Management of Brown Bears (*Ursus arctos*) in Europe.

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(Abstract)

Successful conservation of brown bears (*Ursus arctos*) in Europe is associated with public acceptance of damages caused by bears. Recent increases in sheep depredation and beehive damage in central Austria resulted in the deaths of two bears there. Since bear numbers are low in most European populations, alternatives to the elimination of problem bears associated with damage incidents must be sought. The events described above led to the formation of the Bear Management Group responsible for designing a management plan for Austria that will outline procedures for dealing with bear damage and conservation strategies.

This study provides an overview of the magnitude and seasonal patterns of brown bear damage in Romania, Italy, Slovenia, Norway, Sweden, and Austria. It also illustrates how bears are managed in European countries by comparing different management strategies for dealing with brown bear damage, describing how bear management is organized, determining which organizations are involved, and explaining which duties these fulfill. Bear damage data were obtained from interviews with wildlife managers, hunters, and farmers in Romania, Italy, Slovenia, Norway, Sweden, and Austria, and from official records of their bear management agencies. Most damage incidents involved sheep and beehives in all countries. All countries offered a more or less well functioning damage compensation program to farmers. Conservation success, especially for small bear populations, seemed to be related to a good compensation program and reducing damage to livestock and property. Possible improvements of management strategies to reduce damage and increase conservation success in theses countries were discussed.

The second part of this study was the assessment of the organizational structure of different bear management programs in Europe. Brown bear management in Europe

included a broad spectrum of goals, ranging from no protection, to regulated hunting, to total protection. In each country, different organizations were involved in bear management, including private and governmental organizations. For each study country, I outlined which organizations were involved in bear management, determined if a management plan existed, described if and how hunting and damage compensation were structured, explained how each country dealt with problem bears, and finally, detailed what kind of management problems each country encountered. I tried to find management patterns for bear management in Europe, including advantages and disadvantages of each approach and their effectiveness within the countries they were applied. Methods included a content analysis of interviews with wildlife managers, farmers, and local people in each country. Results showed that two general types of management approaches could be identified. Romania, Sweden and Southern Slovenia took a conservationist approach, which was characterized by economic use of their bear population. All of these countries had viable bear populations. Romania and Southern Slovenia included an additional characteristic of feeding bears, which could be viewed as a utilitarian management scheme. The second management approach, which was classified as the preservationist approach, was observed in Norway, Italy, Northern Slovenia, and Austria. This management strategy was characterized by year-long protection of bears, low population numbers, and no feeding of bears.

Further results of management differences in problem bear management, damage compensation, public education, and effectiveness of management approaches were summarized. The study provides a reference on bear management strategies in Europe.

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TABLE OF CONTENTS

LIST OF TABLES

Chapter 1. General Background

INTRODUCTION

Historically, brown bears (*Ursus arctos*) were distributed throughout Europe (Dandaletche 1989). Since the 12th century, forests have been cleared for agricultural use and livestock grazing, which increasingly fragmented the brown bears' habitat. Bounties on bears existed into the 19th century and greatly reduced the populations. In 1885, Germany and Switzerland eradicated their last bears. Today, most European bear populations are totally isolated from each other (Zunino 1989, Mertzanis 1989) (Figure 1, Table 1).

To preserve the remaining populations, bears have been restocked in some areas to increase genetic diversity and viability (World Wildlife Fund (WWF) Austria 1991). However, bear population growth in small, fragmented areas increases the likelihood of bear-human interactions. Herrero (1985) stated that bears lose their natural fear of people as interactions become more frequent. In addition, living in close proximity with people may eventually lead to problems like livestock depredation or crop damage.

Successful brown bear conservation in Europe is tied to public acceptance of damages caused by bears. Recent increases in sheep depredation and beehive damage in central Austria resulted in the deaths of two bears. Since bear numbers are low in most European populations, alternatives to the elimination of problem bears associated with damage incidents must be sought. The events described above led to the formation of the Bear Management Group, an organization responsible for designing a management plan for Austria that will outline procedures for dealing with bear damage and conservation strategies.

This project was initiated and partially funded by the Munich Wildlife Society (WGM), Germany, and especially Dr. Wolfgang Schröder, president of the WGM, in liaison with the project of writing a brown bear management plan for Austria. This study compares different management strategies for dealing with brown bear damage in several

Table 1. Estimated brown bear population sizes, densities, and status in Europe.

Country	Area	Status	Population size	Bear densities	Source
Romania	Carpathian mountains	hunted again since 1990 closed season Jan.15 - March 1	1950: 1000 1990: 7450 1993: 6000	2 / 10 km^2 8 / 10 km^2 (max.)	Almasan (1993) Weber (1990)
Norway	throughout	protected since 1973	1965: 25 - 50 1982: 20 - 30		Pulliainen(1989)
Sweden	north of 60°	protected since 1912 hunted again Since 1943	1976: 400 - 600 1994: 619	0.012 / 10 km^2	Pulliainen (1989) Swenson et al. (1994)
Italy	Abruzzo Nat. Park	protected since 1939	1970: 70 -100 1983: 50 - 80	0.7 / 10 km^2	Zunino (1981) Sorensen (1990)
	Trentino Nat. Park	protected since 1939	1976: 10 1994: 4	0.13 / 10 km^2	Knauer (1993)
Slovenia	Dinarian mountains	hunted closed season May 1 - Sep. 30	1991: 300 - 400		Adamic (1991)
Austria	south - central	protected	1991: 11 1994: 20		WWF Austria (1994)

Table 1. (cont.)

Country	Area	Status	Population size	Bear densities	Source
Croatia	Dinarian mountains	closed season Jun.1 - Aug. 31	1993: 400	1.0 / 10 km^2 (Plitvic) 0.2 / 10 km^2 (southern)	Huber (1993)
Finland	central to north	hunting allowed in the reindeer areas north	1970: 230 1985: 450		Pulliainen (1989)
Bulgaria	throughout	50 animals hunted / year	1930: 300 1987: 850		Rösler (1989) Genov and Gancev (1987)
Czech republics	Carpathians	protected since 1932	1932: 20 1987: 700		Hell (1990)
France	Pyrenees	Protected since 1972	1937: 150 - 200 1987: 20 - 28 1993: ~ 7		Sorensen (1990)
Spain	Pyrenees, Cantabrian mountains (2 populations)	Protected since 1973	1993: 50 - 70 1993: 10 - 15		Camarra (1986) Clevenger et al. (1990)

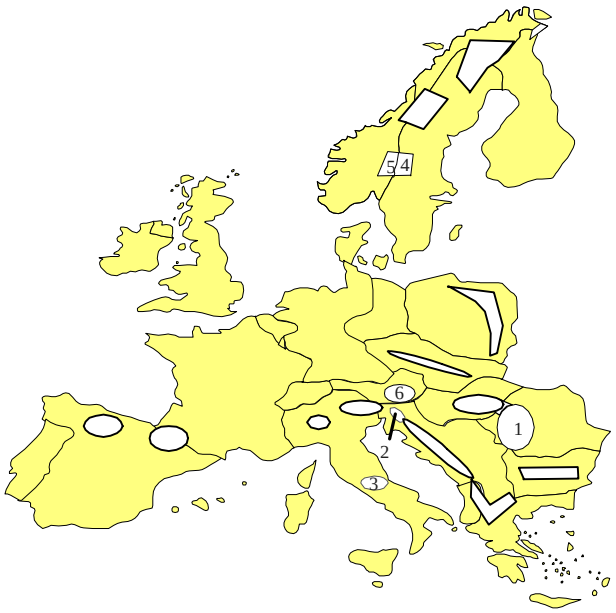

Figure 1. Brown bear (*Ursus arctos*) populations in Europe. Study areas included Romania (1), Slovenia (2), Abruzzo, Italy (3), Sweden (4), Norway (5), and Austria (6).

European countries, including Romania, Italy, Slovenia, Norway, Sweden, and Austria. It also provides an overview of the magnitude and seasonal patterns of damage by brown bears, and describes how bear management is organized, which organizations are involved, and which duties these fulfill. These concepts will be used for designing a brown bear management plan for Austria, where bears recently returned naturally and also were stocked by the World Wildlife Fund (WWF) in 1989, 1992, and 1993.

Literature review

Published literature on the magnitude of European bear damage and management is scant. The following data are from the USA and Canada.

Bear damage in the USA and Canada.-- Losses of livestock and agriculture to bears in the USA and Canada are insignificant compared to losses from other predators, such as coyotes (Jorgensen et al. 1978). A nationwide survey in 1990 revealed that 1,800 sheep and goats with a value of $454,475 were reported lost to black bear predation (USDA 1991). Jorgensen et al. (1978) reported that only 1.7% of lost sheep in 15 western states could be attributed to black bear predation. Cattle and calves lost to black bears in 1991 numbered 1,900 animals with a value of $1,020,000 (USDA 1992). A conservative estimate of apiary damage by black bears amounted to $623,000 in 1988 (O'Brien and Marsh 1990). Black bears also cause considerable damage to orchards and timber production (Calvert et al. 1992). In a 1,630 ha parcel of land in Washington state, black bears destroyed 60% of all trees over 15 cm tall (Hygnstrom 1994).

Bear damage compensation in the USA and Canada.-- Only 12 states or provinces in North America provide bear damage compensation programs (Wagner 1997, Table 2), and most of these do not cover all losses to bears. Livestock losses were compensated in 11 states/provinces, damage to apiaries in 12 states/provinces, damage to crops in 9 states/provinces, and other property in 5 states/provinces (Wagner 1997). Almost all programs require farmers to take preventive measures in advance, in order to be covered in a damage incident. The majority of states allow farmers to shoot a bear if it is caught damaging property or livestock. In many states/provinces, state wildlife agencies offer counseling in preventive measures, and 25 states and provinces loan or finance electric fencing (Wagner 1997). Few states keep complete records of damage incidents, and the remainder only estimate bear damage (Vaughan and Scanlon 1990).

Wagner (1997) reported that most compensation programs were established for valuable species, such as bears, elk and deer, which have increased in population size due to management efforts by state/provincial wildlife agencies. Funding for these programs is supplied by user groups (hunting licenses), general tax revenues, or funds from non-governmental organizations (NGO), such as the Great Bear Foundation in Montana, that are interested in the protection of the species.

Table 2. U.S. states and Canadian provinces that had programs to compensate bear damage in 1994.

State or Province	Agency
Colorado	State wildlife agency
Idaho	State wildlife agency
Manitoba	Provincial wildlife agency
Montana	Great Bear Foundation (grizzly bear damage only)
New Hampshire	State agricultural agency
Pennsylvania	State wildlife agency
Saskatchewan	Provincial wildlife agency
Utah	State wildlife agency
Vermont	State wildlife agency
Virginia [a]	Counties
West Virginia	State wildlife agency
Wisconsin	State wildlife agency

Table after Wagner (1997).

[a] Program only available for residents of counties choosing to require a wildlife damage stamp on hunting licenses. Only 4 counties were involved in the 1994-95 hunting season.

Wagner (1997) pointed out, however, that compensation programs do not take care of the actual problem of bear damage. They only reduce financial problems due to bear damage and increase farmer tolerance of the problem. In order to devise management strategies to actually reduce bear damage, one has to understand the behavior that makes bears cause damage. This aspect of dealing with bear-people conflicts is the degree to which a bear has become used to the presence of people. A bear that is not afraid of people is dangerous and can cause injuries and/or damage

(Herrero 1985). To deal with habituation, one first has to know what it is and secondly what can be done to prevent it.

Definition of habituation and food-conditioning.-- When brown bears become habituated to humans and/or use foods associated with humans, they become a management problem (Herrero 1985, Jope 1985, Mattson et al. 1992). Habituation occurs when a stimulus is delivered repeatedly without any negative or positive reinforcement, and responses to the stimulus weaken or totally disappear (Thorpe 1963, Herrero 1985, McCullough 1982). Thorpe (1963) considered habituation a primitive form of learning through which an animal stops responding to stimuli that are not significant for its survival.

Originally, habituation was thought to be a short-term change in response, which would return to the original response pattern over time. Peeke and Petrinovich (1984), however, showed that in cichlid fish, birds, and dogs the effects can last a long time. He redefined habituation as a relatively permanent waning of a response as a result of repeated stimulation. The waning of the response is specific to the original stimulus, but can be triggered by another stimulus afterwards.

The term "food-conditioned" refers to bears that have formed an association between food and people (Herrero 1985). Once a bear is habituated or even food-conditioned, a strong negative reinforcement (e.g. aversive conditioning) is needed to reverse its behavior. A positive reinforcement of habituation or food-conditioning, such as success in getting food, has a stronger effect than a negative enforcement to reverse the behavior, such as shooting a bear with a plastic slug (Peeke and Petrinovich 1984).

Hinde (1970) distinguished between stimulus-specific and stimulus-general habituation, pointing out that both could result in long- or short-term habituation. He also assumed that the degree of habituation is positively correlated to stimulus frequency and intensity.

A habituated bear that loses its natural fear of humans can tolerate people at close proximity, as shown in Katmai National Park, Alaska (Holmes 1994). While

fishing for salmon along a stream, bears in Katmai often pass within 10 yards of a visitor platform without seeming wary of people (personal observation 1992).

