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Abstract: The plan is structured in three main units. The first unit deals with the methodology of its preparation. Due to a specific innovative approach to the method of formulating the management plan we deemed it necessary and, hopefully, beneficial to include a detailed description of the management plan formulation. The following, i.e. the second unit provides a summarized insight into the essentials of the management plan preparation such as the description of relevant regulations and documents, the biology of the Eurasian lynx, its number and distribution in Croatia and similar. And finally, the third unit is the management plan itself, specifying all necessary and conditionally necessary actions required to achieve the management plan objective and the manner in which these actions are to be undertaken.

STATE INSTITUTE FOR NATURE PROTECTION  
REPUBLIC OF CROATIA



**LYNX**

**Management  
Plan  
for Croatia**





# LYNX

Management  
Plan

for Croatia



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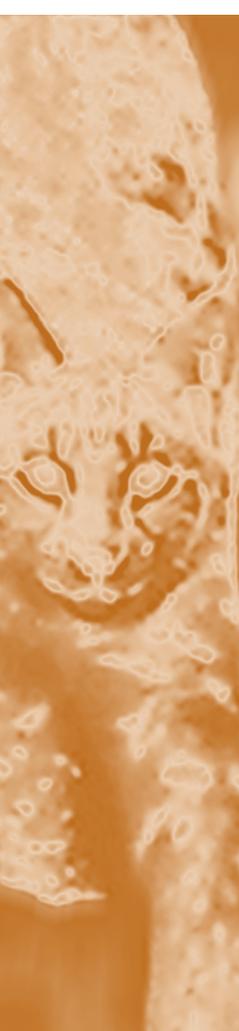
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Croatian Forests, Forest Administration, Gospić Branch Office, Korenica Forestry Office

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# Table of Contents

<b>Foreword</b> .....	5	Habitat capacity .....	30
<b>Summary</b> .....	6	Estimates of the lynx status and number in Croatia .....	31
<b>Introduction</b> .....	7	Impacts of man and rival Species .....	34
<b>Methodology of Management Plan</b>		Direct human impacts on the lynx .....	34
<b>Preparation</b>		Impacts on lynx prey .....	34
Wildlife Population Management .....	9	<b>Lynx Management Plan</b> .....	36
Public Involvement in Decision-Making .....	9	A. Objective.....	36
Key Steps in Management Plan		B. Desired and Possible Capacity .....	37
Preparation .....	11	C. Zoning.....	37
<i>Step I</i> .....	11	D. Activities.....	37
<i>Step II</i> .....	12	<i>Research and monitoring</i> .....	37
<i>Step III</i> .....	12	<i>Interventions in the lynx population</i> ...	40
<i>Step IV</i> .....	13	<i>Interventions in the prey population</i> ...	40
<b>Background for the Preparation of</b>		<i>Habitat</i> .....	42
<b>Lynx Management Plan</b> .....	14	<i>Damage to domestic animals</i> .....	42
<i>Historical Background</i> .....	14	<i>Systematic monitoring of public</i> <i>attitude</i> .....	43
<i>Autochthonous population</i> .....	14	<i>Raising public awareness</i> .....	43
<i>Re-introduced population:</i> <i>colonization, shooting, trends and</i> <i>research (1974-2000)</i> .....	15	E. Plan Implementation	
<b>Regulations and Documents</b> .....	20	<i>Co-operation of all interest groups</i> <i>in the management</i> .....	44
<i>International regulations governing</i> <i>issues of Eurasian lynx conservation</i> ...	20	<i>Committee for Monitoring of Large</i> <i>Carnivore Populations</i> .....	44
<i>National regulations and documents</i> <i>governing conservation of lynx</i> <i>(Lynx lynx)</i> .....	22	<i>Competent ministry</i> .....	45
<i>Inspection and game-keeper services</i> ...	45	F. Plan Revision .....	46
<i>Recommendations for the Action Plan</i> <i>for Eurasian Lynx (Lynx lynx)</i>		G. Plan Funding .....	46
<i>Conservation in Croatia</i> .....	25	<b>Bibliography</b> .....	47
<i>Eurasian Lynx (Lynx lynx) Biology</i> .....	27	<b>Annex</b> .....	49
<i>Lynx Number and Distribution</i> .....	30		
<i>Habitat</i> .....	30		

## Foreword

Croatia is one of few European countries inhabited by all three large carnivores: the lynx, the wolf and the bear. The lynx is, unfortunately, the only species whose autochthonous population has been exterminated from Croatia as a result of man's irresponsible behaviour towards nature. The presence of the lynx has, namely, always been in conflict with interests of man, which is consequently the reason for its extermination from the most part of Europe too.

Owing to the process of re-introducing the lynx into Slovenia in the early 70s it returned to Croatia by crossing spontaneously the border. This population of the lynx has survived in Croatia until today, testifying to a raised level of awareness of the need to protect nature. Each species has its place in nature and is necessary for the maintenance of the natural balance. The loss of any species for nature means also its loss for man in the long run.

It is often emphasized that Croatia is characterized by a well-preserved nature. The principal objective of nature protection is to preserve this wealth and prevent the disappearance of any species, even in case of the so-called "problematic" species. The preservation of the lynx and other carnivores requires necessarily co-operation of all interest groups and a common agreement on the manner in which a specific species may be preserved, at the same time minimizing all possible conflicts. It is only in this way that lynx protection may be ensured in practice, rather than on paper only. This has also been the leading idea when preparing the first plan for the management of a carnivore in Croatia – the Lynx Management Plan. For the first time the representatives of various interest groups, from hunters and livestock breeders to nature protection associations, have decided to talk so as to be able to formulate this Plan by bringing in line opposite viewpoints. This process was ardently supported by Ms. Aleksandra Majić-Skrbinšek, a postgraduate student of Prof. Alistair Bath from the Memorial University of Newfoundland, as the workshop moderator. The same approach was applied to preparation of the Plan for the Wolf Management in Croatia.

The Lynx Management Plan was officially adopted by the decision of the Minister of Culture on 7 December 2004.

The next step is the Plan implementation, which will only be possible providing the co-operation of experts and representatives of all interest groups, because nature protection and conservation of rare species is an obligation of all of us, rather than just a narrow circle of people.



## Summary

The goal of this Management Plan contains three main objectives. Firstly, it is to ensure a long-term survival of a viable lynx population in Croatia. The second component is to eliminate or mitigate the conflicts among lynx and people. Finally, the third component is to synchronize the planned actions with the respective actions in the countries with which Croatia shares the lynx population, namely Slovenia and Bosnia and Herzegovina.

In areas with continuous presence of lynx, the goal is to attain lynx population density of one individual per 100 square kilometres. Subsequently, the desired size of the lynx population in Croatia is between 75 and 100 individuals. Areas with occasional presence of lynx and areas with no presence of lynx were also defined. It was recommended that management actions do not depend on the momentary status of the population, but on the spatial zoning proposed by this plan, except in protected areas with higher level of protection (national parks, strict and special reserves) in which all living organisms enjoy permanent protection against possible interventions in their populations.

Activities proposed by this Management Plan address the following issues: biology research and monitoring of the population (collecting the remains of the dead lynx, radio-telemetry, monitoring of the lynx and its prey populations), interventions into the lynx population, non-consumptive exploitation of the population, interventions in the prey populations, activities for conservation and improvements of the lynx habitat, mitigation of conflicts due to possible damages to livestock and prevention of those damages, documenting and monitoring of public attitudes toward lynx and lynx management and raising public awareness of the lynx by using targeted information and education campaigns.

Cooperation of all interest groups with the competent Ministry, the Committee for Monitoring of Large Carnivore Populations and other government services is crucial for implementation of actions proposed by this Plan.

The Lynx Management Plan will undergo a process of revision within a time period of maximum two years from the day of its finalization. Subsequent revisions will follow as necessary. The revision will be carried out by representatives of all interest groups. The methodology to be used is the same as for the preparation of this Plan (through workshops).

## Introduction

Large carnivores such as the lynx, the wolf and the bear belong to the top of the food chain of mainland ecosystems and represent an important component of biodiversity. However, it is precisely this role in ecosystems that makes them often direct rivals to man. This applies particularly to their diet base, which is at the same time the subject of economic exploitation by man for the purpose of diet, hunting and other interests. Therefore these species are extremely threatened and their presence testifies to the biodiversity value and conservation level of a specific country. The consequences of adverse human impacts may be best seen in West-European countries, where these species have been almost completely exterminated. Recognizing the importance of preserving biodiversity these countries are making every effort and investing considerable amounts in re-introduction programmes. Croatia is, however, still inhabited by large carnivores and their survival in this area must unquestionably be ensured in the future too. This is important for conservation of biodiversity both in Croatia and in Europe and the world too.

Due to their relationship with man, as mentioned earlier, the conservation of large carnivores represents one of the most complex nature conservation problems. One of the steps in resolving this problem is the preparation of management plans which represent specific instructions with respect to measures to be taken so as to preserve populations of large carnivores in a long run and ensure a harmonious co-existence with man. Here we imply the conservation of the so-called viable population or rather population, whose quantitative and qualitative values allow its survival under conditions of being exposed to natural and human impacts. Since nature is ignorant of borders between countries, viable lynx populations are in most cases distributed over the areas of several states. For that reason the lynx management in Croatia has been considered in the context of international or rather regional co-operation, emphasising the need for this plan to be in line with the existing or future plans of the neighbouring states – Slovenia and Bosnia and Herzegovina. The management plan is prepared within the framework of the current legislation, particularly in compliance with international obligations of the Republic of Croatia as a signatory or a party to the majority of international treaties in the field of nature conservation.

The lynx management plan is a result of a close multidisciplinary co-operation of a number of interested experts from Croatia or rather representatives of various interest groups from the neighbouring Slovenia and Bosnia and Herzegovina. In organizing the work on the management plan oral instructions given by Prof. Dr. Alistair Bath (Memorial University of St. John's, Canada) were applied in principle. The Plan was prepared through joint workshops with harmonized opinions for management of Lynx in Croatia. The workshops were moderated by Aleksandra Majić-Skrbinšek. In preparation of the management plan the participants of the workshops supported primarily their personal views.



**Figure 1.** Eurasian lynx (*Lynx lynx*). (B. Kulić)

The plan is structured in three main units. The first unit deals with the methodology of its preparation. Due to a specific innovative approach to the method of formulating the management plan we deemed it necessary and, hopefully, beneficial to include a detailed description of the management plan formulation. The following, i.e. the second unit provides a summarized insight into the essentials of the management plan preparation such as the description of relevant regulations and documents, the biology of the Eurasian lynx, its number and distribution in Croatia and similar. And finally, the third unit is the management plan itself, specifying all necessary and conditionally necessary actions required to achieve the management plan objective and the manner in which these actions are to be undertaken.

# Methodology of Management Plan Preparation

## Wildlife Population Management

One of the numerous contemporary definitions of the wildlife population management describes the wildlife population management as a dynamic, objective and targeted process going on in the environment along with the culturological, economic, political and ecological components. The culturological component covers traditions, religions, values and philosophies of the general public, specific interest groups and decision-makers (competent government institutions) (Decker et al., 2001b). Although the ecological component was traditionally more emphasized than “social” components, today it is evident that wildlife management, as an activity based on human values and primarily focused on “managing” interactions between humans and the wildlife, must also contain all “social” components. According to Decker et al. (2001b) the culturological component has, as a rule, the strongest effect on the establishment of objectives in the wildlife population management, and social values contained in these objectives represent the principal moving force. The area of the “human dimension” in the wildlife management seeks to investigate the ways in which humans evaluate the wildlife, how they would like to manage these animals and how they effect the wildlife, but also how the wildlife and its management affect the humans (Decker et al., 2001a).

In a democratic society the wildlife is managed by competent government institutions on behalf of the electoral body. In doing this the decision-makers apply combinations of biological and sociological methods with increasing frequency. From the viewpoint of a human dimension the conflict between humans and the wildlife may only be deemed solved when interest groups involved consider the conflict solved (Decker and Chase, 2001). One of the ways to solve the wildlife management problems used with increasing frequency is a direct involvement of the public and interest groups in the decision-making.

## Public Involvement in Decision-Making

Public involvement in the decision-making is a process through which viewpoints of all interested parties are incorporated in the decision-making procedure (Praxis, 1998). The selection of the way to involve the public is at present one of the major challenges facing the decision-makers in the field of wildlife population management (Decker and Chase, 2001). Various ways of public involvement are shown in Table 1.

**Table 1.** The scale of public involvement forms – “persuasion” represents the lowest and “autonomous decision-making” the highest level of public involvement (accepted from Praxis, 1998). “Joint planning” was chosen for preparation of this lynx management plan.

Public involvement levels	Description
Persuasion	Application of various techniques for public involvement in an effort to change public attitudes, but without arousing expectations of the public to participate in planning processes.
Education	Dissemination of information and general instructions with the aim to raise public awareness of programmes and related issues.
Feedback	Furnishing, on the part of the state, of information on the status of planning a specific programme on which the State has taken a definite position, and at the same time making a request for feedback on public views in this regard.
Consultation	Formal dialogue between the state and the public based on mutually accepted and originally determined objectives.
→Joint planning	Joint decision-making. Representatives of the public participate in government commissions and have equal right to vote. Issues under consideration must be geographically defined and understandable to representative of the public.
Transfer of responsibility	Transfer of responsibilities usually associated with government agencies to the public or another level of government apparatus possessing adequate competence.
Autonomous decision-making	Immediate implementation of the entire planning process by the public.

Despite the fact that some of the ways of public involvement (persuasion and education) indicated above represent the one-way flow of information, public involvement should be a two-way communication aiming at good quality decisions to be taken by a specific government agency or the state as a whole.

Advantages of public involvement (Praxis, 1998):

- quality improvement of decisions taken;
- management efficiency improvement;
- saving of time and money;
- facilitation of plan implementation;
- avoidance of major conflicts;
- maintenance of credibility and legitimacy;
- improvement of management competence;
- provision of possibilities of joint actions;
- development of public competence and inventiveness;
- more conformity.

For the purpose of formulating the plan for lynx management in Croatia a comparatively high level of public involvement has been selected. “Joint planning” includes joint decision-making and, in some cases, joint actions too. Public involvement was carried out through a number of moderated working meetings

- “workshops”, in which representatives of various interest groups and representatives of the competent ministry (the former Ministry of Environmental Protection and Physical Planning) participated on equal terms. The functioning of workshops and experiences gathered are described briefly under Head C. Key Steps in Management Plan Preparation and an example of a report on one of the workshops may be found in Annex 1.

