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Abstract: The plan is elaborated in accordance with The Law on Protection of Species and Habitats (in force since 05.04.2000) and is suggested as a long term strategy for conservation of the lynx in Latvia. It was compiled for the Convention on the Conservation of European Wildlife and Natural Habitats meeting on Status of Large Carnivore Conservation in the Baltic States in 2001. Its main objectives are to maintain the current population size for a long term, to avoid any fragmentation of the population, and to ensure a free movement of animals between western and eastern sub-populations in Latvia. The carrying environmental capacity and the natural ecological functions of the species in ecosystems is to be conserved and the public opinion regarding the lynx is to be improved by informing about species ecology, threats to the European populations, and conservation needs. A further objective is to abolish the existing management policy of lynx, focused on safeguarding ungulate populations at higher density, and to implement a quota system for harvesting. A high priority should be given to research activities such as lynx monitoring and population ecology because only strong scientifically based arguments can change the hunters' attitude. A revision of this document, the 'Management plan for Eurasian lynx in Latvia', has been adopted by the Minister of Environmental Protection and Regional Development in 2002.

Notes: A revision of this document has been adopted by the Latvian government in 2002, RefID: 4603

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Keywords: 7LV/action plan/Lynx lynx/protection/species/habitat/strategy/conservation/measures/population/status/lynx

Abstract: The plan is elaborated in accordance with The Law on Protection of Species and Habitats (in force since 05.04.2000) and is suggested as a long term strategy for conservation of the lynx in Latvia. Nevertheless, all priorities and measures have to be evaluated and updated following trends in population status on a regular basis.



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CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE
AND NATURAL HABITATS

Standing Committee
21st meeting

Strasbourg, 26-30 November 2001

**Status of Large Carnivore Conservation in the
Baltic States**

**Action plan for the conservation of
Eurasian lynx (*Lynx lynx*) in Latvia**

Document compiled by Janis Ozolinš

The plan is elaborated in frame of the project "Inventories of Species and Habitats, Development of Management Plans and Capacity Building in relation to Approximation of EU Birds and Habitats Directives" financed by the Danish Environmental Protection Agency

TABLE OF CONTENTS

SUMMARY	3
INTRODUCTION	4
BIOLOGICAL REVIEW	5
1. Species description	5
1.1. Appearance and body size	5
1.2. Signs in nature	5
1.3. Habitats.....	6
1.4. Diet	6
1.5. Reproduction	7
1.6. Population structure	8
1.7. Natural enemies and competitors.....	10
2. Population size and distribution	10
3. Limiting factors	11
3.1. Hunting	11
3.2. Habitat fragmentation	12
FORMER STATUS	12
1. Former legal status of the lynx in Latvia.....	12
2. International status	13
3. Former research	13
4. Habitat conservation	14
REQUIRED ACTIONS	14
1. Broad policy	14
2. Required legal status	14
3. Habitat protection and lynx protection within protected areas.....	15
4. Regulations for exploitation	15
5. Minimisation of conflicts with humans.....	15
6. International co-operation	16
7. Advisory capacity.....	16
8. Research and monitoring.....	17
9. Education and public awareness	18
10. Approximated costs for required activities	18

SUMMARY

- **Population status**

The lynx has a viable population but is unevenly distributed within the country. According to expert estimate, the current number is approximately 500, however, official statistics show about 700 individuals. The population has increased since early 90s and a stable status, or even a slight decrease, has been recorded for the last three-years period. Presently the lynx is most common in the northern districts, especially near the Estonian and Russian border. The lynx is comparatively rare in the districts along the Lithuanian and Belarussian border. The present isolation between western and eastern sub-populations can be considered as a threat.

- **Former Legislation**

Game species. The hunting season is closed from 16th March till 30th September. No quotas exist for hunting bag. The fine for poaching lynx is 100 LVL during hunting season and 200 LVL during the closed season.

- **Objectives**

To maintain the current population size. To ensure the spatial continuance of one metapopulation and a free movement of animals between western and eastern sub-populations in Latvia. To maintain the carrying environmental capacity and fairly natural ecological functions of the species in ecosystems.

- **Priority statement**

To improve the public opinion regarding the lynx (special target groups are – hunters, foresters, and students) by informing about species ecology, threats to the European populations, conservation needs and ways.

- **Broad policies**

To abolish the existing management policy of lynx extermination, which purpose is likely to safeguard the ungulate population. Only strong scientifically based arguments can change the hunters' attitude. Consequently, high priority should be given to research activities such as lynx monitoring and population ecology. The knowledge of lynx ecology might contribute to public awareness concerning wildlife conservation in general.

- **Actions**

To develop and start monitoring the species' status. Monitoring tasks should include obtaining scientific data on hunted and dead lynx, so maximum hunting quotas can be defined according to regional characteristic and reproduction capacity of the population.

To clarify the problem of damage potentially caused by lynx.

Through research to understand which habitat conditions are most important for lynx. Based on this data, important areas should be added to the (Emerald/Natura 2000) joint network of protected areas.

To promote public awareness changing peoples' attitude towards lynx and large carnivores in general.

The above listed tasks should be updated in two years.

INTRODUCTION

The lynx is the largest representative of the cat family (Felidae) in Europe and the only wild species of cats in Latvia. In reviews of the Latvian and East Baltic fauna it has always been described as relatively rare and unevenly distributed (Grevé 1909; Taurinš 1982). It has dispersed in the present territory of Latvia simultaneously with post-glacial boreal forest. However, the bones of lynx are fairly few amongst archaeological findings near human settlements of bronze and iron age as well as castles of middle age – only about 1% (Mugurevics E., Mugurevics A. 1999). A written source from the 16th century confirms the lynx presence in "the virgin forest and thickness" both in western and eastern part of Latvia.

The lynx dependence on forest habitats and its valuable fur are considered the main reasons for its relative rarity and uneven distribution. However accurate knowledge on species ecology from specific areas is still missing.

In comparison with other carnivores, the persecution of lynx has been less intense. In addition peasants have paid to hunt lynx for centuries and poaching penalties for lynx have also existed (Mugurevics E., Mugurevics A. 1999).

It is only recently that the lynx has become perceived as a competitor to hunters and a pest species in game management. In soviet period, official opinion of hunters was to keep lynx number at the so called minimum and the lynx was accepted only as a rare representative of native fauna (Taurinš 1982).

Today such an approach can not be accepted in species management policy because:

(1) suitable lynx habitats have disappeared throughout Europe during the last decades leaving the remaining populations threatened by isolation; to arrest this trend, geographical corridors among remained sub-populations as well as increasing or at least stable numbers of lynx are needed;

(2) the minimum size of viable lynx population is rather an unfounded presumption – a stable number far below the level of the given carrying capacity in environment is not possible even theoretically without threats to species survival;

(3) species conservation is closely tied to conservation of suitable habitats, therefore large carnivores can not be preserved unless their main food source - wild ungulates – is represented by a sustainable population and completely outside the territories used by humans for hunting;

(4) successful conservation of lynx in Europe can only result from international co-operation. Geographically Latvia is an important link in the Baltic region between Estonia, which at present has the highest density numbers of lynx in the Baltics, and Lithuania and Belarus where lynx now have become protected as it is rare.