Herrero (1985) believed that habituation can occur without food-conditioning, but that a food-conditioned bear has to be habituated to the smell or sight of people to a certain degree. He considered food-conditioned bears as dangerous and prone to injuring people. Craighead and Craighead (1971), however, observed bears at Yellowstone National Park garbage dumps that were very wary of people and would flee at their sight. They hypothesized, that on rare occasions, bears can become food-conditioned without becoming habituated to the presence of people.

Bears in eastern Europe may live in situations similar to that described by the Craigheads for Yellowstone grizzlies. They are fed carcasses at feeding sites in the woods, but are still wary of people (pers. observation, 1995).

Objectives

The goal of this study was to provide baseline data on how brown bears are managed in some European countries and to use that information to design a management plan for the Austrian bear population. Specific objectives were:

1. Compile damage statistics for brown bears in Slovenia, Austria, Romania, Italy, Norway and Sweden.
2. Compare bear management systems and management practices of Slovenia, Austria, Romania, Italy, Norway and Sweden.
3. Develop management strategies for bear-human coexistence and conservation of the brown bear in Austria.

Chapter 2. Magnitude and seasonal pattern of brown bear damage in Romania, Italy, Slovenia, Norway, Sweden, and Austria.

INTRODUCTION

Successful conservation of European brown bears depends upon public acceptance of damages caused by bears. In Norway, for example, livestock depredation by bears accounts for only 9-19% of the total number of livestock losses, people are still very concerned. Although compensation programs have, in part, insured farmers against the loss of livestock, tolerance of problem bears is very small, especially in areas were bears were extirpated and have been reintroduced (Boitani 1992).

Recent increases in sheep depredation and beehive damage in central Austria resulted in the deaths of two bears. In September 1994, a hunter in central Austria killed in self-defense a bear, assumed to be responsible for most of the incidents that occurred in the Mariazell area in the state of Lower Austria (Knauer et al. 1994). A second bear, presumed to have taken several sheep in central Austria, was killed in October 1994. Low bear numbers in most European countries (Table 1) require alternatives to the elimination of problem bears associated with damage incidents. To meet this need, a Bear Management Group recently was formed to develop conservation strategies for bears and to design a management plan that will outline procedures for dealing with bear damage in Austria.

This summary of brown bear damage in Romania, Italy, Slovenia, Sweden, and Norway presents an overview of the magnitude and seasonal patterns of damage, and discusses possible improvements of management strategies to reduce damage and increase chances of conservation success.

STUDY AREA

This study was conducted in several European countries where brown bears are still present (Table 3). Countries included in the study were selected by the Munich

Wildlife Society (WGM) based upon their personal contacts in these countries and the probability that valuable data could be acquired there.

Table 3. Areas in Europe that still have brown bear populations with or without problems. Problems are defined as a loss of natural shyness towards people, which can result in crop damage, trespassing through towns, etc.

Areas with few or no problems	Problem areas
*Abruzzo (central Italy east of Rome)	*Carpathian (Romania)
*Central / southern Slovenia	*Northern Slovenia (sheep taking)
Greece (Pindus / Rhodopen)	*Styria / Lower / Upper Austria
*Carinthia (southwest Austria)	(central - eastern Austria)
Brenta (three bears left)	Niedere / Hohe Tatra (Slovakia)
Friaul (northeast Italy)	Plitvic Lake Nat. Park (Croatia)
*Norway (except few sheep killings)	
*Sweden	
Spain	

* areas included in the study

Romanian Carpathian Mountains

Bears in Romania live mainly in the Carpathian range and in an isolated area in the Apuseni Range in Central Romania (Figure 2). Habitat deemed suitable for bears encompasses 37,000 km^2 of forested land divided into 616 hunting areas (Ionescu 1993). The habitat consists of coniferous forests above 1,000 m, mixed conifer - beech forest at 800 - 1,000 m, and oak forests below 800 m (Ionescu 1993). The main concentration of bears occurs in the higher mountains of the western side of the Eastern Carpathians with population densities ranging from 1.0 to 3.2 bears / km^2 (Ionescu 1993). The bear population estimate was 6,337 individuals in 1992; the annual harvest in the last 20 years averaged about 300 animals (Weber 1990, Almasan 1994).

Land-use in the Carpathian Mountains is almost entirely agriculture-based with very low machinery use (Table 4). Most farmers live a subsistence-based lifestyle with livestock and crop use.

Sheep farming is very common and occurs in two basic forms. One kind of shepherd owns his own livestock and has two homes. In the winter he lives in a village on his own property and keeps the sheep in the valleys. In the summer he moves to the higher alpine meadows to graze his sheep and lives in semi-permanent structures made of wood. The pastures can be far away. Some shepherds come all the way from the area around the Black Sea (about 150 km from the mountains).

The second kind of shepherd is a hired hand for a larger farmer who permanently lives in the valley. The farmer sends his herd up into the mountains with these hired men. The hired people do not seem to put as much effort in protecting the sheep from predators as the shepherds who own them (see Chapter 3).

Table 4. Human population density, land use and livestock numbers of Romania (Romanian National Statistical Yearbook 1993).

Category	Value
Total area (km^2)	238,390
Human population density (per km^2)	10-97
Fields/plantations (km^2)	147,690
Forests (km^2)	66,854
Unproductive areas (km^2)	83,846
Cattle	3,683,000
Sheep/Goat	12,884,000
Horses	721,000

Slovenia

The Republic of Slovenia (20,151 km^2) encompasses several geographical regions including Mediterranean, Alpine and Karst climates. The High Karst Region provides

extensive forests of fir (*Abies spp*.) and beech (*Fagus dinaricum*). The forest cover in this region averages around 80 %.

Elevations range from 600m to 1,300m (Berce and Strumbelj 1992). The Low Karst produces extensive beech-oak (*Quercus spp*.) forests, which offer a wide variety of underbrush, wild fruit trees, grass, and herbal layers.

Human population density in this area of the country is very low (22 / km^2) (Berce and Strumbelj 1992) (Table 5). The Alpine region in the northern part of the country, with large open meadow areas and high elevations ranging from 600m to 2,900m, is less suitable for bears.

The brown bear originally inhabited almost the entire country, but is now restricted to the southwestern Karst and Alpine part of the country (Figure 3). It is the northernmost part of a continuous population along the Dinarian mountain range, which stretches from Slovenia over Croatia, Bosnia, Herzogovina, Montenegro, Kosovo, and Macedonia. This population is further connected to Albania and Greece in the south.

The estimated population size is 300 to 400 animals in the last decade. The yearly mean harvest is about 40 bears (about 10 % of the estimated population size) (Adamic 1991).

Table 5. Human population density, land use and livestock numbers of Slovenia (Slovenian Statistical Yearbook 1995).

Category	Value
Total area (km^2)	20,151
Human population density (per km^2)	22 - 98
Cattle	495,535
Sheep/Goat	38,375
Horses	7,994

Abruzzo Region in central Italy

The province of L'Aquila in the Abruzzo Region of central Italy is a 5,034 km^2 area in the Apennine mountain range (Figure 4). Elevations range from 600 to 2,912 m, with a 30 % forest cover dominated by beech (*Fagus sylvatica*) and oak (*Quercus spp*.), and interspersed by large upland grasslands and mountain plateaus (Fico et al. 1994, Cozza et al. 1995).

Intensive livestock-use and farming is practiced (Table 6). The area is characterized by "transhumance" sheep farming, which means that large flocks of 500 to 1,500 head spend about 8 months of the year in lowland farms within or outside the area, and are grazed in the upland grasslands from June to October. During the latter period, they are guarded by shepherds and dogs, and are kept in fenced areas during the night (Cozza et al. in prep.).

The Abruzzo National Park (ANP) and its surrounding area in the province of L'Aquila has the main concentration of brown bears in the Apennine Mountains. The park itself is an autonomous organization with its own administration. The surrounding area is administered by the provincial Forest Service (FS) and private landowners.

The Abruzzo Region is also unique because both wolves and bears coexist there. The bear population is estimated to be between 45 and 50 animals and possibly declining (Fico et al. 1993, Boscagli 1986, Fabbri et al. 1983, Zunino 1981). The steady decline is assumed to be associated with a strong poaching pressure just outside the park. Boscagli (1986) noted that about 56 % of all deaths outside the park are related to poaching, but traffic accidents also account for a high loss (27 %). Bears have been protected there by law in this region since 1939 (Boscagli 1986).

Figure 4. Location of the Abruzzo Region and Abruzzo National Park. The Abruzzo Region is divided into 4 provinces: Teramo(1), L'Aquila (2), Chieti (3), and Pescara (4).

Table 6. Population density, land use and livestock numbers for the province of L'Aquila in the Abruzzo Region of central Italy (Italian Statistical Yearbook 1995).

Category	Value	
Total area (km^2)	5,034	
Human population density (\ km^2)	59	
Fields/plantations (km^2, %)	3,243	(64.4%)
Forests (km^2, %)	1,503	(29.8%)
Unproductive areas (km^2, %)	288	(5.8%)
Cattle	29,230	(11.5%)
Sheep/Goat	212,500	(83.0%)
Horses	14,400	(5.5%)

Sweden

Bears in Sweden live in a variety of habitats ranging from Arctic Tundra to Northern Boreal Forests to Alpine mountains. Forests are dominated by Norway spruce (*Picea abies*) and Scots pine (*Pinus sylvestris*) in lower elevations and birch (*Betula odorata*) at higher elevations (Nordic Council of Ministers 1983). The northern areas are dominated by reindeer farming, southern areas by intensive sheep and other livestock farming, interspersed with large timber production areas (Figure 5). Sheep are mostly kept in large enclosures, but are not guarded.

The bear population estimate for Sweden was 620 bears in 1991, with densities ranging from 1.06 ± 3.44 to 1.2 ± 0.81 adult females/km^2 (Swenson et al. 1994). This population is confined to 4 'female core areas' from which mostly males have dispersed (Figure 3., Swenson et al. 1995a). These remnant core areas originated from the bottle-neck population after the persecution of the bear at the beginning of the century (Bjärvall, Swedish Environmental Protection Agency, pers. comm.).

Norway

Climate and vegetation in Norway is diverse, ranging from Alpine mountain areas > 2,600 m, to tundra climate in the north, to mild central European climate in the south. The Gulf Stream gives the coastal areas a wet, cool summer and mild winters with up to 2,000 mm precipitation per year. Approximately 60 % of the total area lies above tree-line (Wanitschek 1996, Table 7).

Today, bears occur only along the Swedish border and belong to a larger Scandinavian population of about 650-700 individuals. These areas correspond to the location of the female core areas in Sweden and are the dispersal areas for bears from there (Sørensen et al. 1994). Data from a joint bear study between Norway and Sweden suggests that the Norwegian bear population supports about 14 animals. An additional 15 animals from Sweden and 6 to 11 animals from the Russian-Finnish population cross back and forth across these borders (Swenson et al. 1995, Wabakken and Maartmann 1994).

Bears received total protection in 1972 after the population had become functionally extinct in most parts of Norway due to bounty hunting (Swenson et al. 1995).

Table 7. Human population density, land use and livestock numbers in Norway (Norwegian Statistical Yearbook 1990).

Category	Value	
Total area (km^2)	205,703	
Human population density (per km^2)	14	
Agriculture (km^2)	10,827	(25 %)
Forests (km^2)	70,360	(34 %)
Unproductive areas (km^2)	124,516	(61 %)
Cattle	340,579	
Sheep/Goat	2,254,297	
Horses	17,853	

(Norwegian Annual Statistic 1990)

Austria

The republic of Austria (84,000 km^2) is a federalism of 9 states. Two major geographic regions, including the Alpine region and the Danube plateau, can be distinguished. The region is characterized by Alpine climate and vegetation of mainly fir-beech forests (Table 8), while large alpine meadows intersperse the forested, lower elevations of the Alps (Aste 1993). Bears inhabit only the Alpine states of Carinthia, Styria, Lower and Upper Austria (Figure 6).

Brown bears have been allowed to return naturally to this country since the early 1970s, and have been reintroduced since 1989. Two main population areas can be identified. Southern Austria, including the states of Styria and Carinthia, still has a natural population with animals from the Slovenian - Croatian population. The second population is located in central Austria in the states of Upper and Lower Austria. Here, bears were reintroduced by the WWF in 1989 after one lone male had been seen for several years.

Current population estimates range from 20 to 25 animals and are steadily increasing (Gutleb 1995, Rauer 1995).

Since 1994, there have been several incidents of bears killing sheep, breaking into farms, and one occurrence of trespassing through a town. In September 1994, a bear assumed to be responsible for most of the incidents in central Austria was killed (Knauer et al. 1994). A second bear, assumed to have taken several sheep in the area, was killed in October 1994.

Table 8. Human population density, land use and livestock numbers in Austria (1995).

Category	Value
Total area (km^2)	84,000
Human population density (per km^2)	93
Fields/plantations (km^2)	27,720 (33%)
Forests (km^2)	39,480 (47%)
Unproductive areas (km^2)	16,800 (20%)
Sheep/Goat	34,896

METHODS

Brown bear damage statistics were obtained from government agencies and hunting clubs. Government agencies responsible for recording bear damage varied widely from country to country and included Ministries of Agriculture or Forestry, and Ministries of Environment. In some countries, damage data were recorded by national or local hunting associations. Data quality varied widely and ranged from computer spreadsheets to handwritten reports. Initial contacts to these agencies were made by the Munich Wildlife Society and were expanded by networking from initial contact persons (Appendix 1).