It is particularly important to note that such a method of work presupposes willingness on the part of the competent government institution to involve the general public.

## Key Steps in Management Plan Preparation

### Step 1

**Selection of the workshop moderator.** The person selected as the workshop moderator should represent an autonomous, neutral party in whose presence all workshop participants feel comfortable. The moderator must be flexible and devote his/her attention equally to all participants in the process.

**Identification of interest groups.** The entire process must be constantly open to all interested parties. Before the process itself starts certain effort is to be made to inform all possibly interested parties about the intention to start the process of involving the public in decision-making. Workshop participants must be willing to express their interests, listen to the others and discuss the principles rather than positions.



**Figure 2.**  
One of the workshops on  
the Lynx Management  
Plan (26 February 2002)  
(D. Huber)

Apart from the representatives of the competent ministry, the representatives of the former Ministry of Agriculture and Forestry, the former Ministry of Tourism, the Ministry of Defence, the Croatian Forests Directorate and individual forest administrations or rather forest offices, the Croatian Hunter’s Association, the Faculty of Veterinary Medicine of the University of Zagreb, the Faculty of Biotechnical Engineering (Ljubljana, Slovenia), the Forests Institute (Ljubljana, Slovenia), the Forests of Herzeg-Bosnia (Mostar, B&H), the Faculty of Science of the University of Zagreb, the Green Action and other interested individuals took part in the preparation of the lynx management plan too.

**Venue selection.** Workshops are to be held at a neutral place (e.g. local sports hall, local school, local community centres, etc.) where all participants will feel secure enough to express their views. Due to financial constraints, in case of the present management plan these criteria were observed in case of the first workshop only, which took place in a local hotel in Gračac. All subsequent workshops were held at the premises of the competent ministry, which might have affected the quality of public participation in the process.

## Step II

The first workshop started with the following question: Are all interested parties present? The representatives of various interest groups and process planner will, namely, recognize all possible interest groups with less difficulty together than the planners alone.

Afterwards, in order to ensure an effective discussion the following discussion rules were defined:

- To avoid long monologues, the speech duration was limited, as a rule, to 30 seconds, whereby only one idea could have been expressed at one time.
- All ideas were written down on square cards, subsequently displayed on large boards so that the discussion could have been followed easily.
- Questions and comments on ideas were written on oval cards of a different colour, additionally indicated by a red arrow and displayed beside the respective square cards.
- And finally, the most important message repeated at the beginning of each workshop was: By saying “yes” when we mean “no” we make problems even more serious.

After having defined the discussion rules, the “ice-breaking exercise” followed, in which the participants expressed their expectations with respect to the process. For that purpose they were offered a simple statement of “I know why I am here”.

The following important exercise enabled the moderator to get an insight into the spectrum of key issues and use them to plan the following workshops. The participants were required to think about the reasons for and against the lynx in Croatia. Then the reasons stated were grouped and issues such as “biodiversity” identified.

## Step III

**Formulation of a common vision and basic values.** The participants were randomly divided into groups of 3 to 5 persons and required to formulate and express their vision of Croatia in thirty years, firstly by means of a drawing and then in one sentence, placing an emphasis on the role of the lynx.

**Identification of advantages and barriers to realization of the vision.** The participants, still divided into groups, tried to recognize barriers to and advantages of realizing the visions as defined in the previous exercise. This exercise made it possible to identify topics and issues to be taken into consideration when

preparing the management plan. The topics thus identified were subsequently prioritized, i.e. divided into three groups – high, medium and low priority groups.

Formulation of objectives. After having identified and prioritized the topics, specific objectives in relation to topics must be established. These objectives represent basic management plan principles.

Identification of work method for individual issues arising from the objectives. At this stage actions were formulated as a method of tackling individual problems. In doing this the <SMART> approach was applied. This means that each action must be specific, measurable, attainable, realistic and timed. For each action tasks were set based on the following questions:

- What is the task?
- What is the desired final result?
- Who should be responsible?
- How much would it cost?
- Where the finance can be secured?
- What is the first logical step?
- Which current projects and processes would be affected?

### *Step IV*

After that individual representatives of various interest groups and the competent Ministry were tasked with drawing up certain parts for the printed version of the management plan. These texts were repeatedly edited by the entire working group using computers and a multi-medial projector.

And finally, it should be noted that this is a comparatively slow process of management plan preparation. However, the preparation of management plans by only a narrow group of experts may, at the first glance, seem more cost-effective, but often entails ignoring of the views of diverse interest groups and consequently results surely in a management plan that will not be approved by all interest groups and whose implementation will be either limited or even next to nil. Nevertheless, public involvement in the management plan preparation cannot guarantee success, because it depends to a large extent on the will of all participants i.e. interest groups to solve the problems.

The credibility of decisions taken in the course of the process of public involvement in the management plan preparation is to be continuously verified along with the general public by a public opinion survey among a statistically representative public sample.

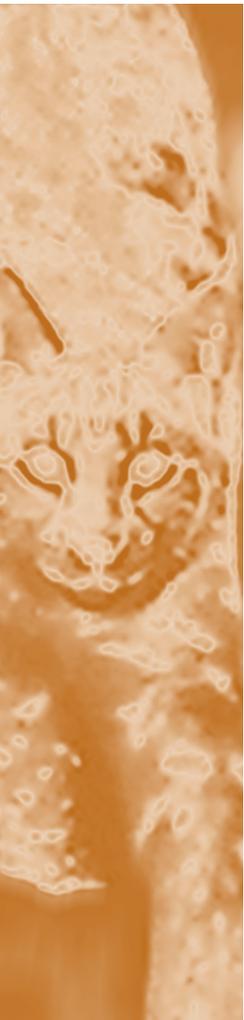
# Background for the Preparation of the Lynx Management Plan

## Historical Background

### *Autochthonous population*

In the past the lynx ranged through much of the European continent. Treated as a harmful and unprotected carnivore, it was extensively hunted and extirpated. Deprived of any protection, it has so far survived in the Carpathians and in the point furthest to the southeast of the Dinaric Alps only, where it is threatened by extermination. The last individuals of the autochthonous lynx were caught in Slovenia (Kos, 1928), Serbia (1908), Bosnia and Herzegovina (1911), Montenegro (1913) and Bulgaria (1935). In Croatia the lynx stayed longest in Gorski kotar and on the Velebit Mountain. One of the last lynxes in the Risnjak massif, in the area of the present Risnjak National Park, was captured and “shackled” in 1854 (Hirc, 1989). The last lynx in Croatia is believed to have been trapped in the forests around Tršće in Gorski kotar in 1903 (Koritnik, 1974).

The only find of lynx remnants from prehistory in Croatia comes from the Velika pećina cave on the Ravna gora Mountain in the north-western part of Croatia. Malez (1986) was the first to determine the find of the upper left canine, subsequently reviewed and confirmed by Gužvica (1996). The stratigraphic position of the tooth points to an age of about 10,000 years, which means the end of the last ice age.



**Figure 3.**  
Skin of a killed lynx  
(Đ. Huber)



**Figure 4.** The area where the first lynx in Croatia was observed – the mountain meadow of Lazac, the Risnjak National Park (A. Frković)



**Figure 5.** The first lynx shot in Croatia (Snježnik hunting ground, Gorski kotar, 1978) (A. Frković)

Little is known about the diluvial lynx in the adjacent Slovenian area, much as in the larger part of Europe. The oldest known evidence of the lynx in the area of Slovenia dates back to the time of pile dwellings in Ljubljansko barje (4,000 years B.C.). In 1875 a well preserved lower jaw of a lynx was excavated along with bones of other animals on the southern edge of Barje close to Igo, which is considered the oldest known evidence of the lynx presence in the area of Slovenia (Kos, 1928).

### *Re-introduced population: colonization, shooting, trends and research (1974-2000)*

By releasing three lynx families – 3 males and 3 females – of the Slovak origin from quarantine in Kočevsko (Slovenia) on 2 March 1973 this carnivore re-appeared in Croatia by a spontaneous translocation after almost a century. The first mature individual was observed in the mountain meadow of Lazac in the Risnjak National Park (Fig. 4) on 16 June 1974, since when data have been regularly collected about the course of colonization and about lynx shot or killed in other ways (Frković, 1998). The fact that animals originating from the Slovak Carpathians were used for re-introduction is still strongly objected by hunters due to their belief that the autochthonous lynx was considerably smaller and did not prey on big game.

The first evidence of the re-colonized lynx in Croatia was found in the Snježnik hunting ground, at the Kašljevac locality (Fig. 5) on 27 September 1978. It was a two-year old female weighing 16 kg (no bowels). A year later, on an unidentified date of 1979, two lynxes were shot in Gorski kotar (at Škurina locality) and the Croatian littoral (Križišće) and one in Žumberak, the wooded area of Blaževo brdo in the County Zagrebačka.

From the Čabar area of Gorski kotar the lynx gradually spread towards the south-east. In 1975 and 1976 it already colonized the entire Gorski kotar (125,000 hectares) and the greater part of the Croatian littoral and started causing the first perceptible reductions in even-toed ungulates (roe deer, chamois, re-colonized mouflon in Grobinščina). Late in the 70s the presence of lynx was recorded in Velika Kapela, in 1980 in the Vinodol valley and Ričičko bilo, in 1981 in Javornica, the area of Drežnica and in Miškovci (Otočac) and in 1983 in the Northern Velebit area. The shooting increased in parallel with this. So in 1980 5 lynxes were shot in the area of Vrbosko, Ravna Gora, Crikvenica, Bribir and Brod na Kupi municipalities, 9 were shot in 1980 (of which the first three lynxes in the Ogulin area and in north-western Lika) and 11 in 1982. In order to prevent any further uncontrolled shooting the Republic Nature Protection Institute took the Decision on Special Protection (Mikulčić, 1982) based on the Nature Protection Act in 1982. From that year up to 1998 the shooting of lynx was only permitted under shooting quotas (special licences) approved by the institute mentioned, or rather its legal successor since 1993 – the State Directorate for the Protection of Nature and Environment. The licence to shoot lynx was based on a provision of the 1976 Nature Protection Act that allowed measures to be taken on protected species solely for scientific research purposes. It was, namely, believed that in this way scientific information on this species would be collected. On the other hand, efforts were made to reduce to a certain extent the pressure of hunters – hunting ground managers who believed that the lynx would considerably affect the number of the wildlife, especially that of roe deer in their hunting grounds. Towards this end the Institute set up the Committee for Lynx Population Monitoring in which Janez Čop, responsible for the project of colonizing the Slovene forests by lynx along the left bank of the Kupa River, participated along with the domestic experts too. One of the bases for the approval of shooting quotas was a poll. The questionnaire contained questions targeted at identification of the legal person as a respondent and also at the lynx number, its impact on the prey and requirements for measures to be taken in the lynx population. This questionnaire was regularly submitted to forest holdings or rather municipal local associations for which it was assumed to have the lynx in their respective areas. The committee used to convene twice a year, i.e. on the eve of approving the measures and analysing the questionnaires received and after the winter hunting season or rather after expiry of deadline by which it was permitted to shoot the lynx within the quota agreed. The approved measure covered between 7 and 14 individuals and was seldom implemented. The implementation of the measure included also the killed lynxes found accidentally and individuals shot outside the time, spatial and other frames as laid down. A great part of lynxes shot was submitted for the analysis to the veterinary institutes of Zagreb and Rijeka. In the Zagreb Veterinary Institute a total of 46 lynxes were analysed (Kovačić et al., 2002).

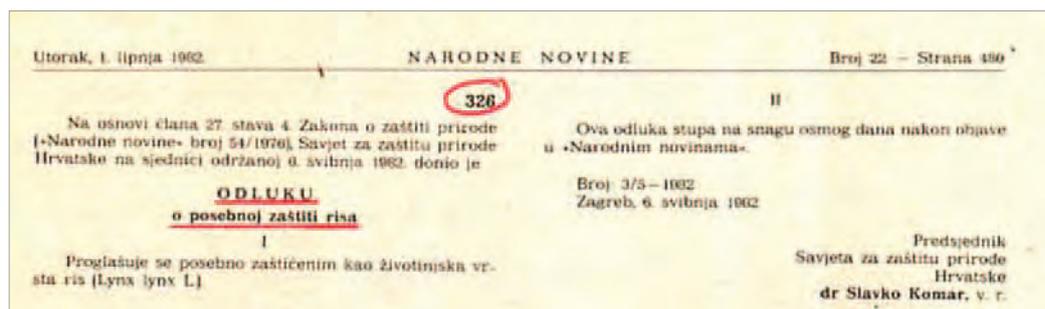


Figure 6. Decision on the special protection of lynx dated 6 May 1982

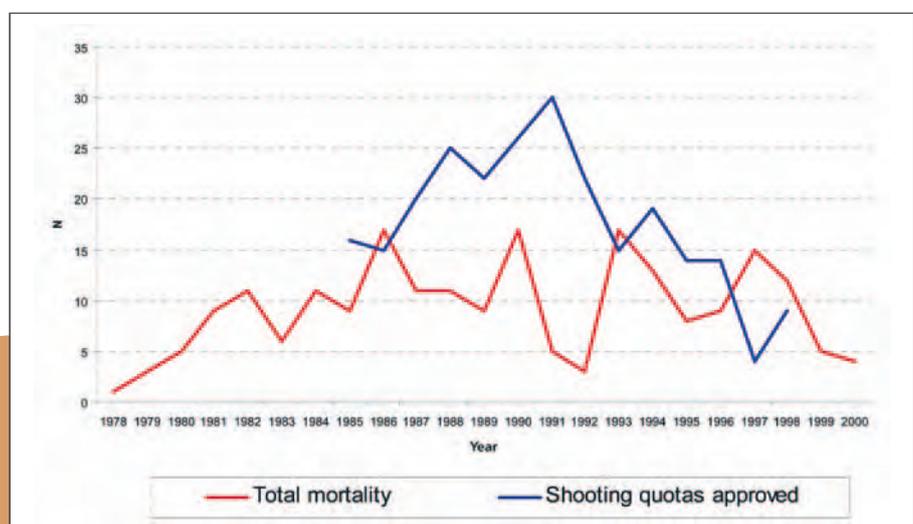
In the period from 1978 to 2000 (23 years) a total of 211 lynxes were shot or in another way killed in Croatia (Table 2). The largest documented number of lynxes was killed in the County Primorsko-goranska (135), followed by the County Ličko-senjska (56) and the County Karlovačka (11). Three lynxes were killed in the County Zadarska, two in each of the counties Istarska and Zagrebačka and one lynx each in the County Vukovarsko-srijemska and Splitsko-dalmatinska. The annual mortality rate ranged between 1 and 17 lynxes, with the mean annual value of 9.2 lynxes (Frković, 2001).