Due to the mentioned reasons, it was suggested to evaluate the current lynx status in Latvia and to formulate a management plan for the species. As very little research has been done on the lynx in Latvia, the management plan is primarily based on knowledge obtained from other countries. Local studies on the reproduction rate in lynx population were started in the frame of project "Inventories of Species and Habitats, Development of Management Plans and Capacity Building in relation to Approximation of EU Birds and Habitats Directives" financed by the Danish Environmental Protection Agency.

The goal of this plan is to ensure the species conservation in Latvia, while taking the expected rapid economic development into account. The main task is to change the general attitude towards lynx. This should be done by informing hunters, relevant local authorities, state officials, as well as international institutions about the true population status and ecological characteristics in Latvia.

BIOLOGICAL REVIEW

1. Species description

1.1. Appearance and body size

After the brown bear and wolf, lynx is the third biggest predator in Latvia and Europe. Weight of an adult individual ranges from 8 to 15 kg according to Novikov (H????? ??.?,1956), from 12 to 35 kg (Breitenmoser et al. 1998), from 10 to 15 kg, rarely up to 30 kg according to Flint (? ????, 1967). Body size varies within certain limits: individuals from the northern and eastern parts of the distribution range are larger than those from the south and the west (Breitenmoser et.al., 1998). Various literature data supports this, e.g., body length of lynx in Russia ranges from 82 to 105 cm (H?????,1956), while in Europe - from 71 to 130 cm (Breitenmoser et.al., 1998). Sexual dimorphism is also known as males are bigger than females.

Lynx differs from the other mammals of similar size by its relatively short and laterally flattened body and relatively long and massive legs. The tail is short. Ears are triangular shaped and end with hair brushes which especially stand out in winter.

Literature on the fur of the lynx is quite comprehensive (Matjuschkin 1978). Fur colour and lynx size are so variable that previously it was believed that there were several subspecies of the lynx even within Latvia (Grevé 1909). K. Greve classified Latvian lynx in the following way:

1. In summer, the upper part of the body becomes rust-coloured, and abdomen becomes white. The lateral sides of the body and legs bear dark spots, which are especially distinguished on the legs. In winter, the dorsal part turns reddish and grey, and the abdomen becomes white with grey tones. The tail has dark cross lines. Ear brushes are 5 cm long and quite thick. This description corresponded with *Lynx vulgaris* Fitz. which was accepted at that time.
2. The dorsal part is spotted with 2-3 rows of dark spots. Ear brushes are shorter. Fur colour is reddish grey, abdomen is white, without spots. Oval black spots are situated dorsally in the three rows which have distinctive borders. On both flanks, there are round black spots situated comparatively dense. *Lynx cervaria* Temm.
3. Abdomen is white, the back is rust-coloured. On the back, there are two stripes situated close to each other. On the back, smaller, darker, almost stripe-like spots are seen, on the lateral sides there are feebly marked small spots. *Lynx virgata* Nilss.

Later it was realised that lynx age, sex and location (Kalniņš,1943) affects individuals of the same species. Pelt colour can range from ash blue to reddish, spots can also be very different. However, the colour on some body parts does not vary. Abdomen, chest, neck, chin, lower part of the sides and armpits are almost white, tail tip is always black, and the rest of the tail is of the same colour as the dorsal part of the body. In summer, pelt colour is more intensive than in winter (? ?????,1956). Sex dimorphism in the pelt colour is not proven (? ????? 1982).

Moulting happens twice a year - in spring and autumn. Pelt is thicker from November till March. Short hair is the reason why spots are more pronounced in the summer time. Spring moulting starts in April and lasts till July. The colour of summer pelt is more intense, in winter, it is lighter. Moulting period is shorter for males and non-breeding females than juveniles and females with cubs (? ?????,??????,1970)

1.2. Signs in nature

Lynx is a very cautious animal, therefore, direct observation of it is seldom. Besides, lynx are active mainly at night and at dawn, therefore, this is the only time when they are likely to be observed. As one cannot base research on observations indirect signs should be used.

Unfortunately indirect proof of lynx existence are not easily noticeable because they are not concentrated in conspicuous places. Footprints are the most common lynx signs, which are best seen on the snow. Four fingers are distinguished in the footprint. In contrast to the footprints of dogs and wolves, which are of similar size, lynx footprints are round and without claw signs. Diameter of the footprint is from 8 to 13 cm. The size of the front paw's footprint is bigger than that of the hind paw.

When moving, lynx puts hind paws into the forepaws' prints. If several lynx move, the last step into the footprints of the first animal. Prints of the left and right paws form a broken line. Pace length varies from 30 to 80 cm. In the forest, lynx do not move in a straight line but in curves, often keep pause. They willingly use quiet forest roads and ditches for walking.

Snow-tracking is the main method used for lynx census and hunt in Latvia. However, the effectiveness of this method is effected by factors such as absence of snow cover and personal judgement of estimates of number of lynx in footprints made by a group. The territory of each plot where lynx are counted often is too small comparing with home range and not all plots are surveyed at the same time. Thus double counting results in over-estimated population size.

Methodological improvement of track recording could give realistic data on lynx density and population dynamics in Latvia.

As lynx are territorial animals, they mark the rendezvous sites by urine, scratches or scats. They also mark their presence by secretion of the skin glands, rubbing cheeks and other parts of the body against different objects. Most of the scats are buried, therefore, it is possible to find them in winter only, while snow-tracking.

1.3. Habitats

In terms of habitat selection, lynx is a typical inhabitant of boreal forests. This is true both for Latvia and the rest of the Baltics. However, it is known that in the north of its range, in the mountains and in Asia, lynx often occur in less forested areas as well. Lynx can climb trees and often use forest plots with wind-falls for denning and resting. However, the image of the lynx as an animal living in the trees and attacking its prey by jumping from the branches is exaggerated. Lynx use elevated places like fallen tree trunks as good observation points. It is believed that in Latvia, lynx prefer forest stands with dense spruces in the second layer. Also, it is found that lynx show a preference towards wind-fall spots of the forest. The essential resources of the lynx are; prey abundance, safe resting and breeding places and water availability. In Latvia Lynx willingly inhabit anthropogenically changed habitats too - drained forests with clear cuts and young plantations. Probably the reestablishment of beavers has improved the lynx situation as beaver habitats attract ungulates and hares which represent the primary food source of lynx.