Much of the general land-use data were found in statistical yearbooks of the countries or at the Ministry of Agriculture. Gathered information included general land-use data, including percent forest cover, percent agricultural area, livestock densities and livestock distribution. It categorized countries from mainly agricultural to highly populated.

Bear population data, including densities and absolute bear numbers varied widely in quality. Romania and Slovenia estimated bear numbers by counting them at bait stations in the spring, whereas Sweden and Norway conducted mark-recapture studies.

Damage to livestock by all wildlife was acquired in order to estimate the percentage done by bears. Livestock damage data were provided in different formats, including amount of money compensated, number of incidents, and number of animals killed or beehives destroyed. Published papers in the study countries provided additional data on bear damage to livestock. The data were then transformed to number of animals killed or number of bee hives destroyed and used to describe peak damage seasons, the kind of livestock mainly affected, the monetary value of bear damage, and what percentage of all wildlife damage could be attributed to bears. Data from Romania were analyzed by regression to test the relationship between bear numbers per county and recorded bear damage per county.

RESULTS

Romania

Bear damage in Romania was notably high for livestock (508,500 million Lei from 1987-1992) and agriculture, including orchards and wheat fields (873,500 million Lei from 1987-1992) (Table 9). Due to high inflation in the last decade it is difficult to accurately translate this amount into a dollar value. Currently, a US dollar is equivalent to 2000 Lei, whereas 10 years ago it was about 500 Lei.

Damage payments by a county were positively related to estimated number of bears in that county (Figure 7, $r^2 = 0.997$, $P < 0.001$) and to number of bears per km^2 of forested area in the county ($r^2 = 0.854$, $P < 0.001$). Conversely, no correlation was found

between livestock densities and damage payments ($r^2 = 0.075$, $P = 0.682$). High bear numbers corresponded, however, to high numbers of human injury in these counties (Figure 8, $r^2 = 0.896$, $P < 0.001$).

Table 9. Bear population size, livestock density and bear damage to humans, livestock and agriculture in Romanian counties from 1987 to 1992.

County	Bears	Livestock density (/ha)	Damage		Humans	
			Agriculture (million Lei)	Livestock (million Lei)	Hospitalized	Injured
Alba	129	70	11,500	10,500	1	4
Arad	12	60	500	1,000	0	1
Arges	335	85	49,000	21,000	15	15
Bacau	227	88	30,500	20,500	2	4
Bihor	40	65	2,000	1,500	0	1
Bistrita	245	78	42,500	26,000	20	20
Brasov	347	79	47,000	31,000	13	15
Buzau	356	77	50,500	26,000	15	15
Caras	179	46	30,000	12,500	4	3
Cluj	71	75	3,000	3,000	1	3
Covasna	655	75	100,500	61,500	25	30
Dambovita	39	61	2,000	1,500	0	1
Gorj	185	70	20,500	11,000	3	3
Harghita	868	55	150,500	81,500	30	33
Hunedoara	419	50	60,500	36,000	16	18
Maramures	325	68	34,000	20,500	5	9
Mehedinti	34	59	1,000	2,000	0	1
Mures	425	84	61,000	36,000	16	18
Neamt	174	97	20,500	7,500	1	3
Prahova	265	82	40,500	21,000	4	12
Sibiu	234	80	30,500	11,000	3	10
Suceava	306	93	20,000	16,000	2	10
Vilcea	225	92	20,000	13,000	2	9
Vrancea	402	86	40,500	36,000	15	15
Satu Mare	20	83	5,000	1,000	0	1
Total	6,517	70	873,500	508,500	193	254

Source: Ionescu unpubl. data

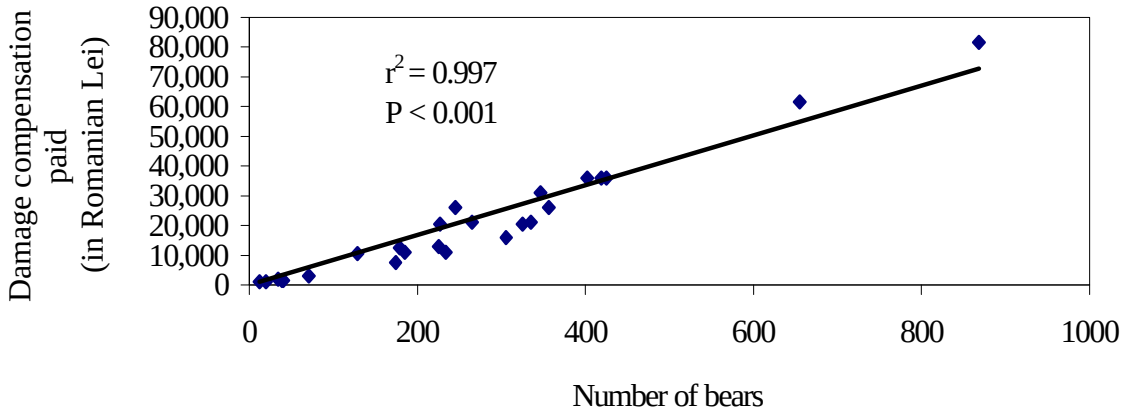

Figure 7. Relationship between the number of bears and compensation paid for bear damage in Romania from 1987 to 1992. Each data point represents a separate county.

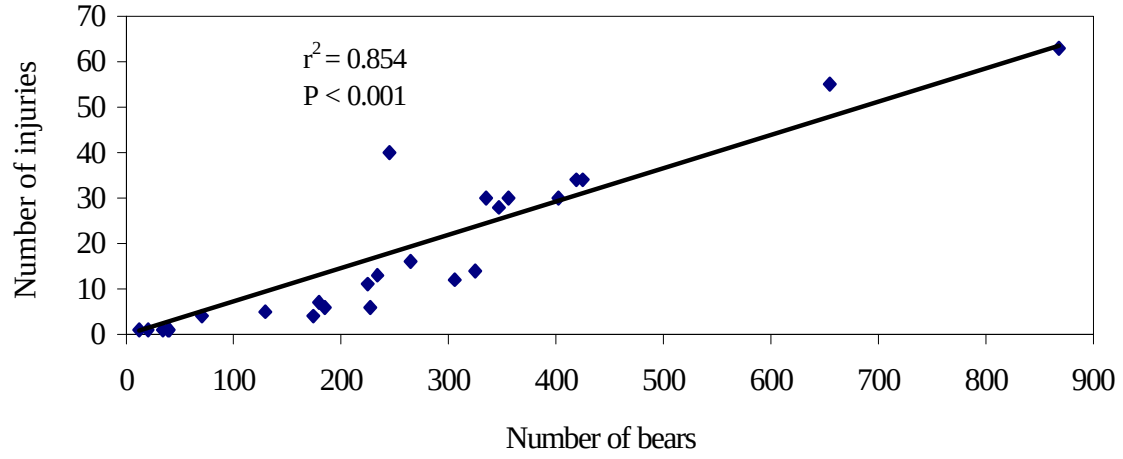

Figure 8. Number of injuries to people by bears as a function of bear numbers in Romania from 1987 to 1992. Each data point represents a separate county.

Slovenia

In Slovenia, bear damage was categorized as occurring inside or outside the bear core management area (for definition of bear core management area see Chapter 3). Inside the core area, bears caused only 2-3 % ($ 6,700 US) of the damage done by all game animals from 1992 to 1995 (Annual Statistical Report of the Slovenian Hunters Association). Even though bear density ranged from 0.17 to 0.98 / 10 km^2, and there was intensive honey production in some areas, damage to bees by bears was rare (Ministry of Forestry and Agriculture unpubl. data, Kaczensky 1995, Munich Wildlife Society, unpubl. data).

Most bear damage in Slovenia occurred outside the core area. In 1995, the Ministry of Forestry and Agriculture paid approximately $ 20,100 US, mainly for sheep damage in the northern part of the country. In contrast to Romania, there seemed to be no correlation between bear numbers and damages paid in Slovenia. About 70 bears (18% of the total population) live outside the core area and were responsible for 75 % of the total damage.

Damage was concentrated in the summer months when unguarded sheep grazed on alpine meadows. Very little bee hive damage was recorded outside the core area (Figure 9), but honey production was much less in the Alpine areas than in the southern Karst area.

Abruzzo Region (Italy)

Reports of damage in the Abruzzo region covered only the area administered by the Italian Forest Service. The data encompassed only the period 1986 to 1990 because recording methods and compensation laws changed after this time period; earlier data are not comparable to current statistics. The original system was reinstated in 1995, thus future data will be comparable to this summary. Statistics for Abruzzo National Park were not released by the authorities.

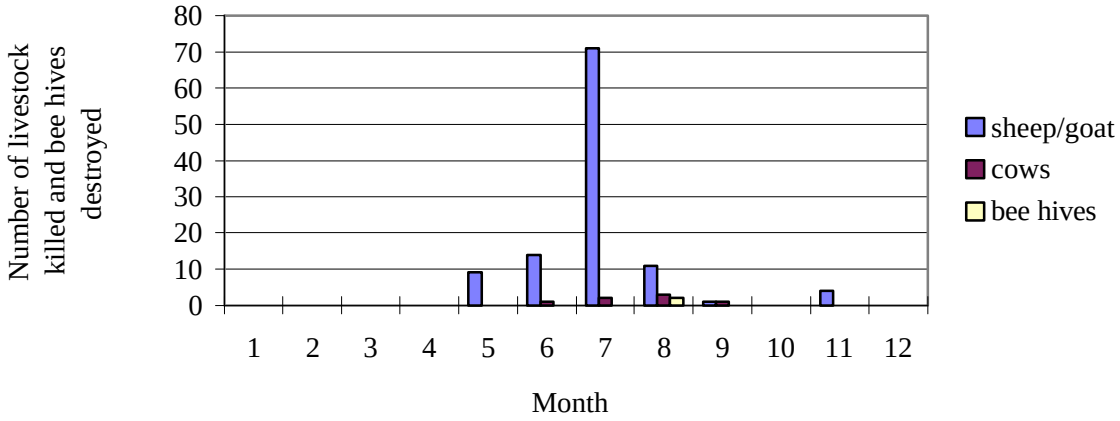

Figure 9. Number of livestock killed and bee hives destroyed monthly by bears outside the core bear management area in Slovenia in 1995.

L'Aquila , 1 of the 4 provinces of the Abruzzo region, had 97.7 % of all claims for bear damage compensation between 1980 and 1988 (Fico et al. 1993). The analysis, therefore includes only data from this province.

Damages outside Abruzzo National Park.-- Livestock losses to bears accounted for 0.03 % of all livestock registered in L'Aquila province (Table 10). Sheep kills (n = 345) and beehive destruction (n = 141) comprised most of the bear-caused damage in the 5-year period (Figure 10). Sheep kills occurred mainly in the months of August and September, whereas bee damage was distributed more evenly over the year (Figure 10).

The peak damage occurred in 1988 with 49 incidents reported. One hundred and forty-two sheep and 45 bee hives, an approximate value of $ 30,000 US, were destroyed. During that year, 18 bears were killed and damage decreased by 18 % the following year (Fico et al. 1993). After 1990, damage compensation laws increased in complexity and reported damage declined further (Figure 10, see Discussion of this chapter).

Table 10. Number of livestock killed , including cows, horses, and sheep, and beehives destroyed by bears, and percent loss of livestock to bears of all registered livestock for L'Aquila province, Central Italy, from 1986 to 1990.

Category	Year 1986	1987	1988	1989	1990	total	% of all livestock
Beehives	18	8	45	33	37	141	
Cows	4	6	7	3	6	26	0.02
Horses	4	6	8	6	5	29	0.04
Sheep	39	27	142	98	39	345	0.03
Total	65	47	202	140	87	541	

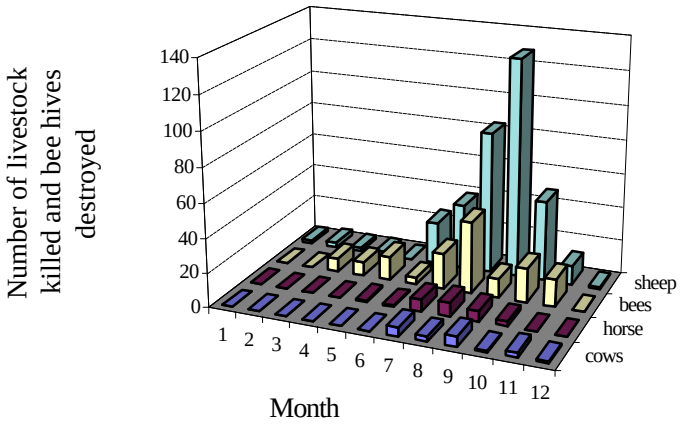

Figure 10. Number of livestock killed and bee hives destroyed monthly by brown bears in L'Aquila province (outside Abruzzo National Park), central Itlay, from 1986 to 1990.