**Table 2:** Lynx mortality by counties

County	Land area (ha)	No. of lynxes killed	Share in total lynx mortality (%)
Primorsko – goranska	253,800 (mainland area)	135	64
Ličko – senjska	374,600	56	27
Karlovačka	331,100	11	5
Zadarska	-	3	1
Istarska	-	2	1
Zagrebačka	-	2	1
Vukovarsko – srijemska	-	1	0,5
Splitsko – dalmatinska	-	1	0,5
<b>Total</b>		<b>211</b>	<b>100</b>

After coming of the Decision on the Special Protection of the Lynx into force (1982) the majority of lynxes were acquired within the hunting period as permitted by special licences, or rather from 1 or 15 November till 28 February. However, despite this fact 58 lynxes were shot in the period between 1982 and 1998 beyond the quotas approved. Apart from the shooting recorded in the first 5 years (1978 – 1982) and in the period from the passage of the Decision on Lynx Protection, the lynxes shot outside the permitted hunting time included primarily individuals killed in highway collisions, by poisoned baits or trapped, captured in or close to human settlements and died for unknown reasons (Fig. 5).

**Figure 7.** Total mortality and lynx shooting quotas approved in Croatia



Considering the age 147 lynxes (70 per cent) over one year and 63 lynxes (30 per cent) under one year of age were shot in total. The age of one lynx was undetermined. Of the total number of lynxes captured 83 (39 per cent) were males and 105 (50 per cent) females. For 23 lynxes (11 per cent) the sex was not determined. With respect to the weight of lynxes captured the majority (n = 103, 49 per cent) weighed between 10 and 20 kg, which makes the total average weight of 16,3 kg.

The lynxes were killed in various ways and by various means (Fig. 8 and 9). With 157 (74 per cent) lynxes caught, shooting is well ahead of other practices, which account for 54 (26 per cent) of the lynxes. Lynx shooting took place by individual (103, 72 per cent) and collective (44, 28 per cent) hunting. The most successful individual hunting practice refers to accidental meetings with hunters in search for other kinds of wildlife, how 78 (50 per cent) of a total of 157 lynxes caught were killed. Collective hunting holds the second position with 31 (20 per cent) of the lynxes shot, mostly by chasing and hunting with pointers, and finally by waiting at a high stand close to a bait or a feeding place. In this way 19 (12 per cent) lynxes were killed, whereas other killing practices account for 9 (4 per cent) lynxes.

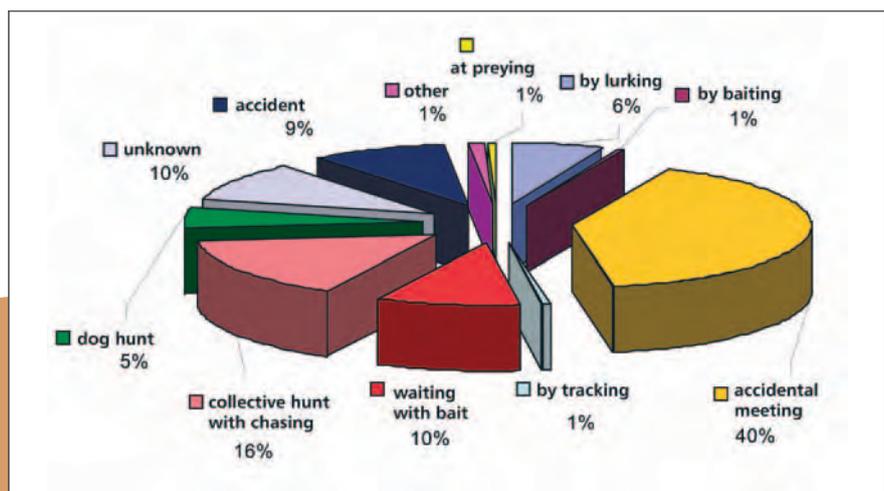


Figure 8. Lynx kill means and practices (by Frković 2001)

Other causes of lynx kills are traffic, traps, poison and other. 17 lynxes (8 per cent) were killed by collision, of which 13 collided with a car and 4 with a train. 10 lynxes were trapped and 2 died because of poisoned baits. One lynx was killed by an anti-personnel mine, one was found drowned in the sea and one cub was captured alive. In the area of Snježnik a case of a female bricked up alive was recorded. 10 lynx kills with unknown causes were recorded. In case of two lynxes killed in the settlement itself (Kuželj, the Kupa river valley, 6 May 1984, and Potkilavac, the field Grobničko, 29 January 1994) the rabies test results were positive (Fig. 10). For the lynx of Kuželj this result was later refuted. For the purpose of investigating the spread of leptospirosis with the wildlife 46 blood samples of lynxes killed in Gorski kotar were submitted for analysis in the period from 1985 to 1998, with antibodies proved in only one of them (Kovačić et al., 2002).

The re-introduction of the lynx population may be said to have had a positive effect in terms of the increased number of individuals and their distribution in the space since the appearance of the first individuals in Croatia in the mid 80s. On reaching its peak, the population seems to have stagnated and in the 90s the number dropped and stabilized at the present lower level.



Since the return of the lynx to Croatia the dead individuals were tested on rabies and some of them on Leptospira too (Kovačić et al., 2002). Since 1999 all the dead lynxes collected have been thoroughly examined in terms of morphometry, health, digestive tract contents and genetics. On 16 December 2001 the first lynx in Croatia (an 8-month old female named Bela) was furnished by a radio-transmitter close to Bijele Vodice by the Risnjak National Park border and in June 2002 located in Slovenia in the area of the Kuželjeske stijene.

Although it is a matter of a re-introduced population, already controversial due to this very fact, no research has been carried out into the human dimension of managing this population so far, either in Croatia or in the neighbouring countries that we share this population with.

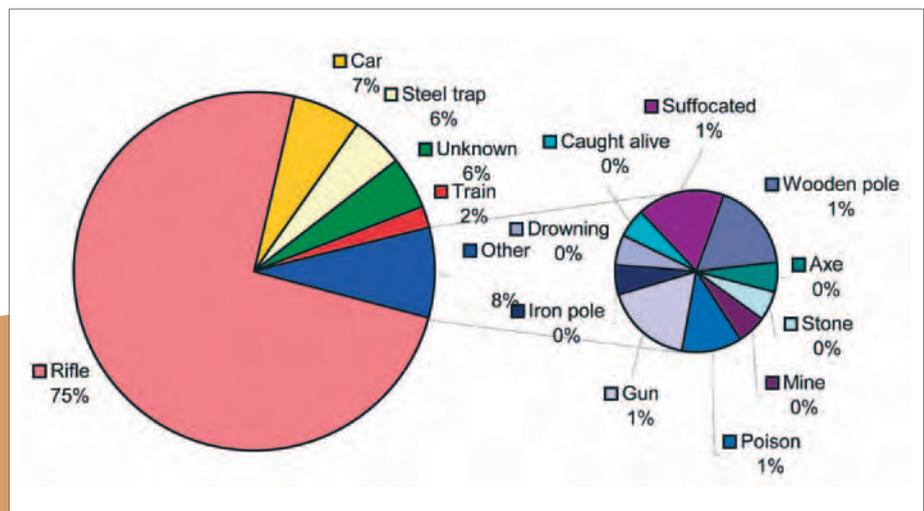


Figure 9. Causes of lynx kills (by Frković, 2001)



Figure 10. News report on a rabid lynx in the field Grobničko

## Regulations and Documents

### *International regulations governing the Eurasian lynx conservation*



- Convention on Biological Diversity (Official Gazette - International Treaties 6/96);



- Convention on Conservation of European Wildlife and Natural Habitats (Bern Convention) (Official Gazette - International Treaties 3/5/00);



- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Official Gazette - International Treaties No. 12/99);



- Directive on the Protection of Natural Habitats and Wild Fauna and Flora (Habitat Directive) (No. 92/43/EEC);
- EU Regulation on the Protection of Species of Wild Fauna and Flora by Regulating Trade (No. 338/97 of 9 December 1996).

The Republic of Croatia is a signatory to all relevant international regulations in the area of nature protection and has thus joined the international community in nature protection on a global scale. One of these regulations is the Convention on Biological Diversity that Croatia ratified in April 1996 and in this way committed itself to conservation and improvement of the current biological diversity and sustainable utilization of its components.

In 2000 the Republic of Croatia ratified the Convention on Conservation of European Wildlife and Natural Habitats (Bern Convention) that lays down all the measures to be taken by the European countries in the protection of wild species as specified in relevant Annexes and their habitats. In Annex III to the Bern Convention the lynx (*Lynx lynx*) is indicated as a protected species whose population may be managed along with control and protection measures prescribed. Given its status in Croatia the lynx is treated as a species under Annex II to the Convention, or rather a strictly protected species that may not be exploited and disturbed, nor its habitat threatened. In order to ensure protection of lynx habitats, the parties to the Convention are bound to include the areas of its distribution into the ecological network of areas of special conservation interest (ASCI) or the so-called Emerald Network. In these areas protection measures must be taken and management methods applied aiming at conservation of their natural values. Exceptionally, the Bern Convention allows a deviation from the provisions stated in case that no other satisfactory solution is available and that the exception will not be fatal to the survival of the respective population. This may only be permitted if justified by flora and fauna protection; prevention of severe damages to crops, livestock, forests, fishponds, water and other forms of property; if it is in the interest of public health, air safety or other prevailing public interests and for the purpose of research and education, repopulation, reintroduction and necessary reproduction. Exceptions may only be permitted under a strict control, on a selective basis and under the condition of a limited capturing, keeping and other reasonable exploitation of certain wildlife species on a small scale. In such cases the party is bound to report in detail on exceptions made to the Standing Committee under the Convention. The Bern Convention adopted the Action Plan for the Conservation of Lynx (*Lynx lynx*) in Europe prepared by the Large Carnivore Initiative for Europe (LCIE) specifying also the recommendations relating to the action plan for the protection of the lynx (*Lynx lynx*) in Croatia too.



The Republic of Croatia is a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) which makes it obligatory to the parties to exercise control over international trade in endangered species by a system of granting import and export licences and certificates. The lynx has been listed in CITES Annex II, which means that as a species it is not, but may become threatened by international trade unless controlled.



The Directive on the Protection of Natural Habitats and Wild Fauna and Flora No. 92/43/EEC is one of the essential regulations governing nature protection in the European Union countries. The European Union member countries are obliged to incorporate the provisions of this directive into their legislation and approximation of the national legislation with this directive is an obligation of the Republic of Croatia in relation to the EU accession process.

The lynx has been listed in Annex II to the Directive covering plant and animal species that are of interest for the European Union and whose conservation requires the designation of special areas of conservation (SAC) as a part of the Natura 2000 ecological network (excepting the Finnish population), but not as a priority species. It is also included in Annex IV covering animal and plant species of interest for the European Union that require a strict protection.



The EC Regulation on the Protection of Wild Species of Fauna and Flora by Regulating Trade No. 338/97 dated 9 December 1996 governs the trade in protected animal and plant species in the European Union, or rather it represents a statutory base for implementation of the CITES in the EU area. The lynx is listed in Annex A to this regulation covering species that are endangered, extinct or rare and whose survival could be endangered by any level of international trade.

As a signatory to regulations mentioned Croatia has committed itself to take all appropriate and necessary legal and administrative measures at the national and international level so as to ensure the conservation of the lynx and its natural habitat, or rather its stable population, which is at the same time a genetic reservoir and a potential source enabling this species to colonize other European countries from which it has disappeared.

The lynx conservation problems faced by the neighbouring Slovenia are similar to those in this country. Namely, this species has been protected under the Nature Protection Act that prohibits any legal shooting of individuals, as it used to happen in emergency cases due to damage caused to livestock, and on the basis of permissions granted by the committee of the Ministry of Environment and the Ministry of Agriculture and Forestry. The Republic of Slovenia as a party to the Bern Convention is allowed to manage this species up to a certain degree, of course, and under corresponding control and protection measures as prescribed. It is presently investigating the possibility to permit shooting of several individuals yearly for the purpose of reducing the illegal hunting and a better insight into the population status.

There are two lynx protection regimes in Bosnia and Herzegovina. The 1994 Hunting Act of the Republic Srpska treated the lynx as a protected game. In the present Act it is not mentioned at all, but the future Act is expected to grant the lynx the status of a permanently protected game. The Federation of Bosnia and Herzegovina is in the process of preparing the new Hunting Act, which is also expected to grant the lynx the status of a permanently protected game (Soldo 2001).

Viewing the fact that the lynx population is distributed over the territories of the Republic of Slovenia and Bosnia and Herzegovina, both countries have expressed their willingness to co-operate with Croatia in future plans for the lynx population management and protection.

### *National regulations and documents governing the lynx (Lynx lynx) conservation*

- In 1982 the lynx was originally protected by the Decision on the Special Protection of the Lynx (Official Gazette No. 22/82) based on the 1976 Nature Protection Act.
- Nature Protection Law (Official Gazette No. 162/03);
- Rulebook on the Protection of Certain Mammal Species (Mammalia) (Official Gazette No. 31/95);
- Rulebook on the Compensation Scheme for Damages Caused by Illegal Actions taken on Protected Animal Species (Official Gazette No. 84/96);
- Law on Hunting ( Official Gazette Nos. 10/94, 29/99, 14/01);
- Animal Welfare Law (Official Gazette No. 19/99);
- Strategy and Action Plan for the Protection of Biological and Landscape Diversity of the Republic of Croatia – NSAP (Official Gazette No. 81/99).

