible for the low numbers presently.

The management of the rabbit population is essential to maintain a viable population of Iberian lynx, therefore, we will present the results of the actions to increase that lagomorph population.

In the Figure 20 one can see the positive effect of the management actions in the rabbit population. The actions that were carried out before the beginning of this LIFE project are taken into consideration to better understand the effects. In Summer 1996, we began with a density of 2.70 individuals per hectare which increased till Winter 2002, with values of 7.38 animals per hectare. In the Winter of 2003, the lagomorph density was very low as explained before, despite that fact the season afterwards already shows a recovery of the density reaching 5.13 rabbits per hectare.

The management actions consisted in the opening of 87 hectares of pastures, implantation of 95 artificial warrens for rabbits and 9 restocking operations.

When we compare these results to the ones obtained in an area with the same vegetation characteristics and the same initial rabbit density, is possible to observe that the number of animals per hectare did not change significantly (Figure 21). The values are always below the three animals per hectare. As observed in Doñana National Park (Moreno & Vilafuerte, 1992), the application of management actions is correlated to the increase of rabbit density.

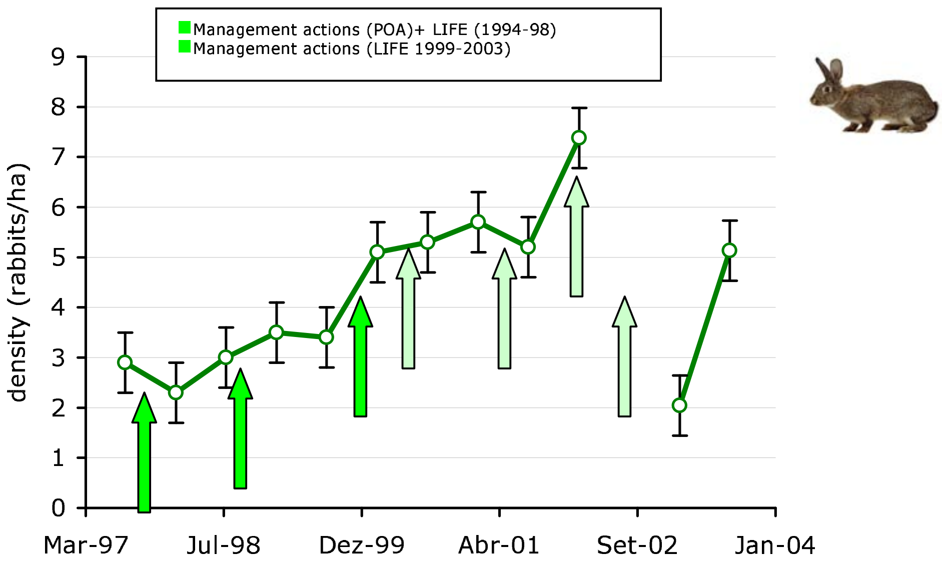

Figure 20 – Rabbit density variation, estimated by latrine counting, in the areas submitted to habitat management actions.

Conclusions

From the gathered data, there are some observations to be taken:

1. Serra da Malcata rabbit populations has a patchy distribution and their mean density is very low;
2. This distribution patchiness can be explained due to environment factors and/or disease outbreaks;
3. The density difference between the management areas and the control areas show clearly the importance of the application of management actions;
4. It is obvious the importance of proceeding with these management actions and applying them to a larger scale.