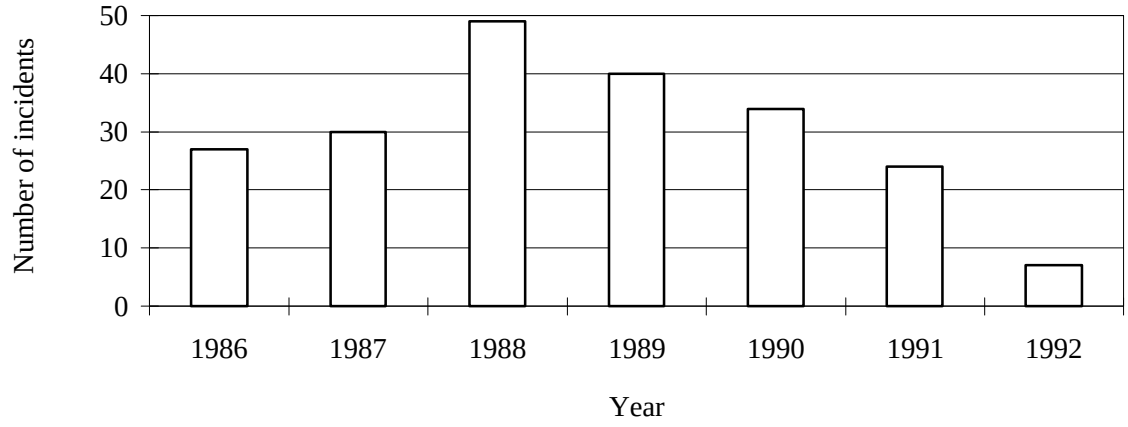

Figure 11. Annual number of bear damage incidents in L'Aquila province (outside Abruzzo National Park), central Italy, from 1986 to 1991.

Sweden

Bear damage to livestock in Sweden, including domestic reindeer, accounted for only 3-12 % of animals killed by all predators (Table 11, EPA statistics 1993). Between 1990 and 1994, reindeer comprised 89 % of all livestock killed by (Table 11). Only 2-10% of reindeer killed by all predators were attributed to bears (Table 12).

Beehive damage occurred only in 1993. Sheep damage was low, and occurred mainly in central Sweden. In 1985, a hunter was injured, and in 1994, 7 bears were shot in self-defense by hunters (Bjärvall, Swedish Environmental Protection Agency, pers. comm.).

Norway

During 1984 to 1993, bears accounted for 9-19 % of all the registered wildlife damage in Norway (Table 13, Figure 12). Compensated bear damage (in NEK) to sheep per county did not seem to be correlated to registered sheep numbers per county, but correlation coefficients could not be calculated because of small sample size

Table 11. Number of livestock killed , including reindeer, sheep, and cows, or beehives destroyed by bears and percentage of bear damage of all registered carnivore damage in Sweden between 1990-1994 (Swedish EPA data) ($ 1 US = 7.5 Swedish Krones (SEK))..

Year	Reindeer	Sheep	Cows	Bee-hives	SEK	bear damage (in %) of all recorded carnivore damage
1990	700	130	0	0	1,877,929	12.0
1991	402	64	1	0	1,172,140	5.0
1992	1,010	67	3	0	2,759,179	8.3
1993	134	96	2	5	489,782	3.4
1994	496	25	1	0	1,182,623	5.3

Table 12. Number of reindeer killed by all carnivores and by bears alone in northern Sweden from 1990 to 1994.

County	Year	Total killed	Killed by bear	% killed by bear
Norbottens	1990	6433	569	9
	1991	4090	233	6
	1992	7034	677	10
	1993	3287	94	3
	1994	3754	278	7
Vasterbottens	1990	1085	57	5
	1991	1480	75	5
	1992	3327	224	7
	1993	1019	20	2
	1994	1874	104	5
Jamtland	1990	1512	74	5
	1991	2584	94	4
	1992	2134	109	5
	1993	1185	20	2
	1994	2150	114	5
Whole country	1990	9030	700	8
	1991	8154	402	5
	1992	12495	1010	8
	1993	5491	134	2
	1994	7778	496	6

and lack of complete data (Table 14). However, Sag r et al. (1995) found a positive relationship between the number of bears and the loss of sheep in the border areas of Norway and Sweden.

Statistics indicated that about 50 to 65 percent of all brown bear damage claims were approved in Norway. In Hedmark county, 1,233 incidents were claimed in 1993 and 810 (65 %) were paid. In 1994, 1,061 claims were filed and 664 (63 %) were paid.

Table 13. Animals compensated for bear damage, percentage of bear damage of all registered wildlife damage, and economic value of bear damage in Norway from 1987 to 1991 ($ 1 US = 6.5 Norwegian Krones (NEK)).

Year	Animals compensated	% of bear damage of all wildlife damage	NEK	NEK for all wildlife damage
1984	636	12	1,149,400	7,449,100
1985	860	14	1,434,400	8,351,600
1986	1,153	17	2,028,900	10,107,300
1987	1,300	19	3,162,500	12,272,400
1988	626	9	1,740,500	12,324,200
1989	1,301	12	3,572,800	15,821,600
1990	982	12	2,438,692	13,670,068
1991	1,579	15	3,259,228	15,948,860
1992	2,111	16	4,180,599	20,177,637
1993	2,289	17	4,634,717	21,314,332

Table 14. Number of sheep registered (Sheep Farmers Association) and amount in compensation for damage by bears paid per county in Norway in 1992 ($ 1 US = 6.5 Norwegian Krones (NEK)).

County	Number of registered sheep	NEK
South-Trondelag	151,081	4,800
Oppland	229,681	24,000
Troms	131,592	131,866
Nordland	203,101	290,894
North-Trondelag	97,156	1,749,836
Hedmark	135,949	1,993,603

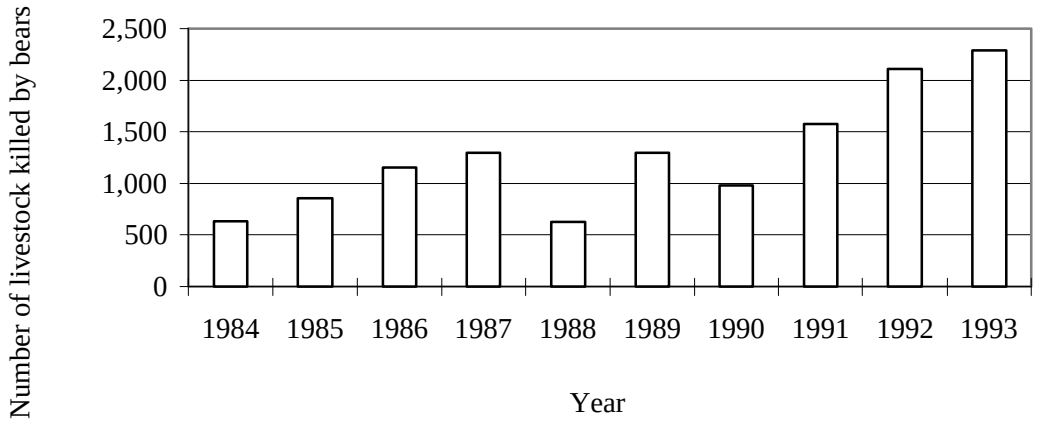

Figure 12. Number of livestock killed by brown bears in Norway from 1984 to 1993.

Austria

Damage in Austria overall.-- Bear damage (animals and/or hives destroyed) increased steadily from the time restocking began in the late 1980s, until it peaked in 1994 with 198 animals and/or hives destroyed. In 1994, 2 bears in central Austria killed 60 sheep, 2 goats and 1 cow, and emptied several fish ponds. The 2 bears were destroyed the same year and damages decreased to 78 animals and/or hives destroyed in 1995 (Figure 13).

In 4 of 6 years, more beehives were destroyed than sheep killed. Sheep losses relative to the total number of sheep grazing ranged from 0.31 % in Carinthia, to 2.5 % in Upper Austria in 1995. The state of Carinthia had the highest number of registered sheep, and recorded the highest number of sheep killed by bears in 1995 (Table 15, Table 16). In 1993 and 1994, however, Central Austria, which includes Upper and Lower Austria, had the most sheep killed. The 2 bears mentioned above were responsible for most of this increased number in sheep killed. Sheep numbers have declined in Austria over the last 10 years (Table 16), but sheep kills have fluctuated between 1990 and 1995 (Table 15).

Table 15. Number of sheep killed and number of beehives destroyed by brown bears in central Austria, including the states of Lower Austria, Upper Austria and Styria, and Carinthia from 1990 to 1995.

	Number of sheep killed		Number of beehives destroyed	
Year	Carinthia	Central	Carinthia	Central
1990	0	1	18	1
1991	19	10	17	5
1992	17	1	8	26
1993	5	47	7	60
1994	2	66	0	130
1995	45	1	0	32

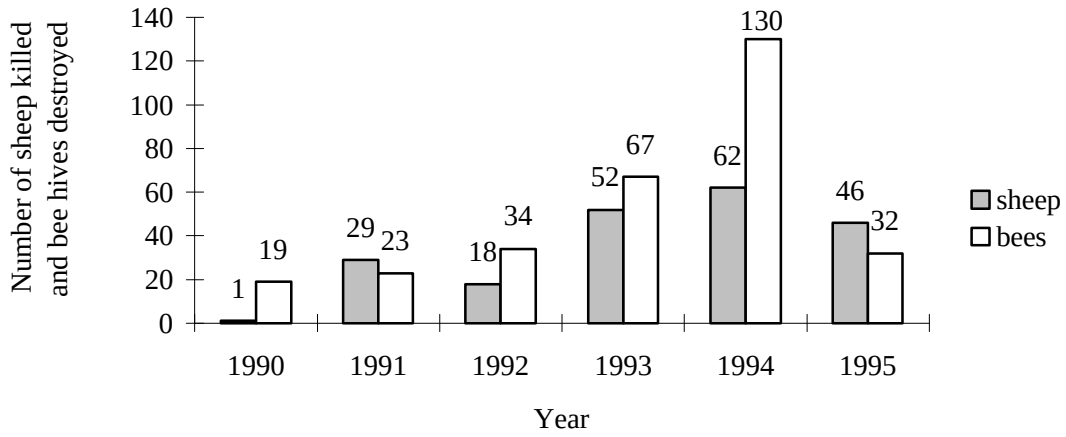

Figure 13. Annual number of sheep killed and bee hives destroyed in Austria from 1990 to 1995.

Table 16. Number of sheep registered at the Ministry of Agriculture in the states of Austria during 1986, 1994, and 1995.

	Number of sheep registered		
State	1986	1994	1995
Upper Austria	2,272	768	1,323
Lower Austria	80	0	0
Carinthia	14,003	16,536	12,098
Styria	10,829	8,663	6,770
Salzburg	26,423	18,206	14,705
Total	53,607	44,173	34,896

Damage in Central Austria.-- Central Austria began keeping bear damage records in 1990 and recorded the greatest damage in 1994 (Table 15). During that year bears destroyed 130 beehives and killed 66 sheep (Rauer, WWF Austria, unpubl. data).

From 1989 to 1995, people reported 173 close encounters (< 60m) with brown bears. The close encounters peaked in 1993 (n = 127) and 1994 (n = 188) (Rauer, WWF Austria, unpubl. data). Observations suggested that bears were most active in the early morning and evening hours (Figure 14), and were most visible during the summer months (Figure 15). However, most observations were made by hunters and foresters, who were most active at the times of peak bear sightings (Table 17). Two bears were shot in 1994, and the number of close encounters dropped 40 % (n = 76) in 1995.

Damage in Carinthia.-- Bear damages in Carinthia have been recorded since 1990 in a standardized format. The highest damage, amounting to 45 sheep, was reported in 1995 (Table 15). Bee damage was minimal in Carinthia during 1990-1995 and amounted to $6,420 US (30,000 Os) per year (Gutleb 1995a).

Damage to sheep usually occurred in early summer (June), except in 1995 when most sheep were killed in August (Figure 16). The majority of bear damage to bee hives occurred in March and April. This was also the season of most bear sightings (Figure 17). There were 61 sightings over the years with 16 incidents closer than 60m (Gutleb 1995a).

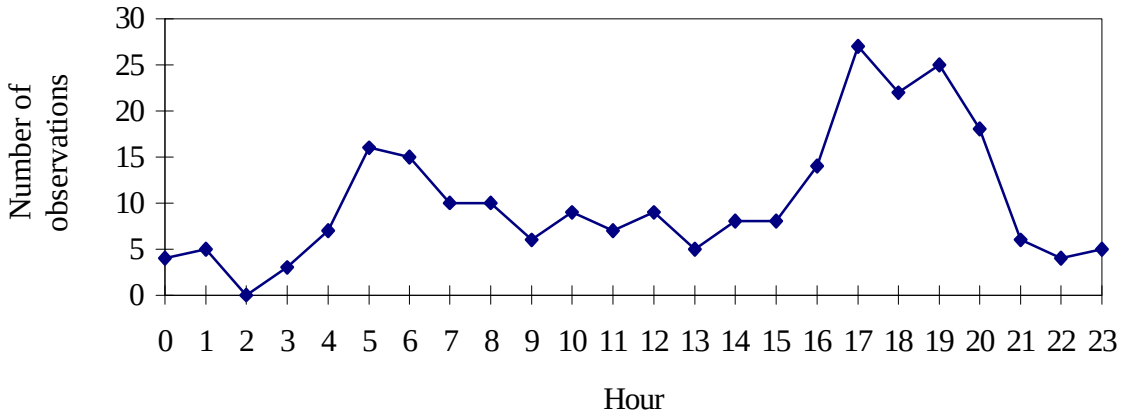

Figure 14. Diel activity patterns of brown bears in central Austria, including the states of Upper and Lower Austria and Styria, as indicated by sightings from 1991 to 1995.