### **Nature protection regulations**

Viewing the fact that the lynx (*Lynx lynx*), found formerly throughout many European countries and Croatia too, was exterminated by unreasonable hunting in the 18<sup>th</sup> and 19<sup>th</sup> century and re-introduced late in the 20<sup>th</sup> century, the current statutory provisions treat it as a protected species. To be more exact, the provisions of the Rulebook on the Protection of Certain Mammal Species (Mammalia) (Official Gazette No. 31/95) determine the lynx (*Lynx lynx*) as a protected species, which means that it is prohibited to harass and disturb the animal in its natural life and free development, to hide, sell, buy and seize or in any other way acquire and stuff the protected animal. It is also prohibited to export, bring out of the country and import the protected species from foreign countries. The activities mentioned may be exceptionally permitted for scientific and research purposes with the previous approval of the ministry competent for nature protection. Under the Rulebook on the Compensation Scheme for Damages Caused to a Protected Species, the killing of a lynx may be punished by a fine of 35,000 kunas.

In October 2003 a new Nature Protection Law was adopted, which has integrated all the obligations of the Republic of Croatia towards international agreements where Croatia is a party or a signatory. The new Law anticipates 2 categories of protected species, according to the Bern Convention model – (i) strictly protected species, whose protection regime is equal to the protection regime as per the 1994 law, with possibility of exceptional interventions under the conditions and in the ways defined by the Bern Convention; (ii) the second category includes protected species, i.e. those that may be used, with certain protection or control measures involved (e.g. game). The State Institute for Nature Protection is currently conducting a review of species and their categorisation.

The Law anticipates the Republic of Croatia as a promoter and supporter of scientific research in the field of nature protection. Protected species research actions require permission by the competent ministry.

The Law also prescribes that nature protection requirements need to be issued by the competent government authority in the process of natural resource management plans development. These requirements are defined on the basis of expert thematic papers developed by the State Institute for Nature Protection. If the manner or scope of the natural resources use immediately endangers the favourable state of a species or a habitat type, the minister in charge may restrict or temporarily suspend the use until the threats have been removed, with the consent of the minister in charge of managing the natural resource in question. In an event of such restrictions being imposed, owners and authorised persons are entitled to compensation proportionate to the loss of income. The compensation amount is defined by mutual agreement.

Finally, in accordance with the corresponding regulations of the European Union, the law defines special ecologically important areas, which include habitats of species threatened at national or at the European level. Protection of these areas is ensured by enforcement of prescribed nature protection measures and requirements.

## Other regulations

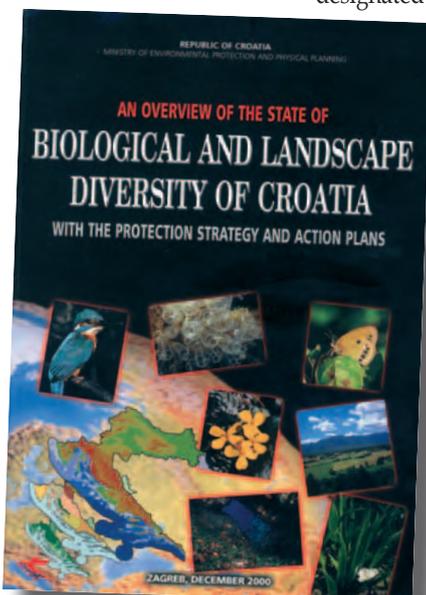
Among national regulations governing the protection of animals a mention is to be made of the Animal Welfare Law and Law on Hunting whose implementation falls within the competence of the Ministry of Agriculture, Forestry and Water Management.

The Law on Hunting regulates breeding, protection, hunting and use of game and its parts. Hunting management basis (HMB) constitutes a detailed planning document that regulates management of game and hunting grounds for a certain period, in accordance with habitat capacity and the state and populations of the game being managed. The HMB content, development methods and the procedure of enactment of the hunting management basis, game management and protection programmes in areas outside the designated hunting grounds are prescribed by separate rulebooks, which address the following issues:

- a) determining animal species populations
- b) overview of types and populations of game and animal species
- c) management of animal species
- d) management of (other, auth. note) animal species that includes measures for their maintenance and preservation.

HMB enforcement service monitors the state of predators and other animal species and implements preventive sanitary measures in the hunting grounds aimed at game and other animals' health protection.

The law requires, inter alia, for the obligatory harmonisation of the hunting management basis and the game protection programme with the ratified international agreements in the fields of hunting, protection of nature and natural game habitats, as well as the Nature Protection Law.



**Figure 11.** National Strategy and Action Plan for the Protection of Biological and Landscape Diversity is the fundamental nature conservation document.

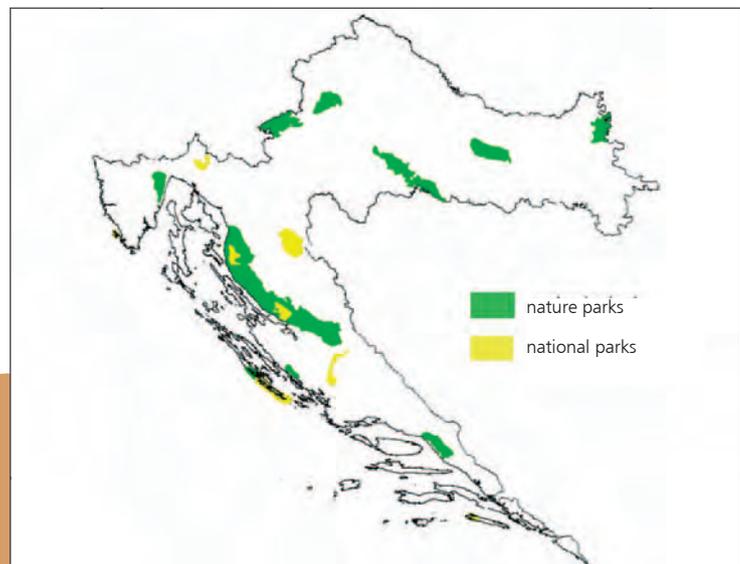
The Animal Welfare Law governs the welfare of animals with respect to their keeping, accommodation, feeding, protection and human relationship towards animals. Among other things this Act regulates also the killing of animals and the protection of wildlife in the wild. So, for example, as regards the killing of animals it has been determined when, in what way and by whom it may be performed (only by a veterinarian or a qualified veterinarian technician under the supervision of a veterinarian). The capturing of wild animals in the wild and their killing is also not permitted, unless exceptionally justified by scientific research and by providing help to a certain population.

### Documents of nature protection

In June 1999 the Croatian National Parliament adopted the National Strategy and Action Plan for the Protection of Biological and Landscape Diversity of the Republic of Croatia (NSAP) (Official Gazette No. 81/99) laying down, among other things, the obligation to prepare action plans for the protection of threatened species. It also determined the need to formulate an action plan for the protection and a management plan for the lynx in Croatia. Based on the conclusions of the meeting of the Committee for Monitoring of Large Carnivore Populations, the Department for Biology of the School of Veterinary Medicine of the University of Zagreb launched the project entitled "The Management Plan for the Lynx of Croatia" funded by the former Ministry of Environmental Protection and Physical Planning.

### *Legally protected habitat segments*

In the area of the lynx distribution, or rather in the area of the counties Primorsko-goranska, Ličko-senjska, Zadarska, Zagrebačka and Karlovačka there are 4 protected nature parts falling in the category of a national park (where economic utilization of natural resources is prohibited, with the exception of tourist and recreation activities in form of visiting and touring) and 3 in the category of a nature park (where only actions and activities are permitted which do not pose any threat to essential features and roles of the space) (Fig. 12).



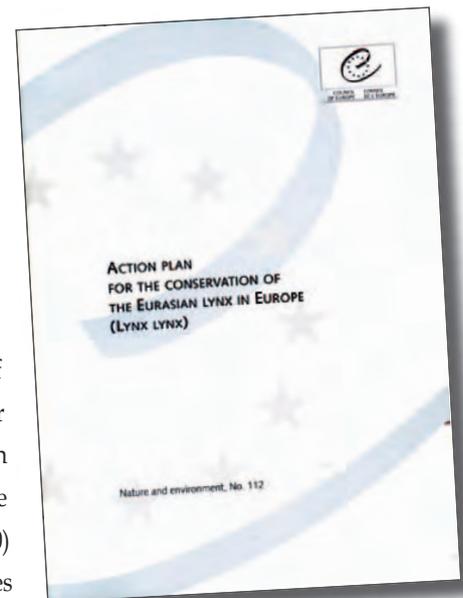
**Figure 12.** Map of protected areas in Croatia (State Institute for Nature Protection, 2004.)

**Table 3.** National parks and nature parks in the lynx distribution area

Name	Land area (km <sup>2</sup> )	Year of designation
«Risnjak» National Park	64	1953
«Plitvice Lakes» National Park	295	1949
«Paklenica» National Park	102	1949
«Northern Velebit» National Park	109	1999
«Učka» Nature Park	146	1999
«Velebit» Nature Park	2,000	1981
«Žumberak-Samoborsko gorje» Nature Park	333	1999

## Recommendations for the Action Plan for Eurasian Lynx (*Lynx lynx*) Conservation in Croatia

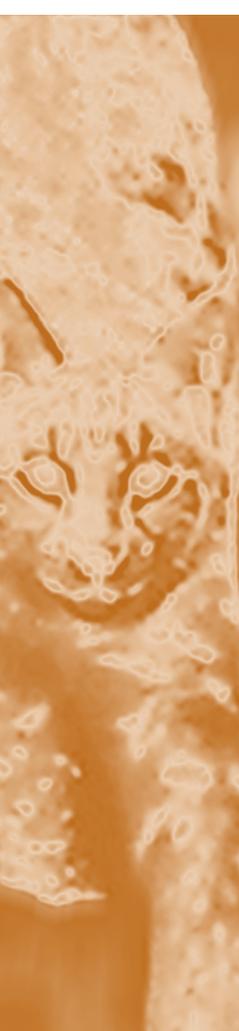
The Large Carnivore Initiative for Europe was established in 1995 with the aim to solve the problem of protecting the carnivores or rather conserving the carnivore populations (the brown bear, the wolf, the wolverine, the Eurasian and the Iberian lynx) in their co-existence with humans. This group had drawn up actions plans for the protection of large carnivores, which were adopted by the Council of Europe at the meeting of the Standing Committee under the Bern Convention in November 2000. One of these action plans is also “The Action Plan for the Conservation of the Lynx in Europe”. In its Recommendation No. 74 (2000) the Council of Europe urged the government authorities to include recommendations of the Action Plan for the Conservation of the Lynx (*Lynx lynx*) in Europe into their respective national plans for the management of this species.



**Figure 13.** The Action Plan for Eurasian Lynx Conservation in Europe with actions recommended for Croatia

The following actions relate to Croatia:

- 4.1.1. The Bern Convention adopts this Action Plan.
- 4.1.2. Establishment of a national lynx management group that produces a national lynx action plans according to this Action Plan. Cross-border management is secured.
- 4.1.3. The lynx is protected by law. Hunting is only allowed if it does not threaten the long-term survival of the population, and if the harvest is in accordance with the goals formulated in the action plan.
- 4.2.1. The lynx should be given strict legal protection and the law should be enforced.
- 4.2.2. Identify the status of the population and establish a monitoring programme.

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- 4.2.4. Public information campaigns to secure the support of the people for the conservation of the lynx should be launched.
- 4.2.5. The viability of the population should be increased through measures that allow the establishment of a viable meta-population (reducing threatening and limiting factors, expand the area or the density of the population, re-introductions, etc.).
- 4.2.6. The genetic status of the population (degree of inbreeding, heterozygosity, relationship to other European populations) should be analysed in order to determine the necessity and strategy of re-stockings.
- 4.3.2. Sub-populations forming a potentially viable lynx meta-population should be connected by habitat corridors. These corridors are maintained or restored wherever they are important for the survival of a sub-population and the genetic exchange between sub-populations.
- 4.3.3. The food supply for the lynx should be guaranteed through proper management and conservation of its most important local prey species. The lynx needs and the impact of the lynx predation are incorporated in the hunting management of the native ungulate populations.
- 4.4.1. Livestock husbandry procedures and protective devices apt to prevent depredation of lynx on sheep, goats, or semi-domestic reindeer in the lynx area should be tested and implemented.
- 4.4.2. The economic loss of livestock owners due to lynx depredation should be compensated for. Compensation systems should aim to promote the co-existence of livestock breeders with lynx rather than to let the owners simply profit from losses.
- 4.4.3. Rules should be fixed saying under what conditions and how lynx causing intolerable losses in livestock herds can be removed.
- 4.4.4. The impact of lynx on its wild prey populations should be recognised and taken into consideration when defining the hunting management of the local (ungulate) populations.
- 4.4.5. Harvest of viable lynx populations through hunting should be allowed when the population can tolerate it.
- 4.5.1. Information campaigns should be launched in order to teach the broad public about all aspects of lynx conservation and management.
- 4.5.2. Detailed educational programmes should be initiated for specific interest groups such as hunters or livestock owners.
- 4.5.3. Local people should be integrated into the planning and implementation of lynx action plans. Establishing boards incorporating all local interest groups could do this.
- 4.5.4. Local people (e.g. represented through management boards) should permanently be involved into decisions concerning lynx management and conservation.
- 4.6.1. Applied research on Eurasian lynx should be co-ordinated, and exchange of methods, ideas, and results must be certain.
- 4.6.2. National or local monitoring systems for the lynx should be designed, tested, implemented and co-ordinated among countries sharing the same lynx population.
- 4.6.3. Human dimension research projects should be launched in order to understand the conflicts between humans and lynx.
- 4.6.4. Research on minimum viable population size, genetic status, (meta-) population dynamics, habitat requirements must be advanced in regard to the restoration of viable lynx populations.

- 4.6.5. Long-term research projects should investigate the impact of lynx on its prey population in relation to human influences of the same populations.
- 4.6.6. Applied and co-ordinated projects should test methods to protect livestock from lynx depredation.

## Eurasian Lynx (*Lynx lynx*) Biology

In the world there are four known lynx species belonging to the genus *Lynx*. In the taxonomy the cats (*Felidae*) are classified into the sub-order of cat-like carnivores (*Feloidea*) belonging the order Carnivora. Two lynx species inhabit the area of North America – the Canadian lynx (*Lynx canadensis*) and the bobcat (*Lynx rufus*). The European continent is inhabited by another two species – the Iberian lynx (*Lynx pardinus*) found in the Pyrenean Peninsula and the Eurasian lynx (*Lynx lynx*).