Bogs are not the favourite lynx habitat, however, lynx often occur at the edges of the bogs, and readily use inaccessible islands in the bogs as resting sites. In addition they often cross the bogs by using the existing roads and paths.

Lynx avoid agricultural lands. When crossing less forested areas they do this under the cover of bushes and in river valleys.

Lynx also are good swimmers. In conclusion, we can say that all big forest massifs in Latvia are suitable for lynx. Lynx distribution at the moment is not limited by the lack of habitats.

1.4. Diet

Compared with other predators, lynx is primarily dependent on the abundance of appropriate prey. Lynx feeds almost entirely on the prey it hunts itself, and its food spectrum is rather limited (Breitenmoser et.al., 1998). Lynx can feed on any animal, the critical point is its ability to catch and kill the prey. Therefore, bigger prey like adult ungulates are rarely killed by lynx. This really only occurs when snow cover is deep and slows the ungulate. Rodents and birds are important food resources during summer. V. Gaross (1995) emphasises that in the previous centuries mountain hare was the main prey of lynx in Latvia, while in this century it is generally roe deer and piglets of wild boar. He also mentions some observations that indicate feeding opportunism, stating that lynx were taking poultry from farms, preying on heron chicks or even black stork chicks.

Within the present research plan, 24 stomachs of lynx hunted in winter were investigated. 16 stomachs contained some prey remains. In 15 stomachs, cervids were found (most probably, these were roe deer (*Capreolus capreolus*) or in some cases red deer (*Cervus elaphus*), in one stomach hairs of mountain hare (*Lepus timidus*) were found (Andersone, unpubl.).

There is a large discrepancy on the information on the amount of food eaten by lynx per day. Despite the big body size, lynx consumes rather little. Some data show that lynx consumes from 1 to 1.5 kg food per 24 hours (?????,?????,1970). Also in the Riga Zoo, daily food standard per lynx 2 kg, but since not all was consumed it was reduced to 1.3 kg. According to other data, an adult male (18-20 kg) eats 2.5-3 kg food per 24 hours in winter. Being very hungry, it can consume twice as much. Thus on average, wild lynx consumes about 2 kg meat per 24 hours (Haglund 1966 cited in Jedrzejewski et al. 1993). As most predators, lynx can do excess killing under certain conditions but such cases are not typical. More often it happens that the prey is only partly consumed, mainly lynx licks the blood and eats internal organs. It is believed that the reason for the lynx “blood thirst” is a consequence of vitamin deficiency. In the intestine of herbivores, vitamins are synthesised, therefore, their blood and liver are rich in vitamins.

1.5. Reproduction

The heat starts in the end of February and lasts until April. Increase in male activity and behavioural changes indicate the start of the breeding period – males move around their territory without hunting and mark their routes by urine. Such activities start already in the end of January. Most of the time lynx live alone. However, during the breeding period their behaviour completely changes, and in places with high lynx abundance, each female is constantly accompanied by several males. Males fight between themselves. While females mate with one male only, the male, especially if he is dominant, can mate with several females in one season. If a female is not fertilised, the heat repeats in 7 days cycles. It is known that females may not mate every year. Sometimes more than one-year old lynx youngsters are observed together with the mother. Cases, when females remain unfertilised, can be connected both with unfavourable environmental conditions and low population density. Normally, females mate every year.

Pregnancy lasts from 67 to 74 days. Cubs are usually born in May. Most often, there are 2-3 cubs per litter, rarely – 4-5 cubs. E.g., in the Riga Zoo, 3 litters of 12 litters contained 1 cub, 6 litters contained 2 cubs, and 3 litters – 3 cubs.

Investigations of lynx fertility have been started in Latvia. So far, 10 lynx females hunted in the hunting seasons of 1998/1999 and 1999/2000 were checked. Their age was determined as well as the number of placental scars, which coincides with the number of embryos during the previous pregnancy (Table 1, page 9). Embryo number does not necessarily correspond with the number of alive-born cubs, because some of the embryos can be reabsorbed and some of the cubs can be born dead. There are cases when, during the winter, lynx females were accompanied by 1-2 cubs which were first hunted down. Later this female may be shot by another hunting team and considered as a single female lynx. Therefore, data collection on the actual lynx fertility by examination of carcasses is still very urgent.

Table 1 : Reproductive evidences in female lynxes checked during the hunting seasons from 1998 till 2000 (n=10)

Date of the shooting	Age – full years	Reproductive evidences (fresh placental scars from previous pregnancy, presence of kittens)	Number of placental scars
99.02.07.	2	-	0
99.12.26.	2	+?	?
2000.01.30.	2	-	0
99.03.08.	4	+	3
98.11.15.	4	+	?
99.03.13.	5	+	2
2000.01.31.	9	+	4
98.01.31.	?	+	2
99.01.12.	?	+	2
2000.03.06.	?	-	0
	n=10	70 % of adult females breed	average* 2,6

* - calculated for females with placental scars

Kittens are born helpless, blind, and weight about 300 g. After 3 to 4 weeks, they start to go out of the den. Three month old cubs already feed on meat. At this time females stop lactating. Natural mortality in young lynx is very high – almost half of them do not survive until maturity. Females live together with the young until the next breeding period. Males become sexually mature at the age of 3 year, females at 2.

1.6. Population structure

Lynxes live alone, except for females with cubs. Daily, they move within their home range, the size of which depends on the feeding conditions in the area. Individual territory can vary from 25 to more than 2000 km². Thus, there are 0.25-5 individuals per 100 km² of forest (Breitenmoser et al. 1998) or up to 0.5 lynxes per 1000 ha, which is the most common unit for calculating game density in Latvia. In Latvia, the only attempt so far which has been made to assess lynx density is in the Kuldiga forestry district. Unfortunately this should be regarded as unsuccessful because the density obtained was disproportionately high – 1.4 lynxes per 1000 ha (Gaross 1994).

Females with newly born cubs have the smallest home range size. On average, females occupy 2-3 times smaller areas than males. Home ranges also differ seasonally. During winter, home ranges of females also increase.

Sex ratio within the lynx population is about 1:1.

In Poland, it was found that the ratio of adult males in the population constitutes 29%, breeding females 23%, cubs younger than one year 35%, and sub-adult lynxes 12%.