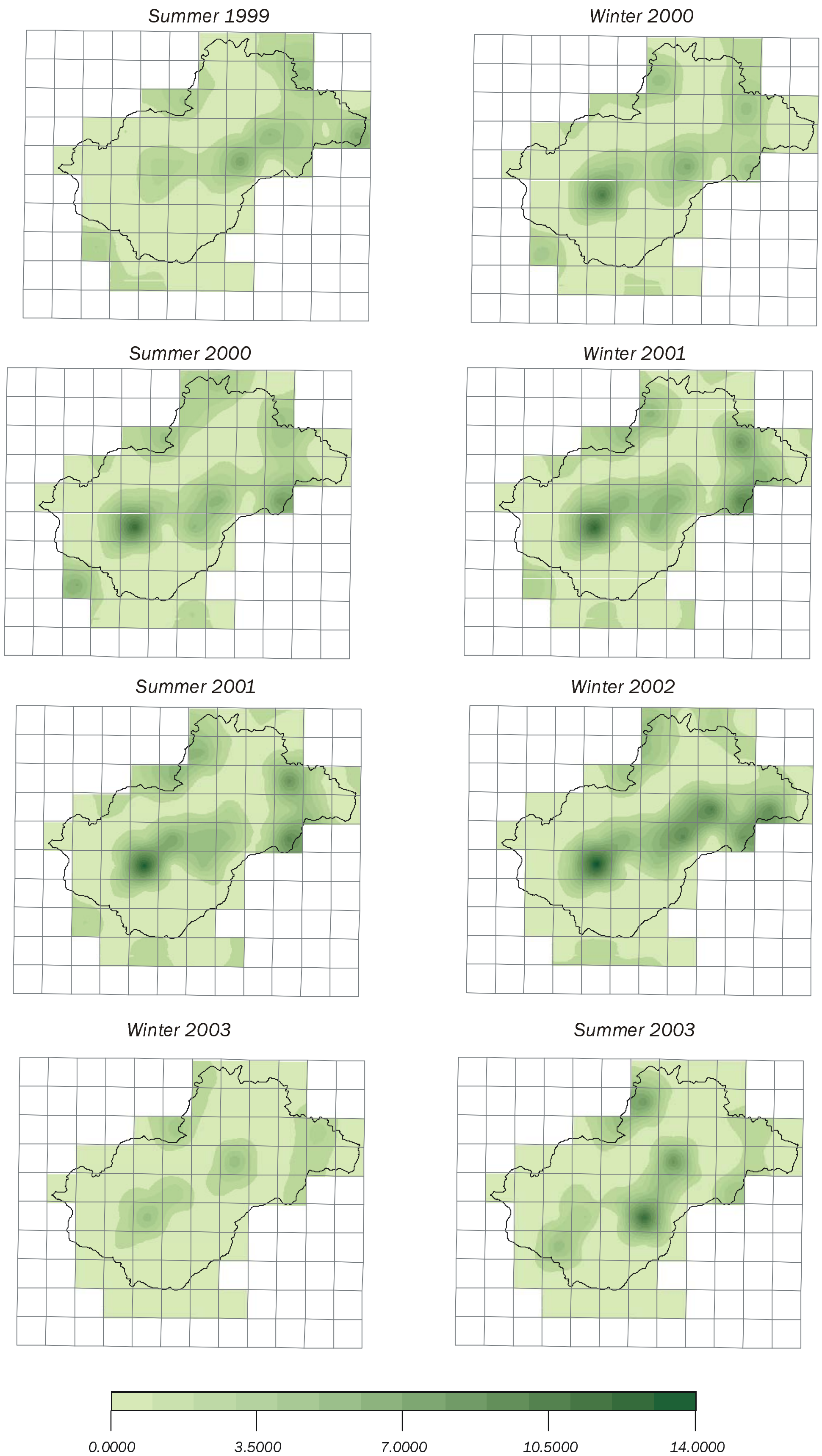

Figure 19 – Temporal variation, from summer 1999 to winter 2003, determined by the Kriging, method (Krige, 1981) of the rabbit density in Serra da Malcata (map divided in 2x2 km UTM squares).

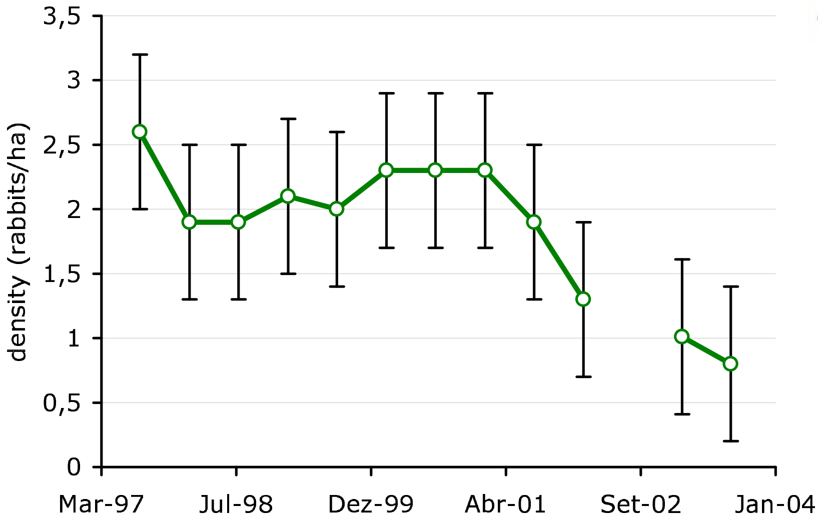

Figure 21 – Rabbit density variation, estimated by latrine counting, in the control areas.