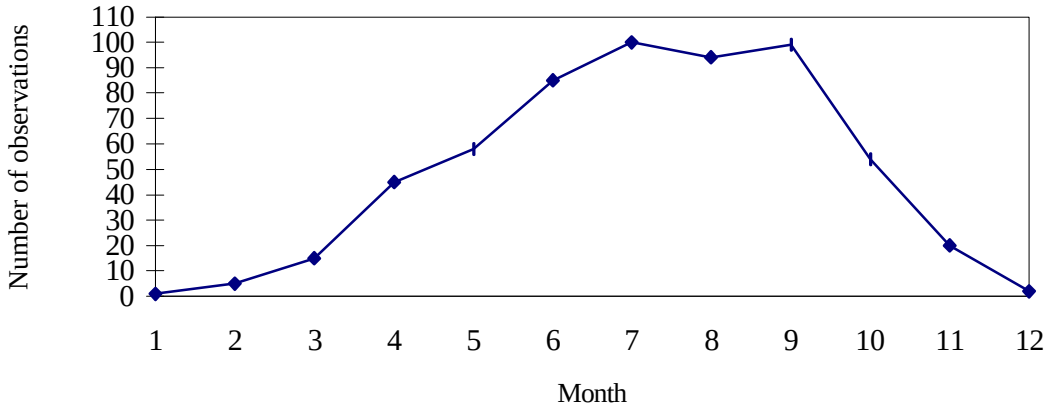

Figure 15. Annual activity pattern of brown bears in Central Austria, including the states of Upper and Lower Austria and Styria, as indicated by sightings from 1991 to 1995.

Table 17. Number of bear sightings in central Austria, including the states of Upper and Lower Austria and Styria, by occupation of observer from 1990 to 1995.

Occupation	Number of observations
Hunters	30
Foresters	25
Local people	27
Scientists	12
Farmers	10
Tourists	2
Police	1

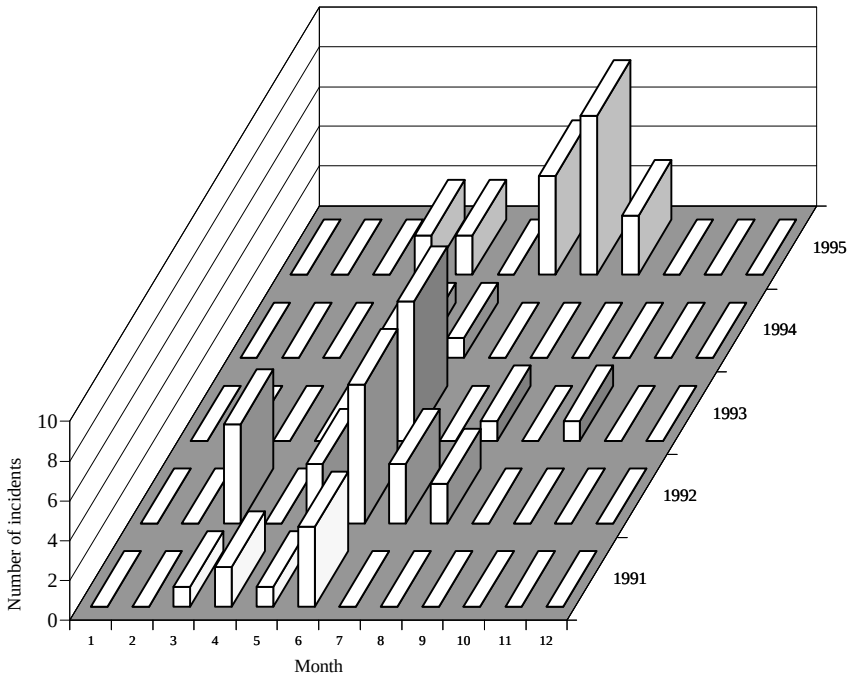

Figure 16. Number of bear damage incidents per month in Carinthia, Austria, from 1991 to 1995.

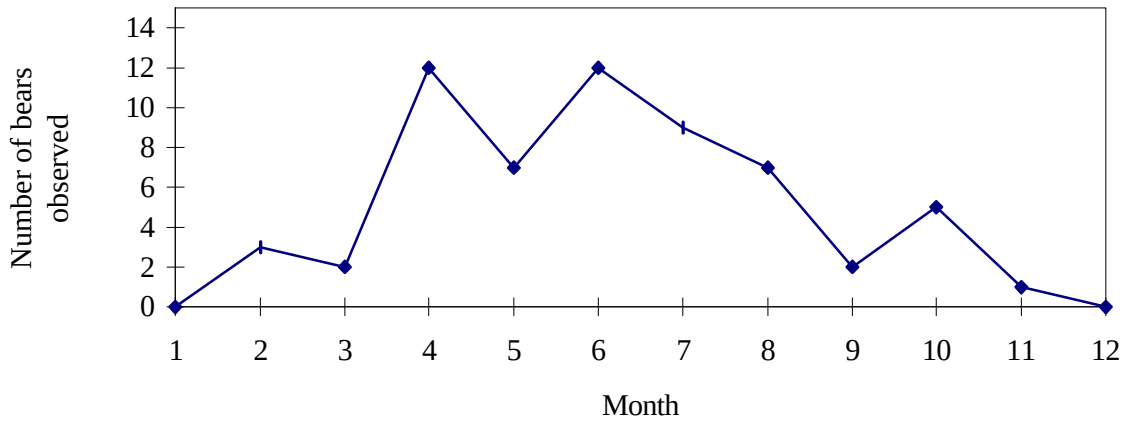

Figure 17. Number of bears observed in Carinthia, Austria, from 1991 to 1995.

DISCUSSION

Limitations of data

The quality of the data ranged from written notes in individual counties (e.g. Romania) to a cumulative data base for the whole country (e.g. Norway). Some limitations of the data included differing time periods of recorded data, quality of statistical livestock data, different measures of damage, and varying damage compensation systems.

Some countries only recently initiated compensation and recording systems, and data have only been available for one or two years. Others, such as Italy, changed compensation laws over the years, making it difficult to compare among years. Thus, in some cases, drawing accurate conclusions was virtually impossible.

When comparing livestock availability to livestock killed in a year, it is important to note that statistics report livestock numbers in the counties they were registered at the beginning of the year. In herding systems like those used in Italy and Romania, however, shepherds cover large distances between summer and winter ranges. Thus, sheep densities in summer grazing areas may be greatly underestimated in the annual statistical reports,

since sheep that were, for example, registered in southern Italy in the winter might spend the summer in central Italy in the mountains where they are vulnerable to bear predation.

Damage statistics were provided in different formats, including amount of money compensated, number of incidents, and number of animals killed or beehives destroyed. Different recording methods made it difficult to compare these results in a meaningful way between countries. To avoid this problem, data were transformed to number of animals killed or number of bee hives destroyed as accurately as possible.

Reported numbers of destroyed bee hives were difficult to interpret because a definition of 'destroyed' was not provided. A beehive could be salvaged in some cases if the queen and vital workers were not killed.

Some countries paid adjusted fees for the quality of the livestock. In Norway, for example, a breeding sheep was valued higher than a non-breeding sheep. Recorded data also depended on how well people were trained to distinguish predator kills. Decisions could be biased by differential payments for different predators. In Italy, for instance, the premium paid for bear damage was higher than the premium paid for wolf or dog damage. It is, therefore, possible that many claims were declared 'bear' to give the farmer some extra money to keep good relationships between the foresters and the farmers (Posillico, Italian Forest Service, pers. comm.).

Another problem, most apparent in Romania, was the difficulty of the damage claim procedure. It was often impossible for farmers up in the mountains to report damage, which caused an underestimation of the actual damage occurring in the country.

Romania

Detailed damage statistics are kept on a regional level only, and currently only total amount of damage (in Romanian Lei) is available at the national level. Romanian scientists currently are compiling more detailed national damage statistics to evaluate recent bear damage in Romania as a whole.

The monetary amount (in Romanian Lei) of bear damage per county seemed to be related to the number of bears per county ($r^2 = 0.997$, $P < 0.001$). Even when bear

numbers were adjusted for the amount of forested area per county, the relationship held ($r^2 = 0.896$, $P < 0.001$), but the accuracy of the data upon which the relationship is based are questionable. Bear numbers in Romania are estimated by game wardens at bait stations in the forests. Populations could be overestimated if bears are double counted at these stations, or underestimated if only a fraction of the bear population visits the feeding stations. The estimate of damage might vary with the accessibility for shepherds to report damage. The shepherds I interviewed felt that those who lived in the mountains do not report damage as frequently as shepherds who lived close to villages. Additionally, wildlife managers may not appreciate the importance of collecting accurate bear population and damage data, and may provide subjective estimates. In rare instances data may be manufactured, but there is no evidence this occurs. Vaughan and Scanlon (1990) did not find a relationship between the estimated number of bear damage incidents and bear population size in the southeastern USA.

In Norway, Sag r et al. (1995) reported that the number of sheep lost were positively related to the estimated number of bears in the area. Conversely, Wabakken and Maartmann (1994) in Norway and Camarra (1986) in Spain demonstrated that the density of sheep in an area was not correlated with an increase in damage by bears. I found similar results by looking at the relationship between livestock densities per county and recorded bear damage (in Romanian Lei) ($r^2 = 0.075$, $P = 0.682$). Thus, from a management perspective, it may be more effective to remove offending bears rather than reduce the number of livestock in an area.

The positive relationship between injuries to people (Nicolae 1994) and bear numbers was in part related to the behavior of shepherds ($r^2 = 0.854$, $P < 0.001$). When bears attack livestock in Romania, shepherds tend to fight for their sheep to salvage the carcass. Since the process of compensation is tedious and often impossible for shepherds that live high in the mountains during the summer, they want to keep the dead sheep for claiming compensation at the end of the season or for food (shepherds, central Romania, pers. comm.). The shepherds need the carcasses to prove damage and receive compensation. Shepherds also noted that they register fewer claims now than before the

revolution of 1992, because inflation makes it unprofitable to go through all the paper work for the small amount of money they get in the end. Currently, Romania does not have the economic power to raise damage payments, which would make it worthwhile for shepherds to file for compensation.

The grazing areas for sheep are auctioned every year by ROMSILVA (the Romanian Forest Service), to the highest bidding shepherd or farmer. The richer farmers usually select the better areas. This often pushes shepherds with marginal grazing areas to illegally graze their animals in the forest, where the probability of predation by bears and wolves is relatively high. Wabbakken and Maartmann (1994) reported, that sheep, grazing in areas in Norway with more than 25 % of the habitat above tree-line, were at a lower risk of predation by bear than in more forested areas. Shepherds also often trespass on forests during migration from summer to winter grazing areas with increased vulnerability of their sheep to predators. Stricter enforcement of regulations would keep sheep out of the forest and away from predators. Fixed migration routes could be outlined by ROMSILVA.

Damage by bears in Romania is high and could be decreased by reducing the artificially high bear population. During Ceausescu's dictatorship, bears were fully protected and fed to increase population size for his hunting purposes. In some areas of Romania, feeding to keep high populations for trophy hunting is still practiced, and bears can reach densities up to 4 animals per 10 km^2 (Figure 2) (Ionescu, Romanian Institute for Forest Research and Management, unpubl. report).

Slovenia

Within the core area, data were available only in an annual monetary amount paid by the Slovenian Hunting Association. No figures for how many animals were killed or which species of livestock were most affected were available, although scientists are currently working on a detailed report. The goal of the Slovenian government is to make a more detailed reporting method mandatory (Simonic, Slovenian Ministry of Agriculture, Forestry and Nutrition, pers. comm.).

Unlike in Romania, bear damage in Slovenia was not correlated to bear population size, a discrepancy that may be explained by habitat differences and food availability. The bear core area in southern Slovenia includes the Karst area, which offers an extensive hardwood forest with lots of natural food including beech mast and berry production (Berce and Strumbelj 1992). In addition, bears are fed by hunters on a regular basis to reduce damage, and increase population size for hunting. Even though this area has the highest bear population density (0.17 to 0.98 bears / 10 km^2), damage is about 1/3 the amount from the northern area (< 0.17 bears / 10 km^2) (Kaczensky, Munich Wildlife Society, unpubl. data).

The northern area of the bear range, which lies outside the bear core area (see Chapter 3), covers the Alpine area of the state with high alpine meadows and conifer forests. Natural food availability is far less than in the Karst area and no feeding is provided, however, bears are not hunted there (Koren, Slovenian Forest Service, pers. comm.). In addition, sheep densities are much higher in this area than in the south. This area had most of the recorded damage in Slovenia, reaching approximately $ 20,000 US in 1995.