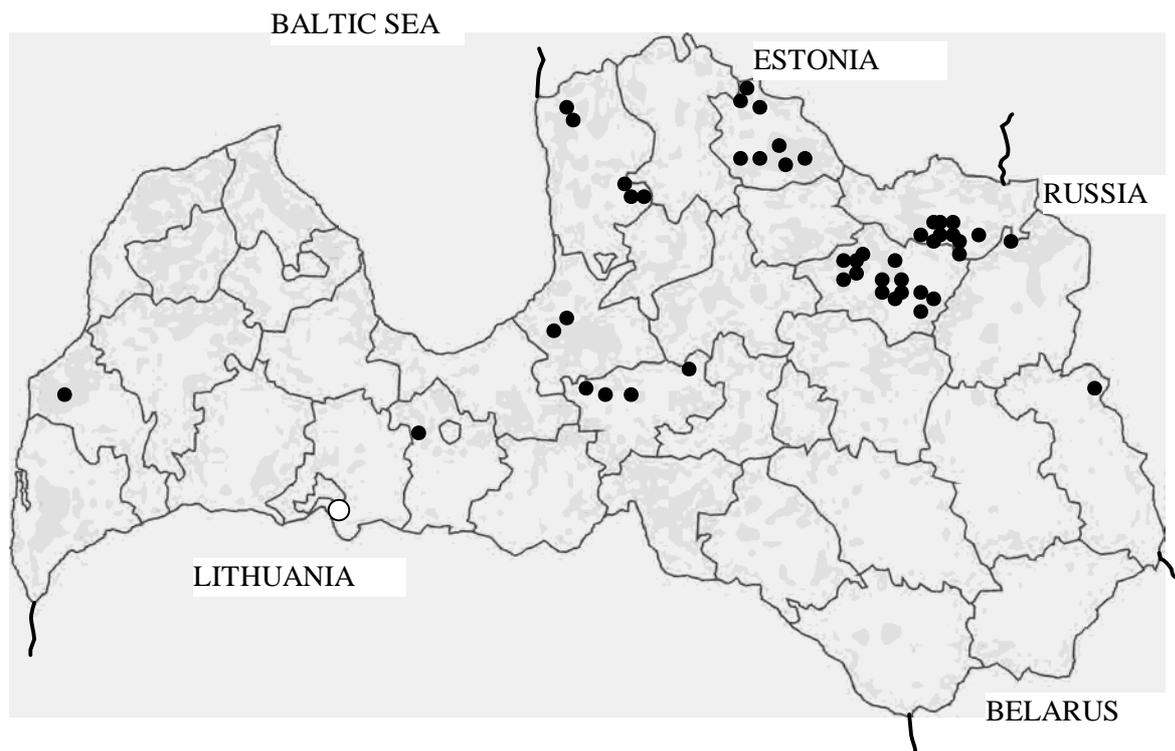


Fig. 1. Spatial distribution of lynx samples in Latvia (n=48; 1998-2000) collected while studying sex-age structure and reproductive signs in females.

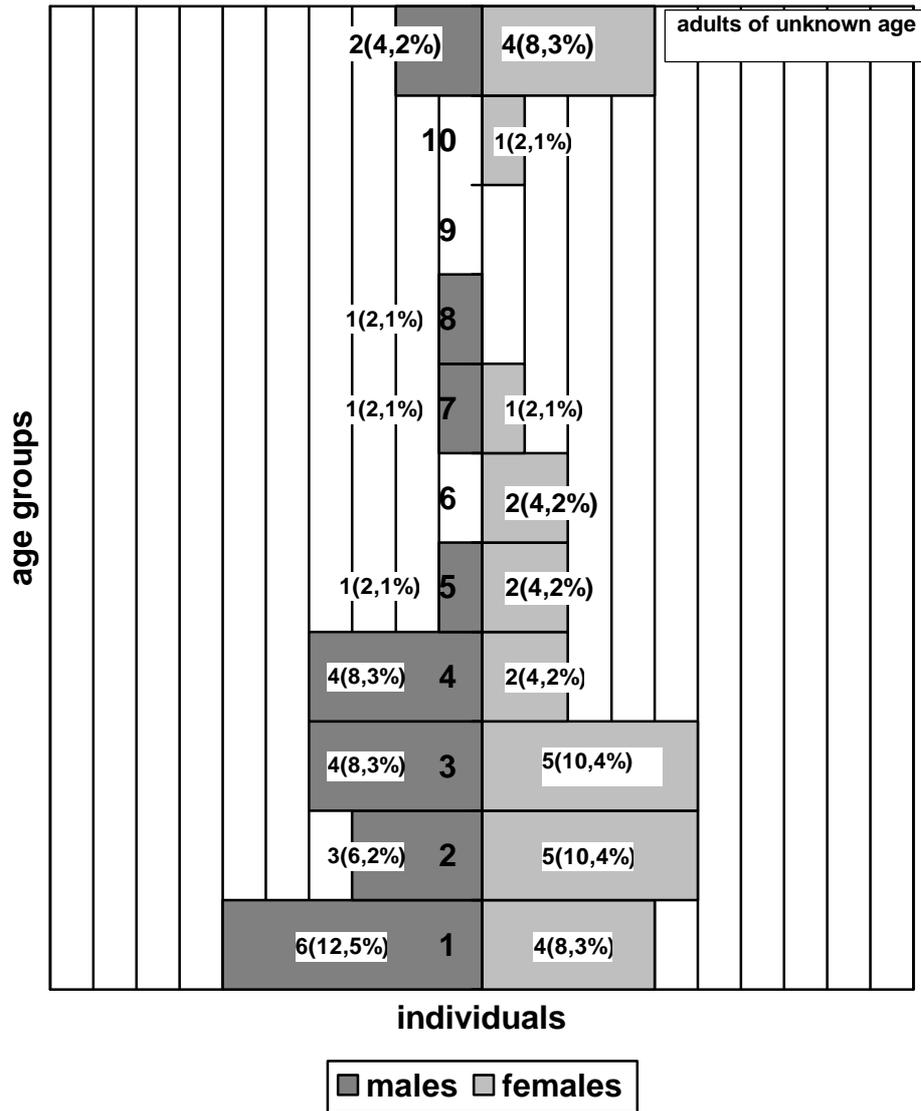


Fig. 2. Age and sex structure of 48 lynx shot in Latvia.

Fig. 3. Microscopic slide of tooth root with cement lines.

Age structure of the Latvian lynx population was studied in 1998-2000. During that time, State Forest Service established contact with hunters, who volunteered for providing data on the hunted lynx as well as lent lynx skulls from their private collections for further investigations. During this investigation one canine was taken out for age determination. The tooth root (1-1.5 cm long) was removed, and the tooth was placed back in order not to spoil the trophy. The root was cross-sectioned, and the age was determined according to the number of growth lines in the tooth cement (Pupila 2000) (Fig. 3). Samples collected originated mainly from the eastern part of Latvia, and their distribution (Fig. 1, page 10) depended on how successfully contact with the local hunters was established.

The ratio of adult animals (Fig. 2, page 11) in the Latvian lynx population does not significantly differ from the mentioned data from Poland. In Latvia, relatively few juveniles up to one year of age are hunted down. That could be related to the hunting selectivity too and does not necessarily reflect population structure of lynx left in the wild (see Part 3.1.).