In the history the Eurasian lynx was distributed throughout Europe and a great part of Asia. Populations were uninterrupted until the 19<sup>th</sup> century when they found their last refuges in mountain chains such as the Alps, the Apennines, the Carpathian Mountains and the Dinaric Alps. The assumption that there were several subspecies of the lynx has not been scientifically confirmed to the present day. The subspecies such as *L. lynx balcanica* (Burech, 1941) and *L. lynx carpathica* are also mentioned within the nominal subspecies. Mirić (1978) describes a subspecies *L. lynx martioni* in the south of the Balkan, characterized by a small-sized skull, a more delicate build and differences in the fur coloration. The subspecies is not recognized as valid, but considered to belong to a segment of the nominal subspecies population (Hemmer, 1993).

The Eurasian lynx is larger than other lynx species, with adult males averaging 21 kg, while females are slightly lighter and average 18 kg. They attain the body length of 0.8 to 1.3 m and their short black-tipped tail is 15 to 20 cm long. The height at shoulder is up to 60 cm. In comparison with other lynx species they have relatively long legs and large paws, which facilitate movement across snow and in winter get

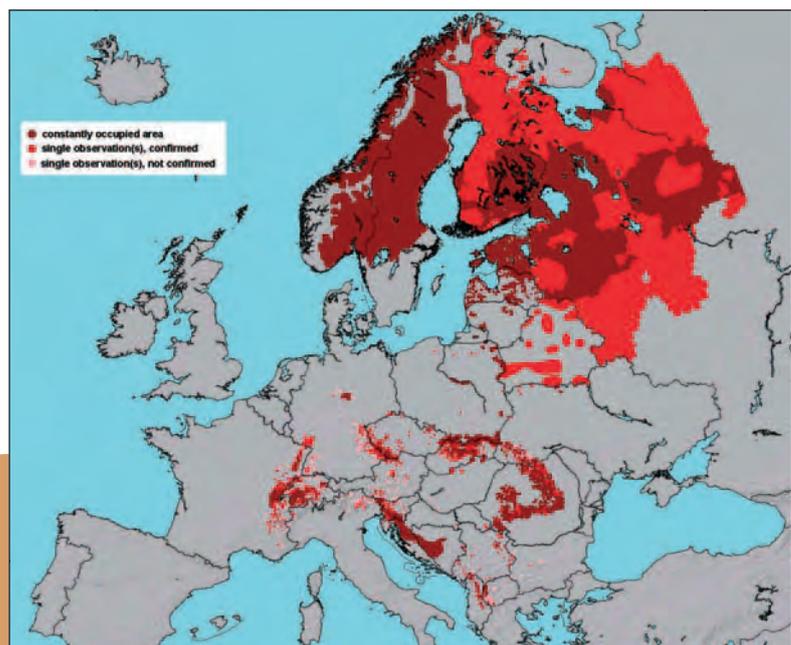


Figure 14.  
Lynx distribution  
in Europe  
(ELOIS)



**Figure 15.**  
*Lynx appearance* (Đ. Huber)

covered by particularly thick hair. The body is covered by thick reddish-grey fur with more or less visible spots. The pointed ears are tipped with tufts of black hair up to 4 cm long. The head is typically cat-like, round with a short snout and strong jaws. The whiskers growing at the sides of the head make it appear larger. Sensory hairs on the snout may be up to 8 cm long. The lynx has a set of 28 teeth: 3 P, 1 incisor, 2 premolars, 1 molar; 3 P, 1 incisor, 2 premolars, 1 molar. The canines and molars are strong and have sharp edges. On the front legs they have five and on the rear legs four toes with sharp claws that may be pulled in to facilitate quieter movement.

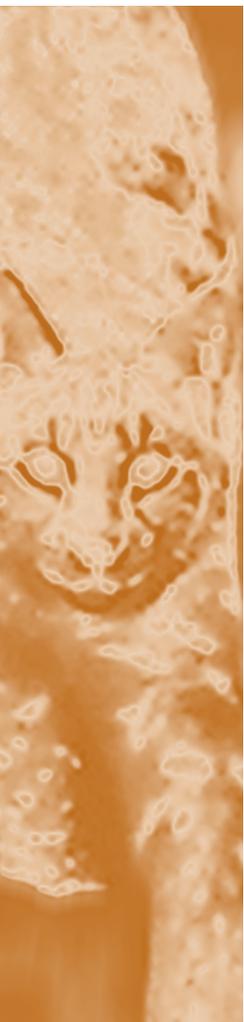
Lynx mate from mid February till the end of March, but mating may also begin in January already and last throughout a part of April (Hemmer, 1993). Exceptionally, some cases are known of mating late in summer and at the beginning of autumn (Schauenberg, 1969; Hemmer, 1993). Although mostly solitary animals, at that time lynx gather at mating places. Females reach sexual maturity at 20 to 24 months and males at 30 months or rather after the third winter (Hemmer, 1993). The gestation period is 73 days on

average - from 65 to 74 days. Litters typically have 1 to 5 kittens, mostly 2 (3). Their birth weight is from 250 to 360 g (males 250 - 360 g; females 250 - 300 g) (Stehlik, 1980). The sex ratio is 1 : 1. The kittens open their eyes after 7 and 17 days. Lactation lasts for five months and they begin eating solid food at the age of 35 to 40 days. Permanent teeth are completely developed at 8 - 10 months of age (Hemmer, 1993). Then, at the beginning of the following mating season they are separated from their mothers and leave their home range. If they lose their mother in the last months before separation of the family group, young lynxes are not capable of surviving, the mortality is high and they often approach settlements (Čop, 1988). The juvenile mortality is high. At least 50 per cent of young do not reach maturity. The Eurasian lynx survives 12 to 15 years in the wild, though they may live over 20 years in captivity.

The lynx is a territorial species. The size of home ranges depends on the amount of prey and the population density and varies considerably for males and females. It is known that home ranges vary in size from 10 square



**Figure 16.**  
*Female lynx with her cub* (Đ. Huber)





kilometres to several hundreds of kilometres, even exceeding 1,000 square kilometres yearly (Sunde et al., 2000). In Switzerland Breitenmoser and associates (2001) applied the method of telemetric monitoring and found that in the area of a stable population the male home range may be from 71 to 209 square kilometres (159 square kilometres on average) and the female home range from 45 to 210 square kilometres (106 square kilometres on average). A male home range may cover up to three female home ranges. Overlaps of home ranges of adult individuals mostly do not exceed 10 per cent (8.9 per cent with females and 6.1 per cent with males). Lynx were found to be highly loyal to their home range for several subsequent years ( $81 \pm 12$  per cent of overlaps in years). Their daily coverage averages 3 to 30 km. They defend their home range by marking it with smell glands secretions, urine and scraping rather than by direct conflicts with the neighbours. The animals do not use the entire home range equally. They remain longer in areas relatively abundant in prey and depart them when the prey declines. Sometimes their movements take them far away from their home range.



The lynx is the most active in the morning and in the evening and generally rests during the day and the night. Their primary food items are artiodactyls and larger rodents. During the winter they more often prey on large animals, because they are easier to catch. They are capable of capturing the prey 3 – 4 times their size. When they capture a prey, they, as a rule, keep returning to the spot for the following 2 – 7 days, depending on the prey size, until they eat it up.



Data collected in Norway (Birkeland and Myrberget, 1980) show the following shares of individual types of prey: reindeers 31 per cent, hares 19 per cent, roe deers 17 per cent, birds 10 per cent, small rodents 4 per cent, sheep 4 per cent, other cervids 4 per cent. These amounts vary throughout the year: during summer months cervids account for 20 to 50 per cent of the diet and in winter for 50 to 73 per cent. In Switzerland (Jobin et al., 2000) the share of prey types is different: roe deers 70 per cent, chamois 21 per cent, foxes 6 per cent and hares 2 per cent (in the area studied the roe deer population density amounts to 6-9 individuals per square kilometre and the chamois density 1.2 – 1.9 individuals per square kilometre). This points to the dependence of the share of species in a habitat containing prey. Based on 37 samples studied in Croatia and Slovenia it may be concluded that roe deer and red deer account for 80 per cent of the lynx diet, thus representing almost the only one food item with males. The remainders of 8 other animal species consumed were found in stomachs and excretions of females and the immature young (Rajković et al., 2000).

The share of individual types of the lynx prey according to data coming from the Czech Republic (Červený and Bufka, 1996) is as follows: roe deers 82 per cent (adult females 53 per cent, young animals 34 per cent, adult males 13 per cent), mouflons 6 per cent, domestic sheep 4 per cent, red deer 4 per cent (young animals 75 per cent, adult females 20 per cent, adult males 5 per cent) and wild boars 3 per cent.

The lynx consumes 1 – 2.5 kg of meat daily (Breitenmoser et al., 2000). Out of the total weight of the prey this makes 3.3 kg a day, measured as the average reduction in the weight of the carcass remainder after each nocturnal meal. Apart from losses due to discharge of fluids, drying and consumption by other animals, this includes muscular tissue, fat and all internal organs except the digestive system consumed by the lynx. A lynx family (the mother with two kittens on average) needs up to 4.4 kg of prey daily. The area covered daily by the lynx ranges from 3 to 30 km and its living space amounts between 100 and 1,800 square kilometres (Breitenmoser et al., 1993).

## Lynx Number and Distribution

### *Habitat*

The general belief that lynx inhabit only forested areas is only partly true (Breitenmoser et al., 2000). In Central Asia lynx occur in open and thinly wooded areas, including semideserts and areas above the treeline. In the north of Europe and Asia they may be found in tundras too. However, in Europe lynx inhabit mostly various deciduous, mixed and coniferous forests.

**Figure 17.**  
National park "Risnjak"  
– typical habitat of lynx  
(A. Štrbenac)



In Croatia the wooded mountainous areas of the Dinaric Alps from the Croatian-Slovene border in the northwest to the border between Croatia and Bosnia and Herzegovina in the southeast are considered the present lynx habitat. In other wooded parts of Croatia lynx are not constantly present, although they could satisfy their needs. The essential feature of a lynx habitat is the presence of adequate numbers of prey, among which the roe deer and red deer are the most important species. Apart from the food, a habitat should provide lynx with shelter for daily rest and especially for raising their young. The chances for survival are determined to a high degree by the amount of the available prey, the habitat integrity and the human-caused mortality due to possible legal and illegal hunting, road-kills and kills in other ways.

### Habitat capacity

The habitat capacity for the lynx as a strict carnivore is directly dependent on the prey availability. The dietary base of lynx in Croatia consists of the roe deer and red deer in the first place.

The starting point for estimation of the prey volume, which can satisfy a specific population size, is the daily need of lynx for meat. For an average lynx this is about 1.75 (1.0-2.5) kg of meat or rather one roe deer per week or about 50 roedeers in a year. Apart from the prey biomass, lynx are also dependent on the prey reproduction ability. According to the data available, the influence of lynx on the prey population

ranges mostly from 2 - 15 per cent of the spring number of populations, which can locally reach as much as 40 per cent. In Europe the studies on the general influence of lynx on the prey are few. In a hypothetical model of density based on one lynx per 100 square kilometres it must be taken into consideration that a lynx kills yearly 0.56 roe deers per square kilometre, if roe deer and red deer are its only food item. The research carried out in Croatia and Slovenia shows that roe deer and red deer account for 80 per cent of the lynx diet (Rajković et al., 2000). Given the foreseeable needs of other predators (primarily the wolf) and hunting-related measures, the density of roe deer and red deer populations should exceed 5 per square kilometre. It is to be noted that in the area of the lynx distribution in Croatia the roe deer density is presently considerably below this number, the same as the lynx population density, which is less than one lynx per 100 square kilometres.

**Figure 18.**  
Even-toed ungulates such as roe deer and red deer are the most common prey of lynx  
(T. Gomerčić)



## Estimates of the lynx status and number in Croatia

Two methods were applied to estimate a possible lynx number:

### a) Estimates made by local experts

For an area of 8,840 square kilometres the lynx number was estimated at 113 (the first workshop held in Gračac). Taking the entire land area of 9,374 square kilometres, the lynx population size is 130 individuals.

### b) Estimates based on prey availability data

Through the mediation of experts from the former Ministry of Agriculture and Forestry, the Croatian Forests and the County Primorsko-goranska data were collected from 50 hunting grounds with a total land area of 5,526 square kilometres relating to estimated number and shooting status of all artiodactyls (roe deer, red deer, wild boar, fallow deer, mouflon and chamois) (Table 4). The results show that there are 9,359 artiodactyls living in the area of 5,526 square kilometres, or rather 1.69 per square kilometre.

It is interesting that the previous collecting of the same type of data (the first workshop held in Gračac) for a land area of 8,840 square kilometres gave the number of 3,668 artiodactyls or 0.42 per square kilometre.

In other words, the repeated collection of data resulted in four (4.0) times as large density of artiodactyls and therefore new data were used for further calculations.