Most damage occurs in July and August when sheep are unguarded on the summer meadows. Farmers only check these animals every other day. Electric fencing has been tried, but it requires intensive maintenance, and has not proven effective so far (Adamic, Slovenian Institute for Forest Research and Management, pers. comm.). One way to reduce damage would be to bring the sheep into a closed corral over night, close to houses. Most of the farmers, however, keep sheep only as a supplementary income and do not have the time or money to invest in additional safety measures (pers. obs.). Introducing feeding sites in the area to supplement natural food sources is being discussed by authorities and is already practiced by the Italian Forest Service across the border.

The elimination of a problem bear in northern Slovenia in 1994 greatly reduced the damage to sheep the following year (Koren, Slovenian Forest Service, pers. comm.). One explanation could be that there are specific bears that cause damage in Slovenia, and once

the offending animal is removed damage decreases. In Norway, however, the elimination of a problem bear did not reduce the damage the next year (Sag r et al. 1995, see below).

Abruzzo region (central Italy)

Most bears in central Italy are inside the Abruzzo National Park (Boscagli 1994), but damage statistics were not released by park authorities. It should be noted that, unlike in the USA, people live inside the park and damage to sheep had been recorded there.

Feeding stations and fruit plantations are provided inside the national park to increase the bear population, to keep bears inside the park, to save them from being poached, and to reduce damage. Several incidents of habituation at these feeding stations have been observed (Posillico, Italian Forest Service, pers. comm., Wolfgang Schröder, Munich Wildlife Society, pers. comm.). Slovenia does not seem to have this problem with feeding stations, but their sites are much further away from civilization than in Abruzzo National Park, where one station is right next to one of the major roads in the park and a picnic area.

Although bears kill only about 0.03 % of all registered livestock in L'Aquila province, damage to an individual farmer can be extensive (see below). In 1988, a peak damage year, the Forest Service of L'Aquila province paid $ 36,000 US in damage claims. Many farmers complain, however, that they sometimes have to wait up to 8 years for claims to be paid. The reason for these long waiting periods is that claims are pushed back a year if the budget is exhausted for the fiscal. The long waiting periods cause frustration among the farmers and seem to be a reason for the high poaching rates for bears in the area. Poaching and accidental killing by wild boar hunters are the main conservation problems for the bear population in the Abruzzo region (Boscagli 1994). The National Park apparently pays damage compensation much faster (within a year) than the Italian Forest Service (IFS). Interviewees reported cases of shepherds carrying their dead sheep into the park to get faster compensation.

In Italy, as in Romania, sheep are usually guarded by shepherds and dogs during the day and put into an enclosure over night during the summer months on the high

pastures. Most damage occurs at night, and can be extensive if enclosed sheep start to panic and kill each other. One incident involved the death of 40 sheep in one enclosure due to panic (Italian Forest Service, unpubl. data). Some of the shepherds complained that they cannot protect their sheep properly, since they have to renew their grazing leases from the IFS every year and cannot build permanent structures on the leased land. Many thought they could protect their livestock better if they were allowed to build electric fences around their night-enclosures, put up lights around the enclosures, and construct better houses to live in on the summer grazing areas.

As in Slovenia, the killing of problem bears seems to reduce damage the following year. During the peak damage year of 1988, 18 bears were killed by poachers and car accidents. In 1989, damages were 25 % less than in 1988, a trend that has continued each successive year. It could be an indication that problem bears were successfully eliminated or that the bear population is not increasing and that home ranges are not filled by dispersing animals.

In addition to the long waiting periods for compensation money, the IFS introduced new compensation laws in 1990 designed to enforce stricter damage prevention methods. The law required 1 shepherd per 200 sheep, mandatory night enclosures, and several other safety measures. Farmers, however, were not able to afford the extra measures and many complaints and poaching threats forced the IFS to abandon the laws again in 1994 (Cozza et al. in prep.).

Most damage in central Italy occurred in the summer and early fall (August and September), and mainly involved sheep (same in Austria). This could be related to natural food availability, since hard and soft mast of the fall was not yet available. Damage to bee hives was distributed more evenly over the year and probably offered a good food source in early spring when bears came out of the winter dens and sheep had not arrived from the coastal areas. Bear damage in this area might be reduced if shepherds were allowed to build adequate night corrals on the summer grazing range. Presently, a supplementary planting of fruit trees and grains to increase natural food availability is practiced with the goal to reduce damages and increase bear population size.

Sweden

Bear damage in Sweden on livestock and domestic reindeer accounted for only 3-12 % of the total damage by predators, but still cost the country about $ 30,000 US annually (Table 11). With an expanding bear population, bears might have to live in closer proximity to people and the chances of habituation and damage would increase. The Swedish Environmental Protection Agency (EPA) stated as a management alternative, that the population goal of 2,000 individuals will be lowered if damages to bee hives and domestic animals increased over the years (Bjärvall, Swedish Environmental Protection Agency, pers. comm.).

Reindeer were by far the most affected category of bear damage, accounting for over 90 % of all reported bear damage. A separate reindeer - predator management plan was developed by the EPA of Sweden in 1991, after poaching by the local Laplander tribe on predators had become a serious problem (Bjärvall, Swedish Environmental Protection Agency, pers. comm.). The new management plan was developed in cooperation with the tribes and has proven to be successful in reducing poaching and developing a better compensation system for the damage.

Norway

During 1984 to 1993, bears accounted for 9-19 % of all the registered wildlife damage in Norway (Table 13, Figure 12). This is considerably higher than in Sweden, even though the bear population in Norway is 3 % of that in Sweden (25 versus 700 bears). These data need to be looked at carefully, however, for the bear population in Scandinavia has been greatly overestimated in the past (Swenson et al. 1995), and damages may have been attributed to bears incorrectly. An estimate of the bear population in 1978 to 1982, based on sightings and bear damages, concluded there were 157-230 bears in Norway (Kolstad et al. 1986). A revised estimate, based on radio-telemetry marked bears, determined that only 14 bears were in Norway in 1995 (Swenson et al. 1995).

One explanation for the higher rate of bear damage in Norway relative to Sweden, seems to be the livestock herding system in Norway. Sheep there are allowed to roam the forests unguarded all summer long. In addition, the breed of sheep in Norway does not stay together in groups, but disperses for grazing during the day. Warren and Mysterud (1995) observed that single sheep are much more vulnerable to predation than flocking sheep. In some areas of Norway (e.g. Hedmark county), bears accounted for 60 % of all sheep losses (Warren and Mysterud 1995).

Warren and Mysterud (1995) speculated that this number could be even higher if the herds get younger from bears selectively preying on mature sheep. Older ewes tend to defend their young and therefore are killed by bears more often. Younger mothers tend not to care as well for their young and do not defend the lambs as vigorously against predators. They concluded that with increased immigration of bears from Sweden, the number of sheep lost in this area will go up. The Norwegian government is also subsidizing farmers to get more sheep in this area, which might also increase the damage problem. The authors mention that sheep losses to bears are minimal when compared to the 2.2 million sheep in Norway, but are very high locally. One farmer lost 1/3 of his sheep in one night after 10 years of no predation by bears at all (Warren and Mysterud 1995).

Sag r et al. (1995) reported that killing problem bears did not reduce sheep loss the following year, and attributed it to additional bears immigrating from Sweden and replacing the killed bears. It seems that the number of bears in an area is important, but not the density of sheep available (see results of Romania). In this study, bear damage to sheep in Norway did not seem to be related to sheep numbers in the area, but a regression could not be conducted because of small sample size and lack of complete data in our study (Table 14). Sag r et al. (1995) also showed, however, that there was a positive relationship between the number of bears and the loss of sheep in the border areas of Norway and Sweden.

A second study in Hedmark county (Figure 5), which has the highest sheep damages in Norway, did not find a correlation between the number of bear attacks on sheep and sheep densities (Wabakken and Maartmann 1994).

Half of all sheep fatalities in Norway occurred in August in Hedmark county. Wabakken and Maartmann (1994) concluded that bears spend more time in Sweden in May/June, and that the damage in Norway is therefore lower at that time of the year. They also reported, like the study of Sag r et al. (1995), that killing of problem bears did not reduced damage, which is in contrast to the observations in Austria and Slovenia.

To reduce bear damage in Norway, wildlife managers suggested separating bear core protection areas from sheep farming areas in time and place, by taking sheep home earlier from the summer grazing meadows or moving them to other areas in Norway that do not have bears in late summer. A second solution would be for the government to subsidize a change to cattle production in bear areas.

Austria

Bear damage in Austria is relatively low. In the last 5 years, Austria recorded 20 to 198 damage units (animals, beehives, fish ponds) whereas Norway, which has about the same number of bears as Austria, reported 982 to 2,289 animals lost. As noted above, however, Norway's reported damage could be inflated due to an overestimation of the bear population.

Damage in Austria seems to be driven by individual bears that have become food-conditioned or habituated, and is reduced drastically once the offending individual is removed from the population. This appears to be the general trend in other countries, such as Italy, where the population is not large enough to quickly replace individuals that are removed. As the population in Austria grows and more animals migrate north from Slovenia, this management option might no longer be successful in controlling damage, but for now this seems to be the best solution.

Sheep numbers have declined in Austria over the last 10 years, but sheep kills have increased along with bear population numbers (Table 15, Table 16.). Similar results were

reported by Camarra (1986), who did not find a relationship between sheep densities and the frequency of bear attacks in the western French Pyrenees.

With the likely disappearance of sheep farming in Austria, which is very labor intensive, killing of sheep by bear might become less and less important than destruction of bee hives. Electric fencing has proven very successful as long as a bear has not gotten to the same hives before (Singer 1995). Since fencing is quite costly, one has to consider if fencing a single bee hive is more efficient than just replacing a hive if it should be destroyed. A regulated compensation program has to be formulated to take into account the feasibility of sponsoring fencing for large honey production operations, common in central Austria. In Carinthia, bee hives are mostly destroyed in the spring when sheep are not yet out on the meadows, and bears are coming out of dens.

Bear sightings and bear damage in Austria peaked in the summer months (Figure 15, Figure 16, Figure 17). The number of bear sightings in central Austria was much higher than in Carinthia for the last 5 years. The reason for these numerous observations in central Austria were 2 habituated bears that were seen frequently close to developments and drove up the number of observations in comparison to Carinthia, where very few bears have been observed over this 5-year period. Several sightings involved close encounters (< 60m) with bears and mainly involved the 2 habituated bears that caused most of the damage mentioned above. Similar situations could be avoided in the future by faster action of the authorities, such as aversive conditioning or removal of the offending individual.

Bears seemed to be most active in the early morning and evening hours (Figure 13). The data could be biased though because most observations were made by hunters and foresters, who are out hunting or working at these times of the day (Table 17.). Similar patterns, however, were observed for black bears in Great Smoky Mountain National Park (Garshelis and Pelton 1980).

CONCLUSION AND RECOMMENDATIONS

The success of many large carnivore conservation projects lies in damage management (Wagner 1997, Olsen 1991). Even though the annual economic loss to bears in most European countries is below $ 20,000 US, often < 10% of all damage by wildlife, damage incidents by bears always get great media attention, and cause people to fear for their safety.

One also has to consider that even if damage, measured over a whole country such as Norway, is small, locally it can have quite an impact (Warren and Mysterud 1995, Wagner 1997, Italian Forest Service unpubl. data). Wagner (1997) reported that most U.S. compensation programs were established for valuable species, such as bears, elk and deer, which have increased in population size due to management efforts by state/provincial wildlife agencies. A good compensation system is therefore mandatory to reduce the pressure on the individual suffering damage and to increase the conservation success for bears. As Italy has shown, a lengthy, not very effective compensation procedure might increase poaching and impede the success of keeping a permanent bear population in Austria. A well-functioning compensation system for Austria will have to focus on making the process easy and readily accessible

A change in livestock herding methods, for example introducing guarding dogs or changing to cattle grazing, does not seem feasible for Austria, since many farmers keep sheep for extra income and do not have the time or money to invest in training dogs. The same is true for collecting sheep every night and bringing them to an enclosure.

Feeding bears seems to work well to reduce damage in the bear core area of Slovenia, although scientific studies of the exact relationship between feeding and damage reduction has never been done (Knauer and Kaczensky, Munich Wildlife Society, pers. comm.). One also has to consider that a low number of damage incidents might be related to very few sheep in the core area, even though other studies by Camarra (1986) and Wabakken and Maartmann (1994) have shown that the number of bear damage incidents are not related to sheep densities, but rather bear population size. A certain threshold of sheep might have to exist before damage by bear becomes important. Craighead et al.

(1995) supported the hypothesis that feeding bears will reduce the size of areas that are necessary for a population to survive and would minimize bear-human conflicts by concentrating bears away from people. Feeding of wildlife, however, is a controversial ethical question with many advantages and disadvantages, and is not a feasible solution for Austria according to wildlife officials there.

A key element for the preservation of the bear in Austria will be a quick reaction by authorities to problem bears. As long as the population size is small, the elimination of a problem bear that causes intensive damage seems to reduce the problem. Aversive conditioning of problem bears can be successful if done early in the habituation process of the animal, but is time intensive and costly (Herrero 1985).

A quick and well functioning compensation program can help reduce negative attitudes towards bears, but has to be used carefully. Damage compensation does not take care of the problem, but may increase tolerance of farmers to bear damage (Wagner 1997). Studies in the US have shown that farmers are more frustrated at a malfunctioning and inadequately paying compensation program than none at all (Wagner 1997).