1.7. Natural enemies and competitors

Theoretically, wolf is the only natural enemy of the lynx in Latvia, however, also brown bear is mentioned (Taurinš 1982). There are no data on the impact of natural enemies on the lynx population.

A similar situation is found with regards to competitors. Most of the carnivores can be regarded as food competitors, including birds of prey (e.g. goshawk), which prey on mountain hares and tetraonids. Small predators (e.g., pine marten) can be regarded as lynx commensals, although they scavenge on lynx prey insignificantly. Besides, lynx usually hides excess food under the snow, which can prevent scavengers at some extent. Several authors regard lynx and fox as antagonists. Fox not only use the same prey base but also often scavenge on the remains of lynx prey, while lynx can track and kill foxes. Lynx and wolf competition can occur during the period of pup raising by wolves. At this time, wolf pups are unable to participate in the pack hunts, making small and medium-sized animals the main prey of wolf during summer. During the rest of the year, wolf preys upon larger ungulates, which are inaccessible for lynx.

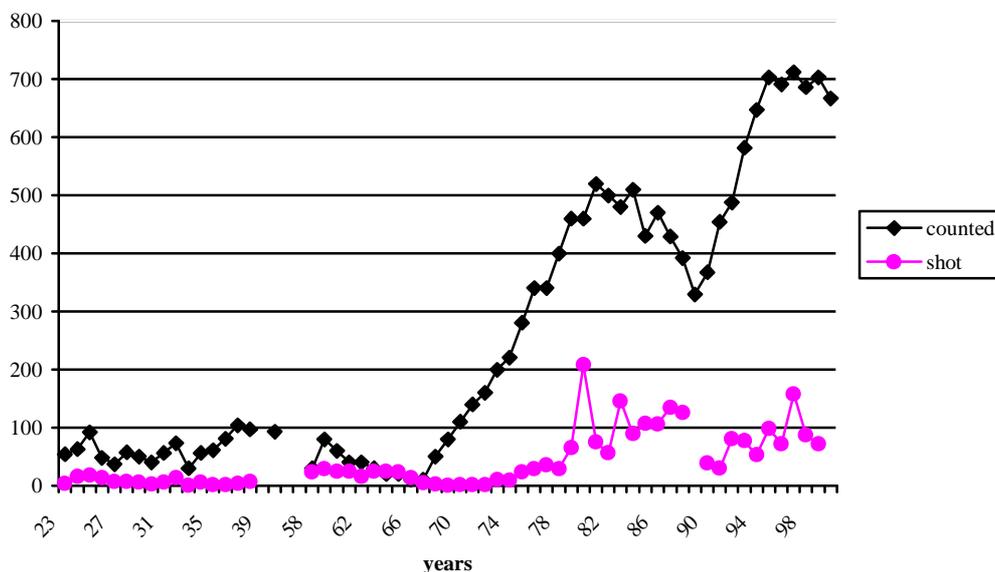
2. Population size and distribution

Data on worldwide lynx distribution are closely related to specialists opinions on species taxonomy. Former information sources inform that the species, occurring in Latvia, inhabits both Eurasia and North America (Sokolov 1979; Gorner, Hackethal 1987) while in the New Continent two lynx species exist. The most recent opinion is that there are 4 species, two of them occur in North America, one in the Pyrenean Peninsula, and one in Latvia and most of Europe and Asia. European distribution of the species, also called the northern lynx, is shown in Fig. 4.

Fig. 4. Lynx distribution in Europe – presence in 50X50 km UTM squares except for the CIS countries (after Mitchell-Jones et al. 1999).

Fig. 5. Lynx distribution in Latvia – 1995-2000. (presence in 10X10 km squares)

Fig. 6. Dynamics of lynx in Latvia (official game statistics). Data are missing for the WWII period and 1989.



The Baltic population is one of the most viable in Europe, with about 2000 animals according to rough estimates. It even reaches Russia, Belarus, Poland and Ukraine.

In Latvia, lynxes are unevenly distributed (Fig. 5, page 16). There are three main areas with higher lynx density, these are North Kurland, North Vidzeme and Selija or the left bank of the river Daugava in the Aizkraukle and Jekabpils districts. It is of crucial importance to maintain the link between these

micropopulations as it is the basis for gene flow within the common Baltic population. In Lithuania and Belarus, lynx has become rare, and its hunting has been stopped (National Strategy 1998; Bluzma 1999). Latgale (eastern Latvia) and Zemgale lowland (southern Latvia), which are both areas with low forest cover, can hamper animal migration westwards and southwards. In the long term, this may cause fragmentation of the population if so called ecological corridors are not ensured.

In the 20th century, lynx numbers in Latvia have remarkably changed (Fig. 6, 17). This change is not characterised by drastic fluctuations as seen in the wolf dynamics (Andersone, Ozoliņš in press) but rather by a pronounced increase, which started in the beginning of the 1970s. Also, the post-war period is not reflected in the lynx dynamics in contrast to the wolf and some other species, which are characterised by a rapid population increase at that time. Lynx population decline in the second part of the 1980s could be connected with the high market price for furs, which was doubled in 1983 by the government of the former USSR. This was confirmed by increase in the hunting bag. During the last few years, the population has been relatively stable, although expert estimates differ from the official inventory data. Three years ago, after having hunted more than 150 lynxes, no further increase in population size has been estimated. Thus a population of 500 lynx in Latvia presently is probably a reasonable figure. In general, official data on lynx should be regarded as satisfactory, taking into account the annual fluctuations of numbers, which are related to hunting in autumn and winter and to cub birth in spring.

3. Limiting factors

3.1. Hunting

Hunting is the main threat of the lynx. There are numerous other secondary factors, e.g., deficiency of natural prey, low population density, range fragmentation, genetic isolation etc.

The main reason behind the intensive hunting of lynx in Latvia is the deep conviction of hunters that lynx is their competitor for wild ungulates, principally roe deer. Scientific data does show that lynx have a significant role regarding roe deer mortality, especially when the snow is deep. However, it is not clearly proven that predators are the main factor shaping density of the roe deer population.

Trophy hunting for skulls and pelts of lynxes is another important motivation for hunters. Its prestige and value, especially of lynx pelts, has always been higher than for any of the other carnivore species. In the former USSR, the state paid up to 200 Soviet rubles per lynx pelt. To compare, the state would pay up to 150 rubles for an otter pelt. Lynx trophies from Latvia and Estonia are highly appreciated by the standards of international game trophy exhibitions. However, skulls are valuable only if they are obtained from adult animals and males.

In connection with the development of the lynx action plan, research was started on the hunting impact on the population's sex and age structure.

From winter 1998/1999 till spring 2000, 48 animals were obtained (Fig. 1, page 12), which constitutes 30% of all lynxes hunted during that time period. The results from the collected animals show several deviations from the desirable model of the population structure in the wild (see Part 1.6.).