3.4.2.2 Influence of the pastures parameters upon rabbit density and distribution

We performed an evaluation of the pastures parameters in order to determine their influence in the rabbit density and spatial distribution. The sampled variables are described in Tables 9 and 10.

Methodology

Thirty-two pastures, located in Concelhos, and 10 pastures, located in Ventosa, were chosen to evaluate their quality and relate it to the rabbit distribution.

Table 9 - Pastures parameters analysed to evaluate their influence upon rabbit distribution.

Variable	Description	Units
Total Area	Quantification with GPS (Garmin® 12) programmed to take readings every 2 seconds	m^2
Perimeter	Quantification with GPS (Garmin® 12) programmed to take readings every 2 seconds	m
Length	Quantification with GPS (Garmin® 12)	m
Width	Quantification with GPS (Garmin® 12)	m
Slope	Divided into classes	
Orientation	Orientation according to cardinal points	See table 10
Presence and use of rabbit artificial warrens	Presence and number of active warrens	See table 10
Productivity	Squares of 900 cm^2 taken randomly (n = 4/pastures)	g/m^2
Rabbit Density	Number of latrines by the pastures edge	See table 10

The field work was carried out in Spring 2000, since this period corresponds to the maximum food availability and highest rabbit density. Statistical analysis were applied in order to discriminate what pastures variables influence rabbit density.

Table 10 - Classes of sampled variables

Classes	Slope	Presence of rabbit artificial warren	Orientation	Rabbit Presence (number of latrines)
0	-	Lacking	-	0 (lacking)
1	Plane	Present	N	1-3 (rare)
2	Low sloping		NE	4-7 (common)
3	High sloping		E	8-22 (very common)
4			SE	
5			S	
6			SW	
7			W	
8			NW	

Results and Discussion

From the nine analysed variables, four were considered to significantly influence the rabbit density: total area (P=0.0427), width (P=0.0099), presence of artificial warrens (P=0.1821) and productivity (P=0.0252).

We verified that the increase of the total area, the presence of artificial warrens and the productivity positively influence the rabbit density.

The influence of width of the pasture on rabbit density might be related to the rabbits strategic defensive behavior, since this species confines its foraging activity to the pastures edges, near the cover of shrubs (Jaksic *et al.*, 1980). This strategy is more effective if the predators are birds of prey, that hunt in open areas, and present diurnal activity (Martins, 1998). If the main predators are nocturnal carnivores, rabbits prefers open areas, so they can perceive the arriving of a predator (Villafuerte *et al.*, 1997), The smaller is the width of a pastures its shape becomes more ellipsoid and not suitable for nocturnal activity. The circular-shape pastures are more adequate, allowing the rabbits to have their daily activity by the pastures edge and nocturnal activity in the open areas.

Pastures productivity is also an important factor for having an high density of rabbits. The pastures with higher fresh biomass have also higher density of rabbits.

3.4.2.3 Rabbit feeding habits

The main objective in this study was to analyse the plant species consumed by the rabbit and therefore evaluate which plant group should be fomented in order to increase this lagomorph density.

Methodology

The pellets were collected in different latrines along the transect lines and the data was divided in four groups according to their spatial distribution (north, south, west or east of Serra da Malcata).

The sampling procedures occurred between October 1998 and February 1999, and of each chosen latrine a sample of 10 pellets was analysed. This process consisted in washing and dissolving the pellets, with hot water, passing a sieve of 0.02 mm. The fragments restrained in this sieve were put in a solution of sodium hypoclorit (NaOCl) for 3 minutes and washed again. To the obtained fragments was added glycerin and then they were observed on the microscopic in a systematical way, until 100 plant fragment are identified.

Results and discussion

In two sampled areas in west Serra da Malcata we obtained 11 plant species (Fig 22). The species *Cytisus grandiflorus* (relative frequency R=42.5%), *Cytisus striatus* (R=23.5%), *Pteridium aquilinum* (R=10,0%) and the non-identified NI13 (R=5,0%) represent 81% of the total items identified for that area.