It will also be important to keep the public informed about actions taken at all times to avoid panic and rumors. Public support has been recognized as the key for success in wildlife management (Conover and Decker 1991, Conover 1994).

Chapter 3. Brown bear management patterns in five European countries and their implications for a bear management plan in Austria.

INTRODUCTION

Brown bear management in Europe includes a broad spectrum of goals, ranging from no protection, to regulated hunting, to total protection. In each country, different organizations are involved in bear management, including private and governmental organizations.

The first part of this study is an assessment of the organizational structure of different bear management programs in Europe. For each country, including Slovenia, Romania, Italy, Norway, Sweden, and Austria, I identified organizations involved in bear management, determined if a management plan exists, if and how hunting and damage compensation is structured, examined how the countries deal with problem bears, and finally, identified what kind of management problems each country encounters. In the second part of the study I tried to illustrate patterns of bear management in Europe, including advantages, disadvantages, and effectiveness of each approach within the various countries. The results of this assessment will be used to recommend a bear management strategy for Austria and provide a reference on bear management strategies in Europe.

METHODS

I interviewed wildlife managers, hunters, government officials and farmers in Slovenia, Romania, Italy, Norway, Sweden, and Austria. Several people involved in bear management in their countries were interviewed. Following the 'snow - ball method' (Babbie 1992), initial contacts were made by Dr. Wolfgang Schröder of the Munich Wildlife Society (for a list of initial contacts see Appendix 1). Interviews with initial contacts resulted in identification of additional people to be interviewed. The initial contacts also helped to establish contact with other interviewees. A total of 90 interviews

was conducted, including administrative officials (e.g. director of a hunting association), local wildlife managers, researchers, shepherds/farmers, and local residents (Table 19).

Table 18. Number of people interviewed in each study country according to their occupation.

Occupation	Romania	Slovenia	Italy	Norway	Sweden	Austria
Administrative official	4	4	-	5	1	7
Local wildlife manager	2	4	3	3	-	3
Shepherd/Farmer	7	4	8	3	-	11
Local resident	9	-	-	-	-	-
Researcher	2	1	2	2	-	2

The interviews were done in person, using a tape recorder for future review and an interview guide (Appendix 2), which was modified according to the level of professionalism. For example, questions about detailed administrative procedures were not used for interviewing wildlife managers in the field. If the interviewee did not speak English or German, a translator, usually a local student, helped in the process.

A separate interview guide was used for interviewing farmers and shepherds (Appendix 3). These people were chosen by random encounters on the road or while hiking in the backcountry. This method was chosen since a list of all farmers of the areas was not available. The same 'random' method was used for residents of Racadau, a suburb of Brasov in central Romania where bears come to trash cans near the houses.

The information we wanted to obtain from the interviews included:

1. What kind of bear - related problems exist in each study area (e.g. habituation, food - conditioning, property damage)
2. How are these problems dealt with by authorities and the public?
3. Is there a management plan and how is it working?
4. What are the strengths and weaknesses for each management approach?

5. What is the level of public knowledge of bears, their attitudes towards bears and their satisfaction with governmental management, and damage compensation.
6. What is the population status (hunted, protected), population densities, and food availability for bears in each study area.

The interviews were all translated into English. The interviews were then analyzed by content analysis (Babbie 1992), in which I counted how many people answered a question with the same intent. For example in Slovenia, 3 of 9 interviewed wildlife managers mentioned fencing of bee hives as a preventive measure to bear damage. I did not use specific words but rather meaning to summarize the answers since many people did not answer in English and their answers were interpreted by me or a translator. The interviews served as a basis of information for the description of management patterns and the evaluation of effectiveness within each country.

RESULTS

Romania

Organizations involved in the management of brown bears and their duties.-- Brown bear management in Romania is shared by both governmental and private organizations. The Department of Forestry and Wildlife (ROMSILVA), under the Ministry of Water, Forests, and Environmental Protection (Ministry) is the head organization (Figure 18). The Romanian Hunting Association (RHA), a non-governmental organization (NGO), is responsible for bear management on land leased from ROMSILVA. Specific duties of the governmental and non-governmental organizations involved in brown bear management are described below.

Governmental Organizations: Forests and wildlife in Romania are managed by the Department of Forestry and Wildlife, under the Ministry of Water, Forests, and

Environmental Protection (Figure 18). The Ministry approves annual harvest numbers for individual counties, issues permission to shoot a problem bear outside the hunting season, and drafts and approves new hunting regulations.

ROMSILVA has 41 county administrations, which are further divided into about 10 to 15 districts per county. The Department of Game Management in the Forest Administration of the counties decides if a problem bear is to be shot, applies for annual harvest permits at the Ministry, pools all the population data of the districts and decides the magnitude of harvest requests (about 10 % of estimated population). Other duties include the distribution of harvest permits among the districts, within the county, and issuing invitations for international hunting guests to hunt in certain districts.

Each district is again divided into 5 to 10 hunting units (~ 40 km^2 each), some of which are leased to the Romanian Hunters Association. The districts are required to employ one professional game warden who must have a degree in wildlife management. The districts also collect data on problem bears and send a game warden to investigate damage cases. They also coordinate feeding (where, how often, what) and other measures, such as planting oat fields and fruit trees in the forest. Other duties encompass organizing the annual population census and the accommodation of hunting guests. The game wardens' responsibilities are numerous, ranging from accompanying hunting guests and taking care of feeding stations, to planting supplementary foods in the forests and censusing wildlife.

The Forestry Research and Management Institute (ICAS) is a branch of the Ministry and is responsible for all research connected with Forestry and Wildlife. It is a large institution with over 100 members. ICAS has representatives at the county level, but the main office is in Bucharest. Research on bears is focused on population research and management for trophies.

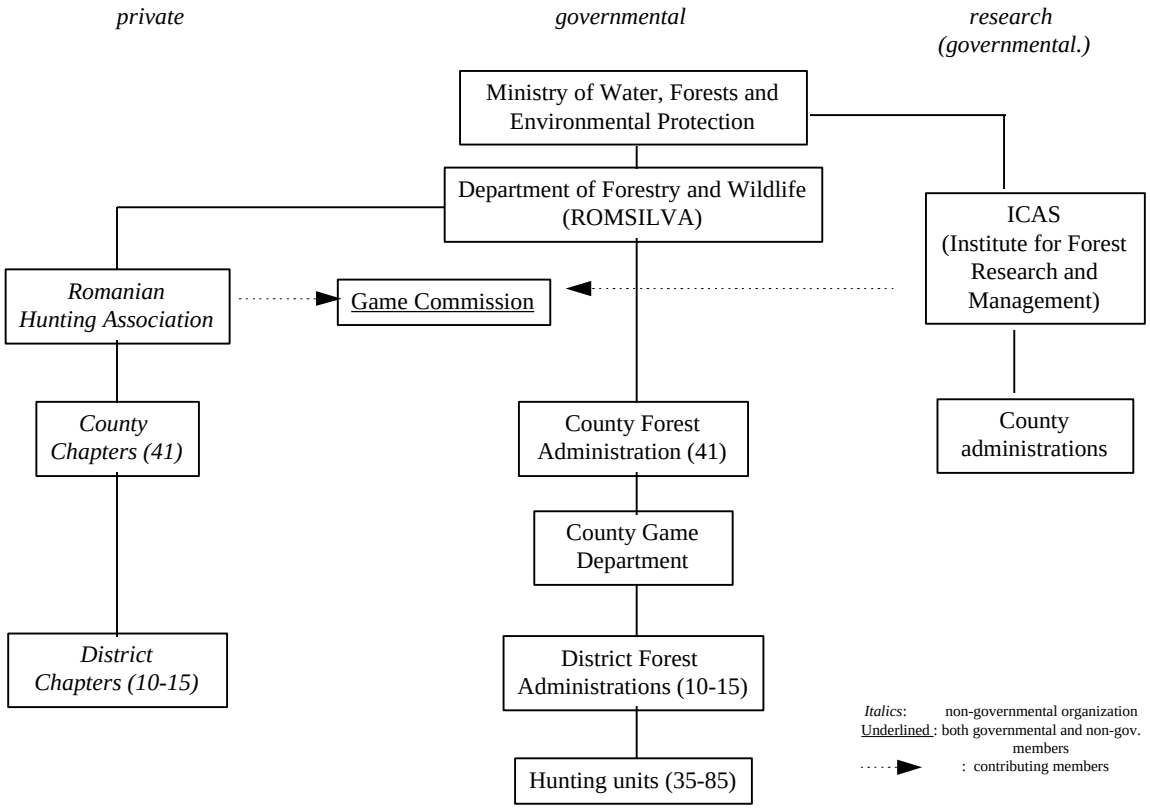

Figure 18. Bear management system in Romania.

Non-governmental Organizations and Cooperation: The Romanian Hunters Association (RHA) is the umbrella organization for the county chapters. It provides a representative to the game commission (see above). Throughout the country, the county chapters collect population estimates and harvest requests from the district chapters and send a collective request to the County Forest Administration. The Ministry endorses harvest requests of the County Forest Administration, which then provides a harvest limit to the county chapters of RHA. The county chapters of RHA then distribute the harvest numbers to the districts. The district chapters of RHA also have to hire game wardens,

who have the same duties as the federally employed wardens (see above). They lease 5 to 10 hunting units with a total area of about 400 km^2 from the county Forest Administration.

Management History.-- Bear management in Romania has been influenced by a strong political regime under the dictator Georgu Ceausescu. During his era (1975 to 1991), bears were fully protected from hunters (except himself).

Intensive feeding all over Romania took place to obtain a strong population of large trophy animals. In the late 1980s, the population reached almost 8,000 animals on an area of 3.8 million hectares, a density much higher than the carrying capacity of the country (Almasan 1994).

In the 1950s, the Ministry of Environment evaluated each hunting unit (*Revier*) for its potential carrying capacity for game animals. The evaluation included abiotic, biotic, and human impact factors. Each *Revier* was then assigned a desirable bear density close to the estimated carrying capacity. The evaluation was repeated in 1987, and concluded that Romania could sustain 4,860 bears (carrying capacity of bears for Romania), far less than the present population size of about 6,000 animals (Almasan 1994).

Present Management.-- *Hunting:* In Romania, bears are hunted during March 15 to May 15 and September 1 to December 31. On average, 500 bears are harvested each year, but females with cubs are strictly protected (Ionescu 1993).

The yearly harvest plan for bears depends on the yearly population census of the districts. Game wardens, with the help of all ROMSILVA personnel, conduct the census and send the estimate to the district office. The districts pass the estimate along to the county administration of ROMSILVA, which gives a pooled estimate for the whole county to the Ministry along with a harvest request (about 10% of the population estimate) (Figure 18).

The Ministry has a game commission, which consists of a forester and a biologist (both from ICAS), and a representative from the Romanian Hunting Association, who review the harvest requests from the counties. Usually, the harvest requests are reduced for each county. The commission considers population trends for the counties and

includes harvest data from the former years to make decisions on the granted harvest number. The reviewed harvest requests are then given to the Ministry for endorsement and passed back to the county administrations.

Management Plan.-- There is no written bear management plan in Romania except annual harvest plans.

Compensation: past, present.-- During Ceausescu's dictatorship, compensation was paid by the local governments after the damage had been inspected by local foresters or police. Damage was compensated according to market value, which is the list price of livestock published by the Ministry of Agriculture. At present, there is no regulated compensation system. Shepherds have to bring their lost livestock to court and claim compensation or have it inspected by police. The amount of money compensated is negligible, and all shepherds interviewed agreed it is usually not worth the trouble of filing a claim.

Problem bear management.-- Problem bears can be shot during the hunting season or with a special permit from the Ministry during the year. The latter is not often done because the killed bear is deducted from the allowable harvest limit of the county the next season. Permits can be sold to hunters at a high price (for foreign hunters up to $ 20,000 US), but special permits to kill problem bears do not require payment. Police can shoot a bear without permits if it poses a personal threat to people or after a person has been injured. Four of 9 interviewed residents of the city of Brasov in central Romania said, however, that officials do not take any measures to deal with highly habituated bears that feed at garbage cans adjacent to houses along the city limits. The general opinion was that these 'trash bears' were not dangerous and only came at night (Table 20, Appendix 4).

Slovenia

Organizations involved in the management of brown bears.-- Brown bear management in Slovenia is shared by both governmental and private organizations. The Ministry of Agriculture, Forestry and Nutrition (Ministry) is the head organization (Figure 19). The Slovenian Hunters Association (SHA), an NGO, is responsible for bear management on

private land or land leased from the Slovenian Forest Service (SFS). A Core Protection Area (CPA) for bears was created by a decree of the Secretary of Agriculture, Forestry and Environment of the Republic of Yugoslavia in 1966. It divided the management of brown bears in Slovenia into the CPA in south-central Slovenia and the area outside of it (Figure 3). Specific duties of the governmental and non-governmental organizations involved in brown bear management are described below.

Government organizations: The Ministry of Agriculture, Forestry and Nutrition approves harvest plans that are sent to them from the Commission for Predator Management (Commission). The Commission is comprised of representatives from the Ministry, the Department of Environmental Management and Forestry, the Forest Management Institute, the SHA, and the State Game Reserves. The Commission receives harvest request for bears every year from game reserves and the SHA. It reviews previous harvest data, population estimates, and damage data to determine harvest quotas in each of the 14 districts. Harvest requests are often too high and get reduced by the Commission, according to 2 interviewed Commission members in Slovenia. Additionally, the Commission discusses requests for permission to shoot problem bears and, if it approves, gives the request to the Ministry for signature. This group is also responsible for lynx and wolf management in Slovenia.