Hunting season 1998-1999 (87 lynxes shot)

Hunting season 1999-2000 (72 lynxes shot)

Fig. 7. Lynx distribution during the last two years: black large dots indicate more than 2 shot animals, small black dots – 1 shot lynx, white dot – no lynx shot but presence recorded.

First, the ratio between young and older animals catches one's attention. Starting with the 3 year class, the proportions amongst age classes can be regarded as normal, but an insufficient number of kittens is observed at the base of the age pyramid (Fig. 2, page 13). If one looks at all adult females (sample number = 30), knowing that 70% of them participate in reproduction and there is a mean embryo number of 2.6 (Table 1, page 11), we can conclude that there could be 55 lynx kittens (59% of the population). In fact, the number of hunted kittens is only 10 out of 48 animals, or 21%. Thus, either some of the lynx cubs were not presented in our sample or their actual number in population is significantly lower than the number of embryos in lynx females. The first case could occur, if hunters

did not report cases where only cubs were hunted or hunting was selective towards adult lynxes, i.e., cubs were not killed. The second case would indicate that there is another factor of embryonic or postnatal mortality apart from hunting.

Examining the situations when hunters and staff of the State Forest Service reported on hunted lynxes, it is expected that some of the material probably was not collected because hunters consumed the lynx meat instead. It is quite a widespread tradition in Latvia to eat lynx meat. Most probably, this could influence the youngest age class of lynxes. This fact should be considered when planning further data collection.

Cases, when only a mother is hunted down, are possible in the beginning of the hunting season, especially during drive hunts before snow cover is established. Only two females from the present sample were shot in November and December, the rest were hunted in the second part of winter (Table 1, page 11). This is a general trend concerning lynx hunting in Latvia, generally hunting takes place during the last part of the winter. It should be noted that kittens left without the mother in the beginning of the winter season have poor survival chances. The sample collected includes an example of such a situation. In December 1999, in Jaunanna area (Aluksne district), where lynx hunting is intensive, a lonely lynx cub (male) was roaming around human settlements for a long time and finally shot. As this case was detected in such a small sample (n=48), it indicates a strong negative hunting impact.

Finally, there is no reason to assume that hunting is the only factor limiting population size. Natural mortality factors can also be important. It can be concluded that the effect of all the mentioned limiting factors have lead to a lower ratio of lynx cubs in the sample than would be expected from the female fertility data. Thus, these data should be regarded as background information for further monitoring of the reproductive status of lynx population. The data also provide arguments for introduction of less harmful hunting methods (see Part 4 of the ACTION PLAN).

In the sample, 2.5 year old lynxes are represented by greater numbers, than the age class of the previous year (1.5 years). This may be explained by the fact that subadult lynxes, in comparison to sexually mature ones, are much more unsettled and move a lot, therefore, they are more difficult to hunt. The relatively high number of 2 year old females (10.4% of the sample) could be explained by high hunting pressure in Latvia compared to the neighbouring territories, Russia and Estonia, which results in increased immigration of sexually mature individuals looking for free territories.

The sample also shows a low number of old animals compared to the potential life span of lynxes which is 17 years (Breitenmoser et al. 1998). This is probably also an indication of hunting impact, especially during the 1980s.

3.2. Habitat fragmentation

As lynx distribution in Latvia is generally dependant on vast continuous forest massifs, any management activities, including disturbance and intensive hunting, should be regarded as undesirable in the areas, which link permanently inhabited lynx areas. The continuous areas of importance to the lynx metapopulation are under threat :

- to the south from Riga and Jurmala: in the zone between Baldone – Olaine – Livberze – Džukste;
- around Daugavpils: in the zone Svente – Likсна – Kalupe – Graveri – Izvalta;
- to the north from Jekabpils: Selpils – Plavinas – Vietalva.

It is thought that in these places highways and railroads hamper free migration of lynxes.

FORMER STATUS

1. Former legal status of the lynx in Latvia

The lynx has always been a game species in Latvia and during some periods of the last century it was persecuted without seasonal restrictions as a pest species. (Table 2). The harm done by the lynx in Latvia concerns only its natural prey i.e. other game species. Furthermore, the lynx was hunted for its valuable fur. In soviet times, all fur had to be sold to state market and hunters received a special permit for each lynx to control this purveyance. Usually, the permit was written out after the lynx was shot

because the aim of this system was more likely to control fur market than to limit the hunting bag. Until 1990, the hunters were allowed to keep one lynx fur as game trophy only if they had received a special written permit from state authority. The price of lynx fur from 1983 till 1989 could be as much as 200 soviet rubles, which equals one month salary of a fairly high qualified technical expert. In the 90s, the price of non-tanned skin of the lynx was between 50-100 LVL, however there was practically no market supply. In the regulations ? 11 by the Cabinet of ministers from 13th January 1998, certain penalty is prescribed to compensate damage done by a poacher to state if a lynx is killed illegally. This amount is 100 LVL or 200 LVL if killed in closed season.

Table 2 : Legal status of lynx in Latvia

Low	Year	Closed season
Hunting Low, paragraph 20	1935	non
German Hunting Low from 1934 with amendments in 1938	1941	all year around
Decree of German Reich commissar: Regulations on hunting seasons	1942	1.04.-30.11.
Hunting regulations in Latvian SSR	1945	all year around*
Decision by Soviet of Ministers Latvian SSR "About amendments to hunting regulations in Latvian SSR"	1946	non
Decree by the chief of Game management department ? 659	1953	non
Statutes about hunting and game management in Latvian SSR	1964	non
Statutes about hunting and game management districts in Latvian SSR	1985	16.03.-30.09.
Hunting regulations in Latvia	1992	16.03.-30.09.
Hunting regulations in Latvia	1995	16.03.-30.09.

* hunting with special permits allowed

2. International status

The lynx in international Red Lists

List	Category
IUCN Red List	Least Concerned
European Red Data Book	Species not globally threatened but of special concern in Europe
Red Data Book of the Baltic Region*	not threatened in Latvia

* since 1998 included in the Red List of Lithuania

Washington Convention – “Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)”. The lynx is listed under Annex 2 as potentially threatened. This means that international trade with lynx is limited and may only occur under strict control.

Bern Convention – “Convention on the Conservation of European Wildlife and Natural Habitats”. The lynx is listed under Annex 3. This means that governments that have signed this convention (Latvia since – 01.05.97) should organise management of the species (reserves, closed season, means of hunting) as well as regulate trade.

Rio Convention - “Convention on biological diversity”. This convention does not contain any list or annex but provides general guidelines on conservation of biological diversity, research and public awareness.

EU Habitat Directive 92/43/EEC On conservation of natural habitats and wild fauna and flora. The lynx is listed under Annex 2 (lynx habitats have to be designed as strictly protected areas) and Annex 4 (prohibition of exploitation).