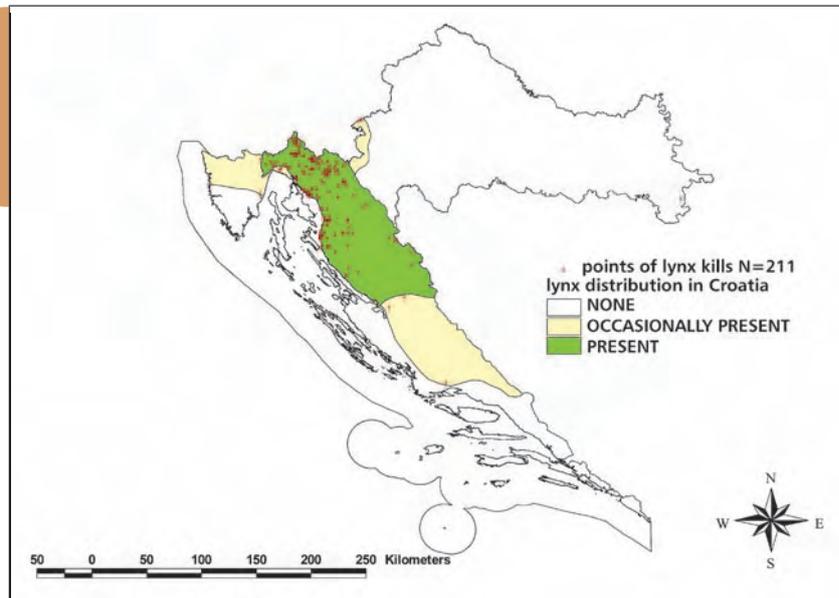
**Table 4.** Collective data on lynx prey in 50 hunting grounds totalling 5,525.7 square kilometres

Species	N	Km <sup>2</sup> indicated	LPP share	N/ km <sup>2</sup>	N/ km <sup>2</sup> LPP <sup>a</sup>	Shooting N	Shooting /km <sup>2</sup> of land area indicated	Shooting /km <sup>2</sup> LPP
Chamois	299	1267	0.14	0.24	1.69	12	0.01	0.07
Wild boar	2436	5509	0.46	0.44	0.96	607	0.11	0.24
Red deer	1983	4537	0.55	0.44	0.79	255	0.06	0.10
Fallow deer	59	122	0.25	0.48	1.93	3	0.02	0.10
Mouflon	302	422	0.44	0.72	1.63	30	0.07	0.16
Roe deer	4280	5368	0.39	0.80	2.04	429	0.08	0.20
<b>Total/average</b>	<b>9359<sup>b</sup></b>		<b>0.37<sup>c</sup></b>	<b>0.52<sup>c</sup></b>	<b>2.07<sup>c</sup></b>	<b>1336<sup>b</sup></b>	<b>0.06<sup>c</sup></b>	<b>0.15<sup>c</sup></b>

<sup>a</sup> LPP – hunting productive area; <sup>b</sup> Total; <sup>c</sup> Average

Based on the data on lynx mortality and observance in Croatia (Frković 1998, 2001) a GIS map (Fig. 19) was produced showing that lynx are permanently present in an area of 9,374 square kilometres and occasionally in an area of further 7,374 square kilometres (Table 5). Since data on the occasional lynx distribution are based on individual rare data over a longer period of time only, all further capacity calculations were based on the area of 9,374 square kilometres in which the lynx is considered to be permanently present and the prey status more favourable. For lynx calculations it was not possible to apply separately the “productive land area” and therefore for all hunting grounds the total, rather than “hunting productive areas” were used for further calculations.

**Figure 19.** Map of lynx distribution in Croatia



**Table 5.** Land area inhabited by lynx

Lynx distribution	Land area (km <sup>2</sup> )
None	36573
Occasionally present	7374
Present	9374
<b>Total</b>	<b>53321</b>

Taking into account that roe deer and red deer, with a share of 80 per cent, are main artiodactyl food items of lynx in Croatia (Rajković et al., 2000) and that it takes one week for a lynx to consume a prey of a size of an average roe deer or red deer, a lynx needs 42 artiodactyls of that size a year on average (80 per cent out of 52 weeks). The land area indicated gave the number of 4,280 roe deer and 1,983 red deer. A correction was made for the entire lynx area in Croatia totalling 9,374 square kilometres by multiplying with 1.7. The expected reproduction of 35 per cent would yield 1,840 roe deers and 496 red deers yearly. The share of roe deer poaching was assumed to equal that of the legal hunting and of red deer poaching to be negligible. All further calculations are shown in Table 6.

**Table 6.** Roe deer and red deer as lynx prey in hunting grounds (80% share in diet)

Animal number (N)	Roe deer		Red deer	
	Indicated for 5526 km <sup>2</sup>	Estimated for 9374 km <sup>2</sup>	Indicated for 5526 km <sup>2</sup>	Estimated for 9374km <sup>2</sup>
Base stock <sup>1</sup>	4280	7276	1983	3371
Reproduction <sup>2</sup>	1498	2547	496	842
Kill	429	729	255	434
Growth (reproduction minus kill )	1069	1818	241	409
Rest after poaching	640	1089	241	409
Rest after wolf (25% of roes and 75% of deer eaten up)	480	817	60	102
Lynx capacity (42 roes or deer per lynx/year)	11	19	1	2
Calculation per biomass (kg)	All artiodactyls			
	in area of 5526 km <sup>2</sup>		in area of 9374 km <sup>2</sup>	
Biomass of all artiodactyls	306,930		521,781	
Biomass increase (40%)	122,772		208,712	
Legal kill	44,982		76,469	
Illegal kill	44,982		76,469	
Increase after kill	32,808		55,774	
Capacity of lynx (1.75 kg/day) and wolf (3 kg/day) – in total 2.4 kg/day = 876 kg/year on average	37		64	

<sup>1</sup> Number of animals at the beginning of a hunting year; <sup>2</sup> Total number of young born in a reproduction year

It follows that the dietary base ensures life for about twenty lynx or about sixty (64) lynx and wolves together in the lynx distribution area of Croatia (9,374 square kilometres).

### c) Workshop participants' estimate

It is possible that even after the repeated data collection the number of roe deer and red deer in the lynx habitat has been underestimated. This could be the only possibility to get a higher lynx habitat capacity. If due to such an error the data indicated were only a half (50 per cent) of the actual roe deer and red deer population, then the most optimistic estimate of the lynx number in Croatia would not exceed 60 individuals, meaning that the present population cannot exceed this number. Taking the number calculated on the basis of the available prey as indicated, the lynx population density is 0.22 per 100 square kilometres. Based on the optimistic estimate of workshop participants and on theoretically twice as much prey, this number could be up to 0.64 lynx per 100 square kilometres.

## Impacts of Man and Rival Species

### *Direct human impacts on lynx*

The known human-caused mortality of lynx is 10 individuals a year on average (ranging from 1 to 17). The actual mortality is very likely higher, but there is no reliable way to estimate it. There is a possibility of unrecorded mortality in the area of Lika, not covered by systematic reporting, as well as in the entire lynx distribution area of Croatia after 1998, since when shooting quotas have not been granted, which makes each hunting illegal.

**Slika 20.**  
*Dead lynx (Đ. Huber)*



### *Impacts on lynx prey*

The main rival species with respect to lynx prey in the country's habitats are man and the wolf. Man affects the artiodactyl population by legal and illegal kill. The illegal kill varies depending on the area of Croatia and in some places exceeds the legal hunting. A major contribution to this state comes from poor efficiency of relevant inspection services responsible for penalizing the illegal hunting. Neither the planned legal kill nor other aspects of hunting ground management take adequate account of the presence of predators.

The wolf, just like the lynx, is a carnivore and a strict meat-eater. Unlike them, the bear - the third and the largest carnivore - can meet more than 90 per cent of its dietary requirements by eating plants and is, consequently, a rival species to a small extent only. The bear may occasionally find a prey killed and partly consumed by a lynx or a wolf, and then it snatches it away from these predators (snatcher). The actual population size both of the lynx and the wolf in Croatia is unknown. The estimates based on local figures provided give a range of 130 to 170 wolf individuals. All artiodactyl species consumed by the lynx are also consumed by the wolf, with the largest overlapping in case of roe deer. The selective pressure on roe deer is, nevertheless, different. While the wolf captures primarily the slower ones, the lynx is more successful in

capturing those less cautious, and both the wolf and the lynx overpower weaker individuals much easier. However, wild artiodactyls such as the red deer and the boar are equally accessible to the wolf, which can, moreover, satisfy a substantial part of its dietary requirements by domestic artiodactyls (sheep, goat, cattle) and odd-toed mammals (donkey, horse).



**Slika 21.**  
Man... (A. Frković)

**Slika 22.**  
... and wolf are the most important competitors for the lynx prey (D. Huber)



# Lynx Management Plan

## 1 Objective

The objective of the lynx management plan is to ensure in the long-term existence of this qualitatively and quantitatively viable carnivore population in a harmonious co-existence with humans. However, to plan such activities it is first of all necessary to know what we have on our disposal. Here we imply the knowledge of the lynx biology, dietary habits and behaviour and the determination of the number and distribution of the lynx population, the population of its natural prey and the habitat quality. It is also necessary to assess the intensity of human impacts on the lynx and its prey populations. On the other hand, account should be taken of the requirements of the local population and of general views of all interest groups, environmentalists, foresters, hunters, scientists, non-governmental organizations and the general public. It is only on this basis that concrete actions to achieve an efficient protection may be identified. Here it must be stressed that this requires the agreement of all interest groups, because this is the only way to ensure the practical implementation of these activities.

As the viable Dinaric population of the lynx is spread over the area of several countries, the lynx management in Croatia has been planned in co-operation with the neighbouring countries – Slovenia and Bosnia and Herzegovina.

## 2 Desired and Possible Capacity

In European countries inhabited by the lynx, its population density per 100 square kilometres ranges from 0.8 in Slovenia and 1.2 in Switzerland to 6 in Poland. The roe deer population density ranges from 8 to 10 per square kilometre. With its population density of 1.2 in Switzerland, the lynx consumes 54 roe deers/ chamois per 100 square kilometres a year.

Considering the Croatian areas inhabited by the lynx the objective should be the average lynx population density of 1 individual per 100 square kilometres. For this purpose it is necessary to ensure yearly about 42 prey individuals (32 roes and 10 deer) per 100 square kilometres. The data collected in Croatia show that in the area of 9,374 square kilometres there are only 10 prey individuals per 100 square kilometres available for its diet at present. This means that the population density of roe deer and red deer should be increased fourfold to reach the desired lynx habitat capacity.

The area of some 9,000 square kilometres inhabited by the Eurasian lynx in Croatia could theoretically, excluding any human impact, support the population of about 200 lynx individuals. Since there are no reliable data either on the lynx population size or on its dietary base (requiring further study of the lynx diet, more accurate estimate of the number of artiodactyls as the major prey, better assessment of wolf and lynx impacts on the lynx diet), the desired size of the base population may be estimated at 75 – 100 individuals. In the area of the lynx occurrence there are several areas protected under the categories of a national and nature park. These areas must form the basis of the space intended for the lynx population. Moreover,

the border areas close to Slovenia and Bosnia and Herzegovina must, with respect to habitat conditions and the population status, provide connectivity between lynx population parts living in those countries, as stipulated by the Act on the Agreement about Cross-border Co-operation and Trade between the Republic of Croatia and the Republic of Slovenia (Official Gazette – International Treaties No. 15/1997).

### 3 Zoning

Actual and present zones based on the lynx distribution identified in Croatia are as follows:

1. Permanent presence in the area of 9,374 square kilometres
2. Occasional presence in the area of 7,374 square kilometres
3. No presence in Croatia's mainland area of 36,573 square kilometres

It is proposed that the lynx management zoning should not depend on the current presence of its population, but rather comply with this Management Plan, except in specially protected natural areas subjected to a strict protection regime (national parks, strict and special reserves), where all kinds of living organisms are covered by permanent protection and thus excluded from possible interventions in their populations.

### 4 Activities

#### *Research and monitoring*

The lynx management plan is based on the knowledge of the lynx population and factors determining the population status. For that purpose it is necessary to establish a national lynx population monitoring

system in order to systematically carry out scientific research and monitor the lynx population status, dynamics and ecology, the presence of its natural prey and the impacts of humans and its rival species. In collecting these data it is necessary and obligatory to ensure co-operation of all interest groups, as achieved to a considerable extent in collecting data needed for preparation of this management plan.

Work methods, the research material and the results expected are as follows:

#### **Collection of lynx carcasses**

- Members of all interest groups and other possible finders must notify the competent specialized institution of each dead lynx (killed in any way whatsoever). At the time of drawing up this plan this institution was the Department for Biology



**Figure 23.**  
*Paw prints of lynx in the snow* (T. Gomerčić)



**Figure 24.**  
Autopsy of lynx at the  
Faculty of Veterinary  
Medicine (D. Huber)

of the Faculty of Veterinary Medicine in Zagreb (Heinzlova 55, 10000 Zagreb, Phone No. 01-2390141, Fax No. 01-2441390, e-mail: [huber@vef.hr](mailto:huber@vef.hr)). The carcass is to be preserved whole, placed in a refrigerator, if possible, or in a freezer, as agreed.

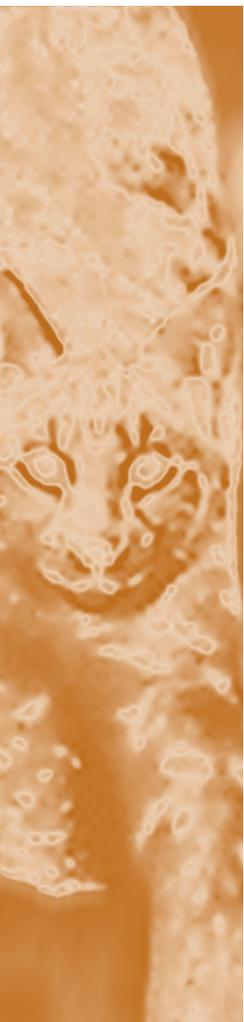
- The lynx carcass will be used for taking all morphological parameters, safeguarding the samples (skeleton, organs, bodily liquids) and analysing the contents of the digestive system. This will be used to collect data on standard morphological features, genetic structure, health condition (physical shape, parasitic infestation, exposure to various diseases such as rabies etc.).



**Figure 25.**  
Samples taken during the analysis of the dead  
lynx (D. Huber)

#### Telemetric monitoring of radio-collared individuals

- Lynx will be live-captured into special traps, chemically immobilized and after measurement and sampling radio-collared and released at the point of capture. They lynx radio-collared will be monitored by a receiver and a portable targeted antenna. In this manner data will be directly provided about their movements and activities and indirectly about the size and selection of their living space, the space use and the rhythm of activities. Insight will be gained in the prey frequency, success and types and in the way and degree of prey utilization. This will also improve understanding of the social relations within the species, the reproduction cycle (sexual maturity, frequency of births, litter size, survival rate of young), health, mortality causes and expectation of life. As mentioned earlier, the first lynx was collared for radio-telemetric monitoring in Croatia on 16 December 2001.





**Figure 26.**  
Marking of the lynx  
with the radio collar  
(D. Huber)



**Figure 27.**  
Lynx marked with  
the radio collar  
on the territory of  
the National park  
“Risnjak”  
(T. Gomerčić)

### Harmonization of monitoring methodology with international standards

International standards for lynx population monitoring are in the first place specified under action items of the Large Carnivore Initiative for Europe as a part of the Bern Convention. In this regard there are similar international agreements on lynx population monitoring in the area of the Alps, the Baltic countries and the Carpathians. The lynx population is monitored in the most detailed manner in the Alps in the context of the SCALP project. A similar project is to be developed for the Dinaric area, first of all between Slovenia, Croatia and Bosnia and Herzegovina.