In central area of Serra da Malcata, where we implemented the pastures, the results of the nine samples consists of 27 plant species identified, standing out *Chamaespartium tridentatum* (R=27.3%), a non-identified species NI1 (R=16.3%), *Secale cereale* (R=12.9%) and *Cytisus grandiflorus* (R=6.6%) (Figure 22).

In the northern area, the results from the 14 samples analysed have similar consumption results to the central region (Figure 22)

.

In the southern area, in three sample analysed we concluded that *Chamaespartium tridentatum* (R=20.7%), *Holcus* sp. (R=19.7%), *Cytisus striatus* (R=18.7%), NI2 (R=17.7%), NI10 (R=7.0%) and *Secale cereale* (R=5%) are the plant species more consumed (Figure 21). The plant group more consumed in the four areas was Dicotyledon followed by the Gramineous plants (Figure 23).

The Kruskal-Wallis analyses test showed differences among the four study areas, explained by the differences in the trophic diversity of these territories. The northern area has a higher diversity value (H=3.9), as well as an equal abundance distribution for each species (J=0.7). The west area (H=2.5; J=0.5) and the southern area (H=2.9; J=0.5), oppose to the northern area, presented a lower diversity index and the relative abundance is focused in a few number of species. The central area is in a mid-term: it has a high trophic diversity values (H=3.6) just like the equitable index (J=0.6).

Final Considerations

Thirty five plant species were detected in the rabbit diet concerning the Winter of 1999, but only 10 have a consumption higher than 5%. With the exception of *Secale cereale*, all the species belong to the native flora of the region.

The relative frequency of legnosus taxa is higher than 30%, and most of them belong to the *Leguminosae* family – *Chamaespartium tridentatum, Cytisus striatus, Cytisus grandiflorus, Cytisus scoparius* and *Genista falcata*.

The gramineous plants are the food item more consumed in the southern, northern and central Malcata, specially due to the meadows and pastures. In the west area, the diet reflects the monotonous habitat and the lacking of pastures or meadows. In terms of management implications is necessary to continue opening pastures not only to provide graminea plants for rabbits, but also to increase the density of young shrubs such as *Chamaespartium tridentatum.*

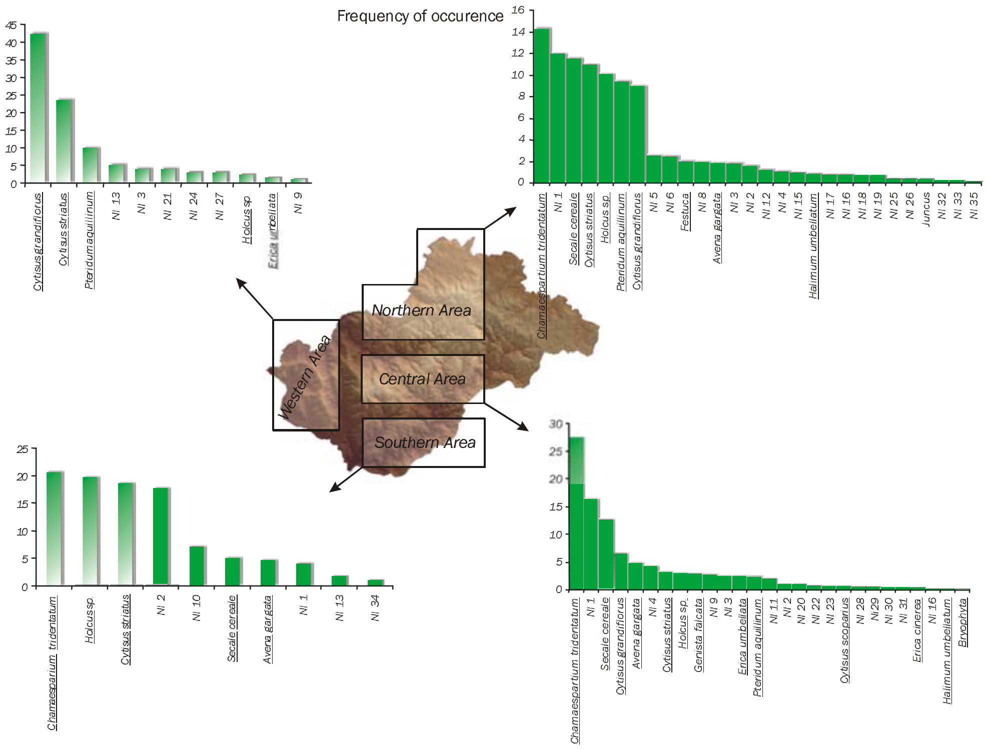

Figure 21 – Rabbit trophic spectrum in Serra da Malcata, from Octubre 1998 to February 1999, obtained by microscopic analyses of excrements. Data is presented in frequency of occurrence.