3. Former research

Conclusions on current status of the lynx in Latvia are primarily based on available scientific results from other countries, and game statistics and so called expert opinions in Latvia. In 1999, a bachelor project on lynx was finished at Biological Department of Latvian University (Bagrađe 1999). Currently Ms. G. Bagrađe is studying lynx diet and parasites in shot animals for her master’s thesis.

Preliminary data indicates that 100% of the lynx population is infected by parasitic helminths – cestodes and nematodes. Consequently this information strongly indicates that parasitic infections in lynx might be a threat to survival of some individuals. Otherwise data on species ecology are absent, except for the results obtained from the mentioned 48 collected carcasses of lynx which constituted part of the work done related to the lynx action plan.

In 1999, a joint project of Estonian and Latvian Fund for Nature named “*Conservation planning of wolves in Estonian-Latvian cross-border region*” was initiated. In this project, Estonian and Latvian border guards are registering the movements of large carnivores, including lynx, across the borders between both countries as well as on the border to Russia (Fig. 8).

The problem concerning damage done by lynx to livestock in countries of middle Europe (Breitenmoser et al. 1998) is not known in Latvia at all. Specific evidence of lynx negative impact

Fig. 8. Records on lynxes crossing the state border between Latvia, Estonia and Russia during snowy periods of 1999 and 2000, provided by the state border guard. Forest distribution is shown in gray.

⇒ exits from Latvia

⇐ entries to Latvia

on game fauna, seen from the hunters view, is recorded on a more or less regular basis by A. Gaross (1994, 1997).

4. Habitat conservation

Special protection of lynx habitats have never been established in Latvia. However, it seems that protected zones along water bodies (bank protection) were of certain importance for lynx in soviet times. Thus during the 80s, it was prohibited to clear cut in forests, in a belt with a minimum width of 100 m, along all streams exceeding a length of 10 km and around lakes exceeding an area of 50 ha. Furthermore, if the streams exceeded 25 km or lakes exceeded 100 ha, the cutting of the forest was restricted within a 300-1000 m wide belt along banks. Similar restrictions also existed along the main roads and railways. Such restrictions, as well as the extensive cutting methods carried out in the forests in collective farms, as opposed to the intensive cutting taking place in private owned forest now, are thought to be management methods which are generally good for the conservation of lynx habitats. In fact, those woodlands provide extremely good corridors for lynx migrations.

REQUIRED ACTIONS

1. Broad policy

The goal is to maintain the still favourable status of the lynx population in Latvia. To do this crucial tasks include that:

- there is no further fragmentation of the wooded land in Latvia which is lynx habitat;
- there is no further increase in area where lynx is absent;
- public accepts lynx presence, at least in less populated ecosystems and that public does not regard the lynx as a harmful competitor nor an obstacle to economic activities. Ideally the public should gain satisfaction from lynx presence. Such a positive attitude would also present a good foundation for building of wide environmental awareness in the future;
- the functions of the lynx in ecosystems (food, dens, migrations and dispersal) are maintained as close as possible to the natural ones;
- controlled sport hunting is still possible.

The framework for the conservation strategy is showed on page 28.

2. Required legal status

Taking the current status of the lynx in Latvia and neighbouring countries into account, it is recommended that the species is maintained under the list of game animals. As it was proposed in the ecological part of this document, the closed season should be extended so it covers the period from 1st April until 30th November. Prohibited means of hunting have to be harmonised between national and

international legislation following to the Annex VI of EU Habitat directives (92/43/EEC). Most of those means have never been allowed in Latvia and there are no records on using them by poachers. The methods which should be particularly mentioned as prohibited ones are:

- any kind of traps;
- automatic or semi-automatic weapons with a magazine capable to hold more than two units of ammunition.

The current Hunting regulations do not allow drive hunting for taking lynx. This restriction has been rarely observed. From the viewpoint of population ecology there is no reason to prohibit lynx shooting by drive hunters if it would not start from 1st October, as it was often done so far.

3. Habitat protection and lynx protection within protected areas

As long as the present population status is stable, there is no need to design specially protected areas for lynx, but hunting of lynx should be prohibited in existing nature reserves, national parks and other sufficiently large protected areas in future. This is of particular importance to the Kemeru National Park, which is expected to be an important link between eastern and western sub-populations. A hunting ban of up to two years is suggested for the district of Daugavpils head forestry and the parts of Riga and Jelgava head forestry districts stretching out of Kemeru National Park. There is seen no need to limit forest use outside the protected areas to favour the habitat conditions of lynx.

4. Regulations for exploitation

The harvesting of lynx population in Latvia can be allowed if the following restrictions listed below will be included into relevant legal acts. The restrictions are that:

- (1) hunting should only be allowed according to Hunting regulations from 1st December till 31st March. The season can be shortened by authorities if quota is applied. During the rest of year, the killing of lynx without special permit should only be allowed near places where lynx attack the livestock and first after the accident has been documented by a written statement (if a lynx has entered human settlements or worried domestic animals, it should be killed and immediately after this should be reported to the veterinary service);
- (2) they should only be shot with legal hunting firearms and during the day time;
- (3) only in areas used for general hunting both drive hunting and individual hunting is allowed using hounds or without hounds;
- (4) hunting may only occur in specially protected areas, when special permits are written out by the Ministry of Environmental Protection and Regional Development. Reasons for hunting in these areas should be in case of predation upon livestock or for scientific purposes;
- (5) it should be obligatory to report about each legally killed lynx to the nearest state forestry office within 3 days;
- (6) once a dead lynx is found or accidentally killed (by traffic etc.), it has to be documented in a statement and reported to the nearest state forestry office within the same or subsequent (if night time or weekend) working day.

5. Minimisation of conflicts with humans

A standard procedure for declaring, registering and examining damages done by carnivores to livestock should be developed. In places where repeated attacks by lynx occur, hunting with special short-term permits can be allowed regardless of hunting season. If damages were significant, a compensation system should be available. An extensive summary on international experience is available on this subject – “Compensation for damage caused by bears and wolves ... “ (see the list of references). Especially, damages in protected areas should be of high priority for compensation. Thus if a pilot project on damage prevention is to be initiated, it should evidently be carried out within protected areas or their buffer zones.

6. International co-operation

Latvian experts must make the most of being involved in the Pan-European network: *The Large Carnivore Initiative for Europe (LCIE)*, which was initiated in 1995 in Italy. It is supported by the World Wide Fund for Nature (WWF), governmental officials, international organisations and Conventions and interested individual researchers, managers, and citizens across Europe. The goal is to create a network, which will ensure the coexistence of brown bears, lynx, wolves and wolverines with people throughout the current and modern Europe. Recently, the LCIE has made action plans for all mentioned species and tasks for all countries of concern including Latvia are also integrated in the plans. The Action Plan for the Conservation of Eurasian Lynx in Europe was compiled by Urs Breitenmoser et al. (1998).