### Prey population monitoring

The quantitative and qualitative status of the prey population will be monitored on the basis of:

- kill and waste data;
- estimates of local bearers of hunting rights and competent public institutions in protected areas;
- number estimates based on collaring;
- monitoring the signs of presence and
- other possible methods.

### Application of the Geographic Information System

All data will be mapped using the Geographic Information System (GIS), which will facilitate their spatial and time-related interpretation in relation to natural features of habitats, human impacts on the respective habitat and their interrelations (e.g. prey distribution, predation sites, lairs, resting places, lynx kill places, etc.).

#### *Action plan:*

*Establishment of a national lynx population monitoring system and harmonization of that system with international standards*

### Interventions in the prey and lynx population

One of the essential steps in lynx management is harmonization of the wildlife management in hunting grounds with the lynx conservation. Therefore, when preparing basic documents of hunting economy account should be taken of the lynx as a natural factor in the hunting ground and it should be brought in line with the commercial interest and nature protection in the context of the hunting ground management (e.g. lower rents for hunting grounds inhabited by the lynx, etc.). This is a starting point for interventions in the prey and lynx population.

### Interventions in the prey population

Since the rivalry of man and the lynx in Croatia is reflected in the presence of their common prey, the following steps are to be taken to mitigate the conflict:

- to combat poaching (towards this end the efficiency and powers of competent inspection services, game-keepers and hunting ground supervisors are to be improved);
- to regulate shooting measures so as to provide conditions for the growth of artiodactyl populations up to the number specified by this plan (i.e. to quadruple this number gradually);
- when determining the method of managing the local artiodactyl populations account should be taken of the impact of the lynx on populations of its natural prey;
- to re-introduce the prey, if possible.

#### *Action plan:*

*To initiate the action to increase powers of nature protection and hunting inspectors, especially of gamekeepers and supervisors.*

*To reduce the shooting of artiodactyls with the final aim to quadruple their population gradually.*

### Interventions in the lynx population

Since the population size estimated currently is lower than the capacity desired at the time of adopting this Plan, only minimum interventions in the lynx population may be planned.

These interventions are only permitted in case that there is no other satisfactory solution available and that this exception will not be fatal to the population survival. The following measures may be envisaged:

- possible translocation of specific individuals within the area of distribution;
- possible introduction of specific individuals into the area of distribution;
- possible bringing of specific individuals out of the country;
- shooting under specific circumstances:
  - for the purpose of preventing serious damage that may be caused to livestock and other forms of property;
  - in case of an objectively identified stronger economic impact on wildlife<sup>1</sup> and
  - in the interest of public health and security and other prevailing public interests.

### *Population utilization options*

The term “sustainable development” is widely used in Croatia nowadays. The sustainable development concept implies a well-balanced relationship between natural and man-made elements in creating a better life. In the effort to incorporate the sustainable development concept into the planning of the lynx population management in Croatia a need has arisen to consider all possibilities of the economic utilization of this population. In this regard it is to be noted that the range of these possibilities is determined by the multitude of values represented by the lynx in the present society.

The most appropriate branch of economy that should create specific products respecting the protection principles is tourism. Due to low estimates of the population number the traditional hunting tourism is not feasible under present conditions. This is further accompanied by a constant downward trend in the popularity of this formerly attractive and important product of tourist industry. At the same time the demand rises for products originating from a comparatively young branch of the tourist industry, the so-called ecotourism. In this context it is possible to evaluate the lynx population through ecotourist product, especially in protected areas.

Creation of products such as the programme for inclusion of the lynx into the tourist offer in protected areas situated in the lynx distribution area, including participation of the local community, may give a significant contribution to prevention of poaching as one of the major threats that might cause extinction of the lynx in its habitats in Croatia.

#### **Action plan:**

*Investigation of the possibility to include the lynx in tourist offer of 3 protected areas belonging to the lynx distribution areas (Risnjak National Park, Northern Velebit National Park, Velebit Nature Park) in co-operation with representatives of protected areas and local communities.*

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<sup>1</sup> In this regard it is necessary to organize an objective assessment mechanism or rather to introduce a principle of an objective insight (e.g. mechanism for assessment of damage caused by carnivores to livestock).

## Habitats

In order to preserve habitats it is indispensably necessary to preserve the integrity of habitats and their quality.

In order to preserve the habitat integrity it is necessary:

- to make every effort to avoid fragmentation of habitats by various constructions so as to preserve the biological whole;
- when constructing roads, to ensure “green bridges” for wildlife crossings;
- to preserve the spatial ratio of forests, meadow and agricultural areas to the highest extent possible.

**Figure 28.**  
Green bridge “Dedin” on the Zagreb-Rijeka highway, the first green bridge for animal crossing in Croatia (F. Knauer)



For the purpose of the habitat quality preservation it is necessary:

- to monitor the quality of habitats where the lynx is present (to monitor specific habitat elements and to provide insight into the actual state of habitats by field research);
- to prevent excessive utilization of natural resources and alterations of the basic habitat features;
- when drawing up physical plans of counties whose areas are inhabited by the lynx, to ensure participation of the members of the Committee for Large Carnivores of Croatia with the aim to take into consideration the known corridors for lynx movements when constructing roads and opening new quarries (if data based on telemetric monitoring are available);
- given the well preserved biological diversity of Croatian forests on the European scale, to maintain the existing state; to maintain the thinning out practice in forest management so as to preserve forest components of various age structures and provide shelter for daily rest and especially for breeding the young;
- to prevent introduction of allochthonous species into habitats.

## Damages caused to domestic animals

Although Croatia is not faced with the problem of damages caused by the lynx to domestic animals, the following actions are to be envisaged for such a case:

- to identify circumstances under which the damages occur and
- to take measures to avoid damage.

## Systematic monitoring of public attitude

Public attitude towards the lynx and various options of the lynx population management may have a significant impact on the long-term lynx management. This requires a continuous monitoring of public attitudes towards the lynx, especially as regards the population in the area inhabited by the lynx. The results of these studies must be taken into consideration when making decisions on the population management. Since no major damages on livestock caused by the lynx have been recorded in Croatia so far, it would be interesting to investigate opinions of livestock breeders on this predator too.

Apart from conducting surveys of opinion about the lynx, it is also necessary to identify beliefs concerning the lynx and the level of the basic lynx biology and status knowledge so as to use these data for preparing information and educational campaigns aimed at raising the public awareness.

As the basic method for the collection of above mentioned sociological data it has been recommended to periodically conduct a survey among a representative selection of general public or certain target group representatives.

### Action plan:

To make a survey attitudes of local population about the lynx.

## Raising public awareness

In conformity with the needs and based on the monitoring of public attitudes towards the lynx or rather the public knowledge of the lynx, targeted information and educational campaigns are to be organized and conducted. Information and educational campaigns are to be primarily conducted in areas inhabited by the lynx, i.e. among the population sharing directly the environment with this carnivore and whose behaviour has a direct impact on the success in conservation of this species. Apart from the general public of the area inhabited by the lynx and special interest groups (e.g. hunters, livestock breeders, school children), these campaigns should also cover the population of large towns, which does not come into direct contact with this species, but whose familiarity with this problem area might affect positively its long-term conservation.

In order to record and improve the efficiency of information and educational campaigns in the future, it is necessary to investigate systematically the attitudes of the target population expected to be affected by the campaign, both before and after the campaign.

### Action plan:

Organization of an educational and information campaign.



Figure 29. Lynx poster printed with the support of EURONATUR association



Figure 30. Lynx Brochure by A. Frković

## 5 Plan Implementation

### *Co-operation of all interest groups in the management*

The starting point for a successful organization and implementation of the management plan is co-operation of all interest groups. Environmentalists, scientists, hunters, foresters, non-governmental organizations and local population, including other competent government authorities and competent bodies of local government and self-government units, must co-operate in collecting relevant data on the lynx and in planning and taking possible measures in the population, as well as in undertaking actions as a precaution against poaching and illegal activities in connection with the protected animal. Towards this end representatives of the general public and the government representatives should as a rule meet at least once in two years.



**Figure 31:**  
*Workshop for the development of the Lynx Management plan for Croatia (D. Huber)*

### *Committee for Monitoring of Large Carnivore Populations*

The Committee for Monitoring of Large Carnivore Populations considers and puts forward the proposals and recommendations to the competent ministry relating to all activities as provided for by this management plan and in doing this exercises control over implementation of the following action points:

- **research and monitoring:** at the beginning of each research project and at least once a year, relating to the course of projects and their results;
- **requests for interventions in the lynx population:** delivers the opinion on justifiability of interventions and in case of a positive opinion puts forward a proposal for the extent of the intervention at least on a yearly basis, but not later than the end of September for the period from the beginning of November till the end of February, as well as at any time as may be necessary;
- **proposed possible interventions in the prey population:** delivers the opinion, if required, and makes effort to improve the lynx dietary base;

- delivers opinion in the process of proposing and/or taking measures likely to affect the lynx **habitat quality** and advocates permanently the preservation of its optimum quality;
- delivers its **opinion about possible damages caused to domestic animals** when requested by competent experts and accompanying services, and keeps trying to find solutions so as to prevent or minimise the damage;
- with respect to **raising public awareness** encourages all activities likely to improve the existing state.

As the advisory body the Committee is actively involved in consultations on specific issues with a wide circle of experts including those from abroad.

The Committee takes special care to co-ordinate all actions with those taken in Slovenia and Bosnia and Herzegovina, and encourages international co-operation.

As required, but at least once in two years, the Committee also encourages organization of meetings of representatives of all interest groups.

### *Competent ministries*

The conservation of the lynx falls within the competence of the Ministry of Culture, the Nature Protection Division, which takes decisions based on recommendations given by the Committee within the framework of international and national regulations.

The Ministry of Agriculture, Forestry and Water Management, as a government authority responsible for hunting or wildlife management affairs, is also bound to participate in implementation of this Plan.

Other ministries and all interest groups submit their comments to the Committee for consideration.

### *The State Institute for Nature Protection*

The State Institute for Nature Protection is responsible for preparation of base documents for monitoring of the lynx population status in Croatia in co-operation with other interest groups.

### *Inspection and game-keeper services*

Practical implementation of all actions as determined by laws and subordinate laws is ensured by inspection and other authorized services.

## 6 Plan Revision

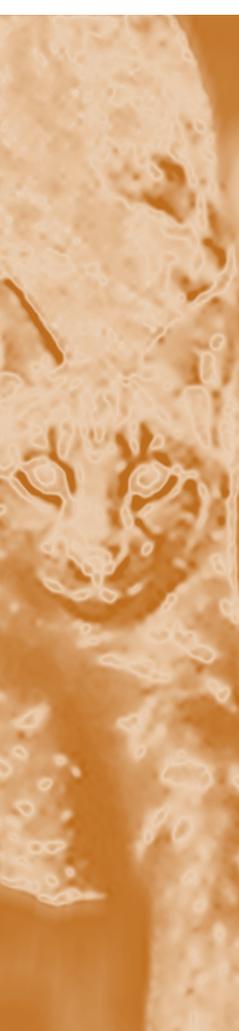
The Management Plan must undergo the procedure of the first revision not later than two years upon adoption and after that, if required. The revision is to be initiated by the Ministry of Culture on the basis of a technical document prepared by the State Institute for Nature Protection and the recommendation of the Committee for Monitoring of Large Carnivore Populations. The revision procedure is conducted by representatives of all interest groups in the same manner as when the plan was adopted (through workshops). In this way insight will be gained into realization of items planned and into possible occurrence of any changes, and new actions will be added in that connection.

## 7 Plan Funding

The finance necessary for implementation of the Plan will be secured mostly by the government budget, but it is also possible to solicit for financial support from international funds. County budgets may also be a source of a part of the finance. The establishment of the Environmental Fund has provided the possibility of funding the Plan implementation too.

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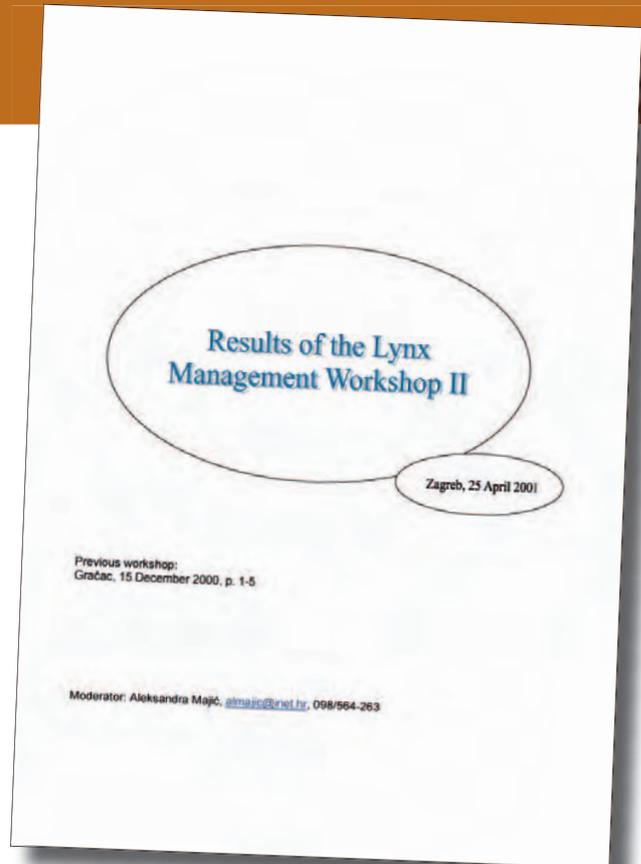
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# Annex

Results of the Lynx Management Workshop as an example of the work method applied when drawing up the Lynx Management Plan for Croatia.