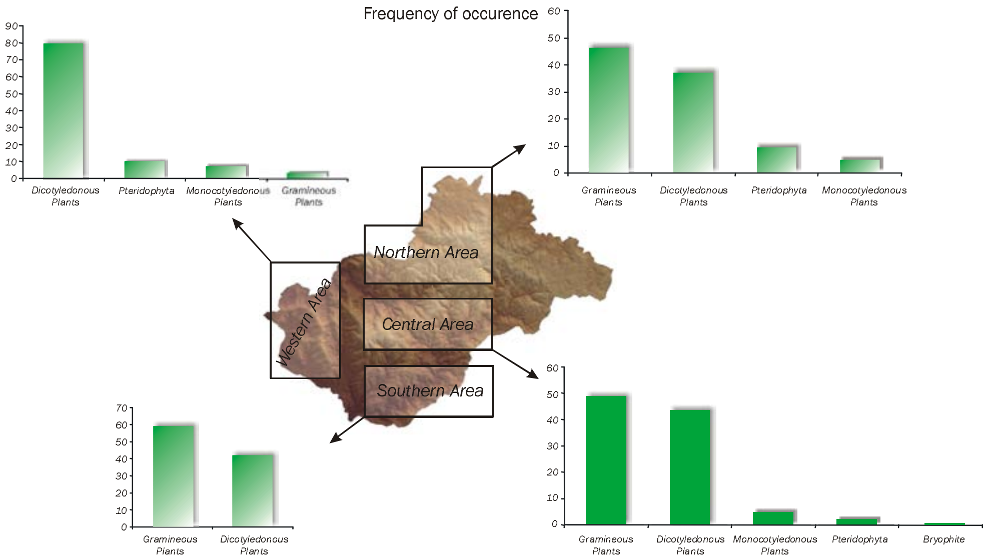

Figure 22 – Rabbit trophic spectrum, represented by taxonomic groups, in Serra da Malcata, from October 1998 to February 1999, obtained by microscopic analyses of excrements. Data is presented in frequency of occurrence.

4. Overall project assessment

4.1 Successes and failures

Endangered species recovery is a highly complex undertaking. Only by cooperative organizing expertise under a well-designed program structure will the effectiveness and efficiency of the process improve. Traditional bureaucratic public administration systems, however, are poorly suited to address the complexity, uncertainty and urgency of the recovery task. As a result of highly complex administrative processes and significant delays and in last years even impossibility, in having access to funding, the project suffered from a variety of problems: delays, inefficiency, inability to overcome, in some actions, the uncertainty and complexity of the recovery challenge.

The problems in having access to funding affected mostly the following actions:

1- Rabbit restocking operations – During the project we conducted a total of nine operations. If we had a proper administrative process we could have conducted, at least, 20 operations;
2- Information bulletin – six number were publish for a total of 12 predicted;
3- Merchandising – no merchandising was produced due to bureaucratic problems.

Success of the programme should be assessed at several levels using different criteria. The recovery actions should be evaluated in terms of biological criteria (such as number of rabbits per hectare), valuational criteria (such as the change in public support or acceptability), and organizational criteria (such as the effectiveness of formulating and implementing the recovery options).

In terms of biological criteria, the project achieved a proper success in several areas. In managed areas, rabbit density recovery from 2.53 rabbits per hectare to 5.13 rabbits per hectare. Other variables such as lynx carrying capacity and percentage of suitable habitat, also had a positive evolution (Table 11).

Table 11 – Evolution of the success indicators in pre and post project phases.

Success criteria	1999	2003
Rabbit density	2.53	5.13
Lynx carrying capacity	<1	4
Suitable habitat for resident lynxes	481 hectares	2527 hectares

Valuational criteria could be analyse in terms of the rate of illegal hunting. Although significant progresses were made in controlling this phenomenon, we can conclude that public attitude towards this problem did not change. Poachers are still in action and operating. The main difference is that the most problematic areas are now outside the Nature Reserve.