A contact person for LCIE group is:

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In April 2000, the *Baltic Large Carnivore Initiative (BLCI)* was established in close co-operation with LCIE. Its main task is to develop a strategy and framework for large carnivore conservation with special consideration placed on the specific characteristics of Baltic States. The goal of this strategy is “thriving populations of large carnivores, having a widespread public acceptance, managed in a scientifically based and responsible way that balances the need for conservation, harvest and the use of other natural resources in the Baltics”.

A contact person for BLCI group is:

Žanete Andersone (see the Table on next page)

7. Advisory capacity

Table 3

Institutions and individual experts	Addresses and contact persons	Professional awareness
the Ministry of Environmental Protection and Regional Development	Vilnis Bernards Peldu iela 25, Riga, LV-1494 Phone: +371 7026524, Fax: +371 7820442, E-mail: mopsis@varam.gov.lv	Permits for export/import, hunting and catching in special protected areas, public awareness
State Forest Service	Janis Baumanis 13. janvara iela 15, Riga, LV-1932 Phone/Fax: +371 7212776, E-mail: baumanis@vmd.gov.lv	Monitoring, hunting
WWF Latvian office	Ugis Rotbergs Elizabetes iela 8-4, Riga, LV-1010 Phone: +371 7505640 Fax: +371 7505651, E-mail: wwf@com.latnet.lv	International co-operation, public awareness
Latvian University Department of Biology	Prof. ass. Dr. Janis Priednieks Kronvalda bulv.4, Riga, LV-1842 Phone: +371 7325593, E-mail: jpriedn@lanet.lv	Ecology, education
Latvian Fund for Nature	Maris Kreilis Kronvalda bulv. 4, Riga, LV-1842 Phone: +371 7322852 Fax: +371 7830291	Public awareness, international co-operation, research

Latvian Mammalogical Society	Valdis Pilats Kristapa iela 30, Riga, LV-1046 Phone: +371 7614808	Ecology, research, public awareness
Latvian Hunters' Association	Juris Rankevics Ormanu iela 26, Riga, LV-1002 Phone: +371 7228257	Game management, contacts to hunters' clubs
Žanete Andersone	Kemeri National Park, "Meža maja", Kemeri, LV-2012, Jurmala Phone: +371 7765386 Fax: +371 7765040, E-mail: kemeri@vdc.lv	Ecology, research, international co-operation, Baltic Large Carnivore Initiative
Janis Ozoliņš	State Forest Service, 13. Janvara iela 15, LV-1932, Riga Phone: +371 9364528, E-mail: vmi-riga@latnet.lv	Ecology, monitoring, public awareness
Karlis Vismanis	Kronvalda bulv. 4, Riga, LV-1842 Phone: +371 7325593	Parasitic infections
Alda Pupila	Kronvalda bulv.4, Riga, LV-1842 Phone: +371 7325593, E-mail: sb60027@lanet.lv	Age determination
Agris Strazds	State Stock Holding Company "Latvian State Forest" Kristapa iela 30, Riga, LV-1046 Phone: +371 7602075 +371 9343702 E-mail: a.strazds@lvm.lv	Game management, eco-tourism

8. Research and monitoring (Work Agenda A, C – page 28)

Monitoring tasks: to follow changes of distribution pattern, population size, reproduction rate, animal condition and health, abundance and quality of habitats as well as trends in human dimensions.

Duration: 2001-2003

Methods, suggested to be continued and developed:

1. Recording of lynx presence-absence per forestry unit provided by foresters and hunters. Data can be used for distribution monitoring.
2. Peoples recording activity about killed individuals. Data can be used for distribution monitoring and as an index of public attitude and interest in species conservation.
3. Snow tracking to estimate population density and habitat use. Preferably, this should be organized yearly by experts throughout a head forestry district or in a few districts simultaneously. Three or four people from the professional staff of the State Forest Service should be involved for at least one day. Their task should be to survey each fresh found track of the lynx and they should be provided with maps (or GPS) and mobile phones.
4. Recording of the frequency of border crossings.
5. Collecting and laboratory examination of killed individuals (at least 30 lynxes per year). Records on morphometrics, reproductive evidences, age, parasites and diseases should be obtained. Data will characterize viability and capacity of self-reproduction in the population.
6. Damage counts if present.
7. Epizootic information from State Veterinary Service.
8. Data on foraging by analyses of stomach contents and scats. Data will show the trends in habitat quality and food supply. Involvement of students from university is desirable in studies, because these investigations are especially time consuming.

The main task of the scientific research is to provide conservationists with new knowledge, which is the platform for an effective conservation strategy. Only by knowing the requirements of the species, can one carry out sensitive monitoring and convincing education material. Priority should be

given to investigations of home ranges and patterns of habitat use. Radio-tracking of 1-2 lynx individuals (preferably implantation of transmitters in pups) should be started. The main gaps in the present knowledge are thought to be as follows: (1) evident explanation of preliminary results; (2) evidences that the present net of protected areas in Latvia (in future Natura 2000) is really sufficient for lynx conservation; (3) proposals to improve the monitoring system and to explain results; (4) further development of the conservation policy through improved public awareness.

9. Education and public awareness (Work Agenda D – page 28)

Public awareness is likely the main priority in Latvia to develop the policy of large carnivore conservation.

The goal for public awareness and education is to change the very negative public attitude, which means that people will not accept any conservation measure. This attitude can be changed by providing sound scientific information about the lynx, its life history, functions in ecosystems etc. Presently the wild cat is only associated with predation on roe deer. Knowledge about females' care for the kittens might be of particular importance in educational campaigns. Only the most interesting and easily understandable materials should be used for this purpose.

It would be recommended to focus the public awareness campaigns on the lynx as a representative for all the threatened carnivores. It is essential to link knowledge about species with the natural environment in general and this education should take place on a regular base.

The main target groups in Latvia are hunters, foresters, students, tourists, and land owners. Awareness of journalists is of particular importance also because their contribution will be extremely important, and free of charge, for conservationists.

The executors promoting public awareness should initially be national experts (see Table 3, page 25) on the species who are employed by educational, governmental and non-governmental institutions. International knowledge should also be used.

A contact person at international level in the field of human dimensions:

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10. Approximated costs for required activities

Action	Duration	Costs in LVL
Approximation of national legal acts to requirements of species conservation and international standards	2001	-
The preliminary study of damage problems	2001	1500,-
The monitoring	2005	3000,- per year or 15 000,- for 5 years
Expert assistance in building public awareness	permanent	-
Compensations for caused damages	?	?
Radio-telemetric investigations	2004	40 000,-
Elaboration of Action Plan for the next triennium	2003	3000,-