**Participants:**

Name	Coming from	Dealing with
1. Bezak, Karlo	Applied research – Forestry and hunting services	Ph.D. of forest science
2. Čaleta, Marko	College of Science, Zagreb	B.Sc. (Biology)
3. Firš, Boris	Croatian Forests	ecology
4. Frković, Alojzije	Rijeka	large protected carnivores
5. Grubišić, Marijan	College of Forestry	Assist. Prof. - hunting
6. Guščica, Goran	School of Veterinary Medicine, Zagreb	Ph.D. of science
7. Herman, Danko	City Office for Agriculture and Forestry	B.Sc. (Forestry)
8. Huber, Đuro	School of Veterinary Medicine, Zagreb	carnivores
9. Ivčević, Branko	Ministry of Agriculture and Forestry	B.Sc. (Forestry)
10. Jovanović, Olga	Green Action, Osijek	biology student
11. Kovačić, Darko	Krapje	M.Sc. (Biology), head of expert activities in Lonjsko Polje Nature Park, forestry and hunting
12. Križaj, Domagoj	State Inspectorate	independent associate for forestry and hunting, B.Sc. (Forestry)
13. Kulić, Blaženka	Rijeka	violence
14. Kusak, Josip	School of Veterinary Medicine, Zagreb	B.Sc. (Forestry)
15. Magdić, Nikola	Pitvice Lakes National Park	M.Sc. (Forestry)
16. Malnar, Josip	Croatian Forests	B.Sc. (Biology)
17. Pađan, Ivana	College of Science, Zagreb	B.Sc. (Biology)
18. Spudić, Darko	Ministry of Environmental Protection and Physical Planning	B.Sc. (Biology)
19. Starčević, Mirna	Croatian Forests	ecology
20. Štahan, Željko	Ministry of Environmental Protection and Physical Planning	M.Sc. (Forestry)
21. Štrbenec, Ana	Ministry of Environmental Protection and Physical Planning	biological diversity
22. Užarević, Tomislav	Korčula	B.Sc. (Forestry)
23. Zec, Davor	Gračac	B.Sc. (Forestry)

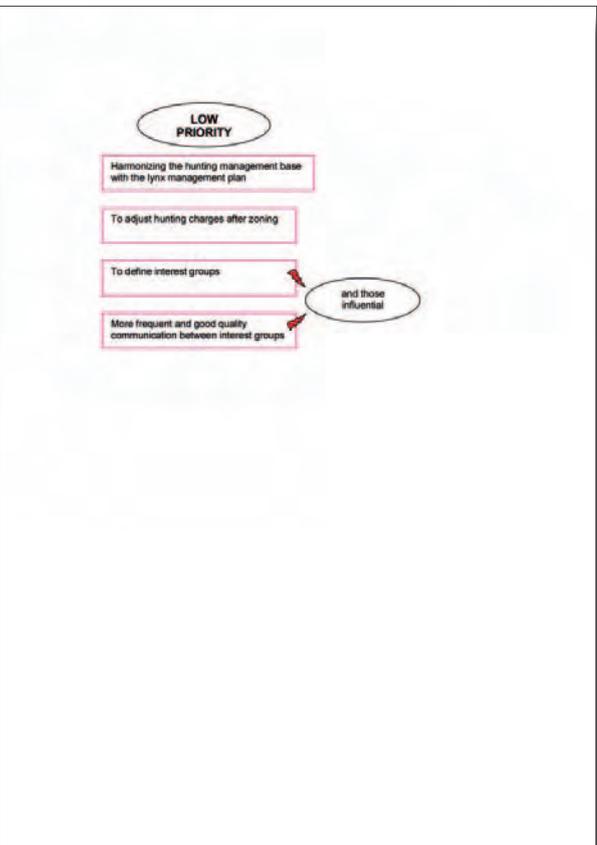
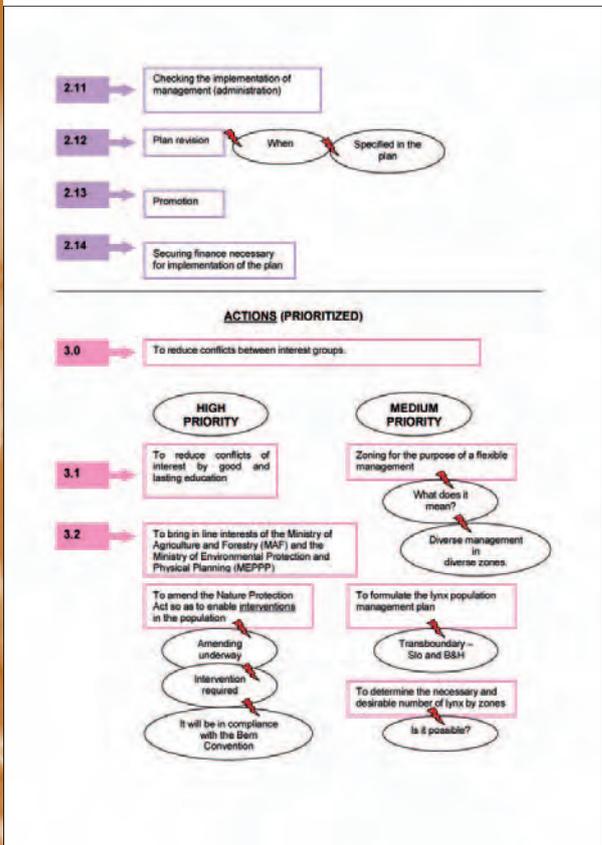
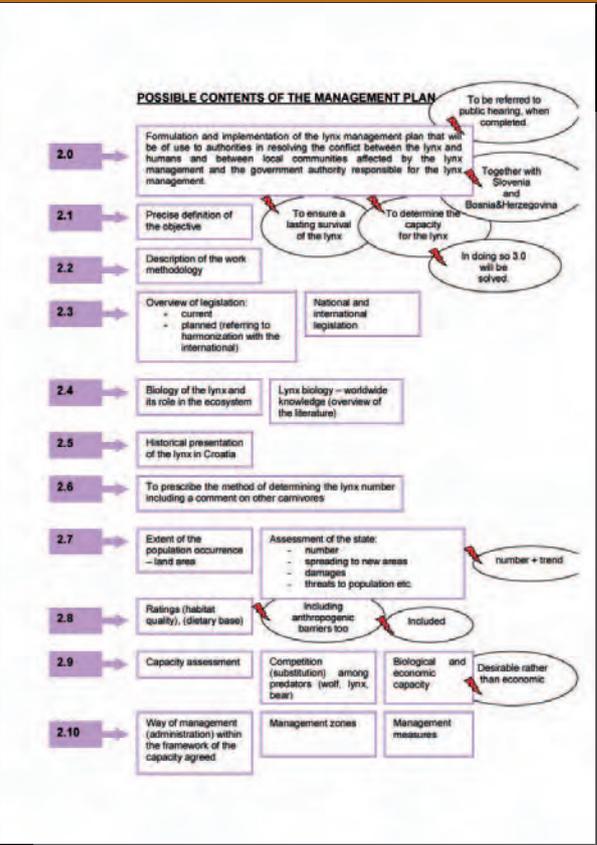
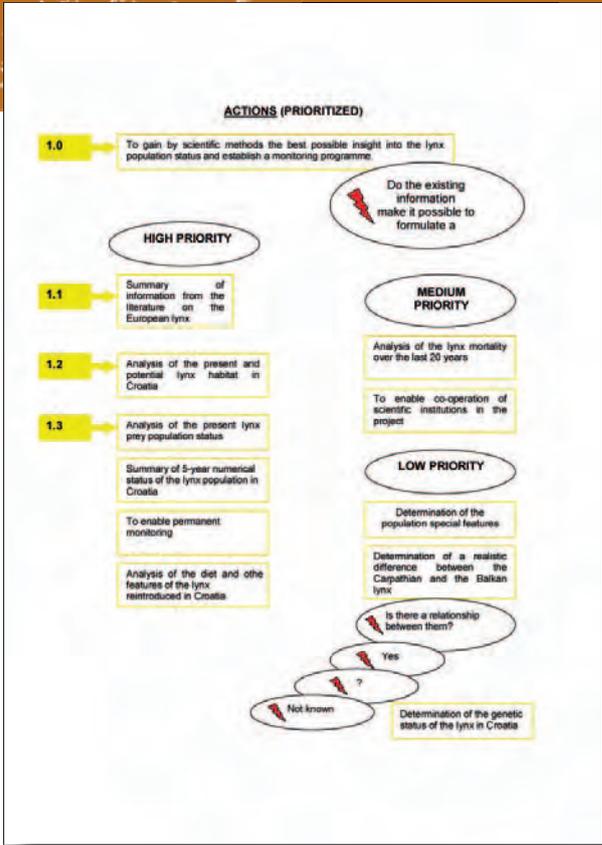
**CATEGORIES CONTAINING OBSTACLES TO ACHIEVEMENT OF THE VISION:**



● = most important category; ● = most important category that may be affected

**OBJECTIVES**

- 1.0 → To gain by scientific methods the best possible insight into the lynx population status and establish a monitoring programme.
- 2.0 → Formulation and implementation of the lynx management plan that will be of use to authorities in resolving the conflict between the lynx and humans and between local communities affected by the lynx management and the government authority responsible for the lynx management.
- 3.0 → To reduce conflicts between interest groups.
- 4.0 → To intensify information flow and raise public awareness with the aim to receive support for lynx management from all parts of the society.
- 5.0 → Conformity of Croatian regulations and the EU legislation.



**ELABORATION OF ACTIONS**

For each action at least 1 task is to be set. The below listed questions concerning each task are to be answered. In case of the "Management/Administration Plan" the main titles represent actions and the tasks mean elaboration of each individual title.

- a) What is the task?
- b) What is the final result desired?
- c) Who would be responsible?
- d) How much would it cost?
- e) How will the funds be secured?
- f) What is the first logical step?
- g) Which current projects/processes are affected?

e.g.

Action 2.3. ....

	Task 2.3.1.	Task 2.3.2.
a)	.....	.....
b)	.....	.....
c)	.....	.....
d)	.....	.....
e)	.....	.....
f)	.....	.....
g)	.....	.....

1.1. Summary of information from the literature on the European lynx	1.2. Analysis of the present and potential lynx habitat in Croatia	1.3. Analysis of the present lynx prey population status
<p>To order and cover the costs</p> <p>1.1.1.</p> <p>a) Drawing up the bibliography of published and technical data sources about the lynx</p> <p>b) To have insight into information from the literature and selection of priorities for the heads of the management plan</p> <p>c) Committee for Large Carnivores</p> <p>d) 1,000 kn</p> <p>e) MEPPP and the Ministry of Science</p> <p>f) Identification of existing sources in case of persons and institutions involved</p> <p>g) None</p>	<p>1.2.1.</p> <p>a) Development of a model of habitat suitability to lynx</p> <p>b) Map of possible extent of lynx occurrence in Croatia and possible conflict zones</p> <p>c) Committee for Large Carnivores</p> <p>d) 20,000 kn</p> <p>e) MEPPP, MAF, the Ministry of Science</p> <p>f) To select components for development of the model and provision of basic documents</p> <p>g) None</p>	<p>1.3.1.</p> <p>a) Determination of the trophic base for the lynx survival in Croatia</p> <p>b) Map of occurrence and density of lynx prey in Croatia</p> <p>c) Committee for Large Carnivores</p> <p>d) 3,000 kn</p> <p>e) MEPPP, MAF, the Ministry of Science</p> <p>f) To collect data, preferably of the spring status</p> <p>g) None</p>

2.1. Definition of the objective	2.2. Description of the work methodology	2.3. Overview of legislation
2.1.1.	2.2.1.	2.3.1.
a) To formulate	a) To describe the work methodology on the management plan	a) To write an overview of legislation
b) Preservation of a stable lynx population with the approval of all interest groups	b) By working in workshops together with interest groups	b) To consider the statutory framework
c) Đuro Huber and Ana Štibenec	c) Aleksandra Majc	c) Darka Spudić
d) Nothing	d) ?	d) Nothing
e) MEPPP	e) MEPPP	e) MEPPP
f) To formulate the objective proposal	f) To formulate	f) ?
g) Nothing	g) Nothing	g) MEPPP
2.4. Lynx biology (from the literature)	2.5. Historical overview	2.6. Identification of the number
2.4.1.	2.5.1.	2.6.1.
a) Essentials for management measures	b) Understanding the number and distribution trends	b) Approximate number
c) Đuro Huber and Josip Kusak	c) Alojzije Frković	c) Working group
d) ?	d) ?	d) Working group meeting
e) MEPPP	e) MEPPP	e) MEPPP
f) ?	f) ?	f) ?
g) ?	g) ?	g) ?
2.7. Extent of lynx occurrence	2.8. Habitat analysis	
2.7.1.	2.8.1.	
a) To prepare a map	a) To describe relief, vegetation, prey and local number of lynx	
b) Zoning base	b) Base for capacity determination	
c) Josip Kusak	c) Josip Kusak and the working group	
d) ?	d) ?	
e) MEPPP	e) MEPPP	
f) ?	f) ?	
g) ?	g) ?	

2.9. Habitat capacity assessment	2.10. Lynx management measures
2.9.1.	2.10.1.
a) To define the optimum (desirable, needed, agreed upon)	a) Zoning
b) Agreement as regards the number	b) Reaching optimum populations with minimum conflicts
c) 1. Đuro Huber and Josip Kusak 2. Marijan Grubešić and Josip Malnar 3. Ana Štibenec (Jasminka Radović) and Darka Spudić 3 versions to be agreed upon	c) Josip Kusak
d) ?	d) ?
e) MEPPP	e) MEPPP
f) ?	f) ?
g) ?	g) ?
2.9.2.	2.10.2.
a) Impacts of man and rival species	a) Determination of the plan duration and conditions for starting the revision
b) Possibility to influence the habitat management	b) Good quality revised plan
c) 1. Đuro Huber and Josip Kusak 2. Marijan Grubešić and Josip Malnar 3. Ana Štibenec (Jasminka Radović) and Darka Spudić 3 versions to be agreed upon	c) Committee and the competent administration of the MEPPP
d) ?	d) ?
e) MEPPP	e) MEPPP
f) ?	f) ?
g) ?	g) ?
2.11. Checking the implementation of management and administration	2.12. Plan revision
2.11.1.	2.12.1.
a) Determine and write down the methodology of checking the plan implementation	a) Determination of the plan duration and conditions for starting the revision
b) Determination of (possible) lynx shooting quotas and formulation of the prey shooting plan.	b) Good quality revised plan
c) 1. Đuro Huber and Josip Kusak 2. Marijan Grubešić and Josip Malnar 3. Ana Štibenec (Jasminka Radović) and Darka Spudić 3 versions to be agreed upon	c) Committee and the competent administration of the MEPPP
d) ?	d) ?
e) MEPPP	e) MEPPP
f) Setting up a working	f) Setting up a working







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