Organizational problems, such as the pointed above, were the main cause of the project failures. Although we try to learn about the bureaucratic structure associated with project funding and figure out how to best work within this structure and culture, it was not possible to improve the process and the situation became even worst in the last two years.

If we are to improve our performance in endangered species management and in future projects, it is vital to point out the lessons. A number of important lessons are evident from the examination of project efforts.

Lesson 1. It is necessary to obtain reliable knowledge early on about both the biological and nonbiological dimensions of the conservation problem. Early acquisition of reliable information on the target species and ecosystem is the best way of achieving conservation and carrying out a successful program. If a species is allowed to decline to vestigial levels before the conservation problem is investigated, the difficulty and costs of recovery increase and the chances of success diminish. Moreover, such projects easily attract criticism from researchers, ONGs and the public. The Iberian lynx case is a good example of this situation, besides from the Doñana, population, which characteristics are extremely different from the rest of the lynx range, there is a considerable lack of information. So is fundamental to obtain rigorous, reliable biological and ecological knowledge and to use these information at the right time and the right way.

Lesson 2 – Ecological processes are complex and solutions are often influence by a significant number factors – Recovery programs usually face a complex mix of biological and non-biological challenges. Rabbit recovery could be influenced by climatic conditions, disease ecology, predator density, food, shelter, poaching, landscape characteristics, etc.. So the applied recovery actions can faille if one of this components is not favourable.

Lesson 3 – Do not expect changes in bureaucracies – Is necessary to learn how to operate in an adverse administrative structure.

Lesson 4 – Regular and thorough program review is essential - Comprehensive program evaluation should be designed into all aspects and stages of the conservation project. Evaluations should be a formal part of the program and should conduct to changes in the project based on the results. According to results and the evolution on the scientific knowledge several methodology approaches were changed during the project. The methods of rabbit restocking operations were changed in order to address properly the conservation problem.

4.2 Conservation benefits for the Natura 2000 site and species/habitats target

The project had a significant positive effect on the recovery of the central Serra da Malcata habitats for the Iberian lynx. Areas that otherwise would be not managed or improve, became suitable for reintroducing the species. Rabbits, the main prey on Mediterranean ecosystems for a significant amount of endangered species, also increase significantly in the project target areas. This fact could influence not only the future success of a reintroduction programme, but also the survival and population level of threaten species such as the eagle owl, the wildcat and the golden eagle.

4.3 Incentive/pump-priming effects

The Life project constituted an extremely important conservation base for the Nature Reserve and the Malcata site for two main reasons:

- It was the first conservation project in Serra da Malcata with continuous and significant conservation actions, acting in a wide geographic range and temporal scale;
- Project actions will be continued, in a wider range, as a result of the approval of the POA project "Management of habitat and priority species of Serra da Malcata".

4.4 Demonstration and innovation value

This Life project is a suitable base for Iberian lynx conservation in order parts of Portugal. The recently finish action Plan for Lynx Conservation in Portugal, used a significant amount of information obtained during the project, for modelling and conserving lynx habitats. Predicted actions of reproduction habitat protection and enlarging, rabbit restocking operations, surveillance efforts and monitorization of target species, developed during the project, are described in the Action Plan and are already being applied in other parts of Portugal.

The project is also related with conservation actions applied in Spain, not only by the use of scientific knowledge, but also by the regular exchange of information with Spanish teams. The diagnosis of the Iberian Lynx populations (Guzmán *et al.*, 2002), applied in both Spain and Portugal, from 1999 to 2002, was also related with the Life project.

4.5 Socio-economic effects

Although we still face a preoccupying problem in terms of poaching activities, it was possible to generate a positive effects on the assistant of educational actions. The process of public education operates in a long-term time scale, and in four years is difficult to measure success.

Two jobs of field biologists were supported during the project and this jobs will be maintained, at least, during the next two years.

4.6 The future: remaining threats and further actions needed

The conservation action will continued by the application of the POA project "Management of habitat and priority species of Serra da Malcata". The target areas will be significantly increased to most parts of the Nature Reserve in order to continued to improve highly degraded habitats and recovering the density of rabbit populations. It is necessary to continue the conservation efforts, to apply the conservation strategy expressed in the Lynx Action Plan, in order to make possible a species reintroduction in a long-term. Ensuing actions will also contemplate the construction of a lynx reproduction centre and reintroduction experiences in control environments using other lynx species.

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