The Ministry employs one carnivore specialist who cooperates closely with the SHA. The carnivore specialist is in charge of damage compensation for bears outside the CPA and the issuing of licenses to kill a problem bear outside the core area. The Department of Environmental Management and Forestry, a branch of the Ministry of Agriculture, employs 14 game wardens for each district who report directly to the carnivore specialists in the Ministry about damage incidents, population estimates, problem bears, and local public relations.

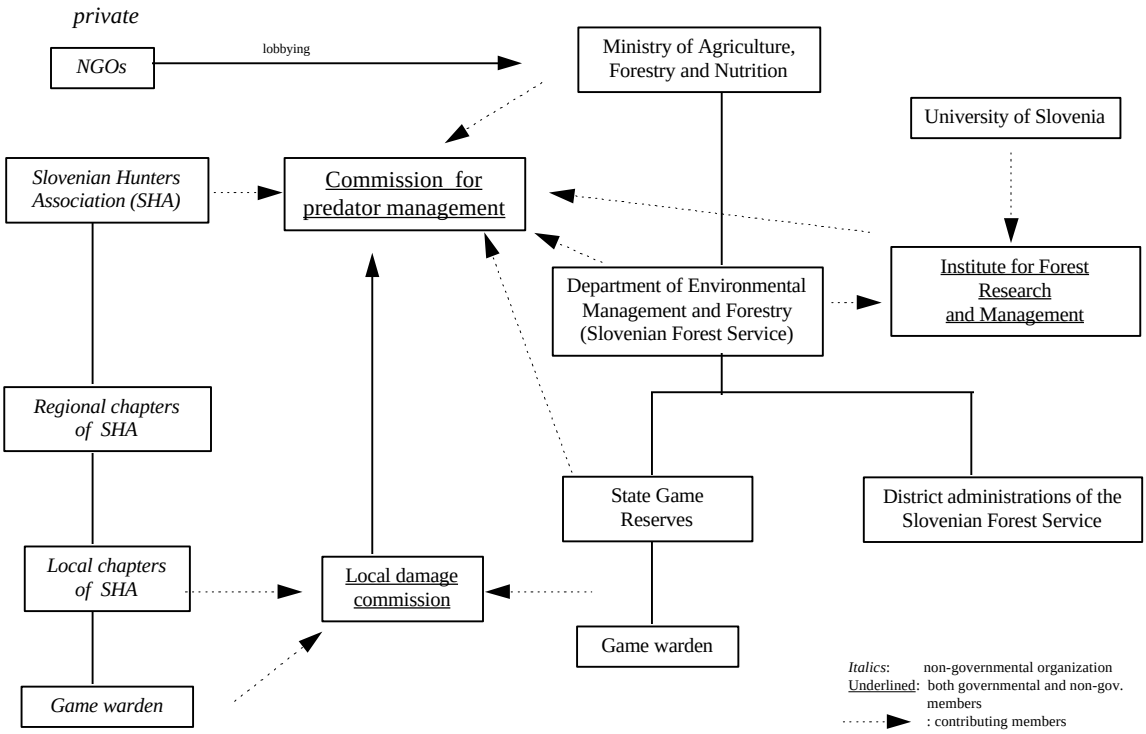

Figure 19. Brown bear management system in Slovenia.

The Forest Management Institute is a joint research institute of the Department of Environmental Management and Forestry and the University of Slovenia. It coordinates research projects, such as the impact of highways on the bear population (Kaczensky 1995), and has a representative in the Commission.

The State Game Reserves' (SGR) goal is to preserve and increase populations of game animals. The SGRs have an intensive feeding program for bears. They also have an annual harvest quota from the Commission and often sell hunting permits to foreigners who provide a major source of income. The SGRs hire professional game wardens, who have degrees in forestry and who usually have some training in wildlife management.

The SFS and its district administrations are also important in the management of brown bears in Slovenia. Each district has a professional game warden who is responsible for damage evaluation for all carnivores and game animals. He sends his reports to the carnivore specialist in the Ministry. If damage reports become frequent and one bear can be identified, the warden asks for a permit to kill the problem bear. The game warden also serves as a consultant for local hunting clubs, including damage prevention, damage evaluation, and population censusing, but this function depends very much on the individual game wardens and the effort they want to invest. One interviewee mentioned that some game wardens do not like to work with local hunting clubs.

Prior to 1996, the SFS was responsible only for areas outside the CPA. However, new hunting regulations and re-organization of the forest districts gave the SFS responsibility for all game animals in the country. The 2 administrative officials interviewed mentioned that the agency's goal is to make forest and hunting districts, which traditionally have not overlapped, the same. The lack of overlap in districts had caused problems in critical habitat protection since the SFS could harvest trees in areas that were, for example, breeding grounds for deer.

Non-governmental Organizations and Cooperation: The SHA is a non-governmental organization that has an important role in the protection of brown bears. The SHA is responsible for damage compensation within the bear core protection area and it adopted voluntary guidelines in 1991, which stated that a bear could be shot outside the core management area only if it caused damage to property or posed a threat to people. Females with cubs could be shot only if they injured or killed a person. The guidelines initiated the formation of the Commission and provided that outside of the CPA, the Ministry would compensate damage victims. Inside the CPA, local hunt clubs that leased the area would pay. The Commission sets a date for all the hunt clubs to conduct population counts, but it is not mandatory for them to do it. The guidelines are followed voluntarily by the SHA. Violations cannot be prosecuted except as an internal matter of SHA. Newly proposed hunting regulations (drafted by the Department of Forestry and Environmental Management) would make it mandatory for hunt clubs to participate in

population counts following a standard protocol, and make the other guidelines a legal requirement.

The SHA leases hunting units from the Ministry and has management responsibility for bears in the leased units. Once each year, the SHA sends a collective harvest request of all hunting clubs to the Commission. Local hunt clubs are subunits of the SHA. They lease areas of about 40 km^2, usually consist of 40-70 members, are in charge of feeding, annual population counts, harvests, damage compensation, and law enforcement.

Management History.-- From 1953 to 1966 brown bears were protected year-round in all of Slovenia. Increasing numbers of human-bear incidents, including the death of a hunter killed by a bear in 1964, led to hunting of bears again. In the CPA, bears were protected from May 1 to September 30, while outside the area, bears could be hunted year-round, including females with cubs.

Present Management.-- The CPA was established to protect bears while allowing strictly regulated hunting. The hunting season lasts from Oct. 1 to April 30. An average hunting quota of 40 bears, divided into 3 weight classes of < 100 kg, 100 - 150 kg, and > 150 kg, is harvested annually. Hunters are generally chosen by seniority, within hunting clubs, to shoot a bear. Licenses cost between $ 300 and $ 500, depending on the size of the bear. Foreigners are frequently charged much more for the license.

A supplementary feeding program was initiated by the SHA in 1986. Local hunting clubs are required to hunt from elevated stands over feeding sites in the forests. Hunting clubs maintain one meat feeding station per 60 km^2 and several corn feeding sites, which are also used for wild boar and deer. These feeding sites are usually stocked with carcasses of livestock local farmers have lost. The goal of feeding is to reduce livestock-bear problems, to keep the bears within the core area, to allow a selective harvest at bait stations, and to facilitate annual bear population counts.

Management Plan.-- The bear harvest quota and the guideline of one meat feeding station per 60 km^2 provide the only written guidelines at the moment. The SFS is developing a management plan at the present time.

Compensation: past, present.-- Damage by bears is compensated by the Ministry outside of the core area (Adamic 1991). A local damage commission, which includes the professional game warden of the district forest administration, the professional game warden of the local hunt club or another representative, and the claimant him/herself, and sometimes a police officer, assesses the loss and sends a report to the carnivore commission. The farmer is paid the market price of the animal (as determined by the Ministry), which includes higher prices for breeding animals with certification.

Inside the core, area local hunt clubs or SGRs cover 2/3 the damage payments, while the Ministry pays 1/3 of each claim. Evaluation of the damage is done by local game wardens who receive no standard training. A summary of the annual loss (in Slovenian currency) is sent to the SHA headquarters.

Problem bear management.-- There are 4 reported cases of bears killing humans in Slovenia since the beginning of the century. In May 1996, a female with cubs seriously injured a man. Most problems involve sheep farmers in northern Slovenia. Since northern Slovenia is outside the core area, special permits, which are limited to a certain county and time period, have to be issued by the carnivore commission. Eight of 9 interviewed wildlife managers pointed out that they are very hard to get. Females with cubs may be shot only in cases of human injury or death.

Within the core area, a problem bear may be harvested as part of the set quota for that county or with special permits by the commission, if the quota has been filled or the incident occurs outside the hunting season. The killing of a problem bear is viewed as the only management solution, since relocation is not feasible in such a small area.

Abruzzo Region (central Italy)

Organizations involved in the management of brown bears.-- Bear management in central Italy involves both governmental and non-governmental agencies. Abruzzo National Park (ANP), a non-governmental organization, and the Italian Forest Service

(IFS) are the two head organizations (Figure 20). There is, however, little cooperation between the two and they must be seen as two separate entities.

Government organizations: The IFS, which is a branch of the Ministry of Natural Resources, Agriculture, Forestry and Nutrition, is divided into two divisions, the traditional forest service, which deals with forest operations and harvesting, and the Ex ASFD (*ex azienda di stato per le foreste demaniali*), which is the research branch of the IFS. The IFS is the umbrella organization for the 20 regions of Italy and appropriates the research and wildlife damage compensation budget for each individual region.

The regional branches of the IFS administer a comprehensive data base on all validated wildlife compensation claims. The IFS office of the Abruzzo Region (Figure 4), which is the only region in Italy that still has brown bears, designs a management plan for its region. The regional IFS is further divided into provinces. The Abruzzo Region includes the provinces of L'Aquila, Teramo, Chieti, and Pescara. The provincial branches of the IFS employ local foresters who validate claims and send standard claim forms to the provincial administration. In addition, the veterinarian institute of the IFS (*Instituto Zooprofilattico*) determines the cause of death on the bears, and can make recommendations for management strategies to the regional IFS, e.g. to close dumps because of disease possibilities. The provinces send an annual summary to the regional administration, which controls the wildlife damage compensation budget. By law, the IFS of the Abruzzo region has to provide game wardens and rangers to the Abruzzo National Park, but that has not been accomplished yet. A large portion of land that is administered by the IFS is leased to shepherds in the summer for grazing of livestock.

Non-governmental Organizations and Cooperation: The ANP and its surrounding area in the province of L'Aquila has the main concentration of brown bears

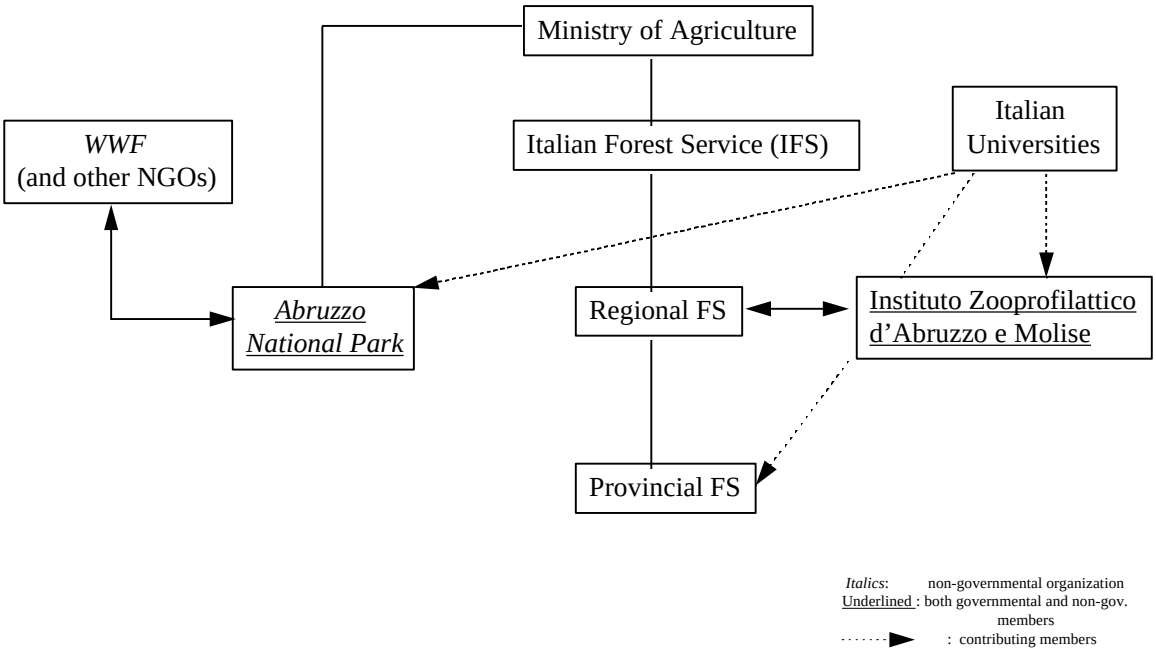

Figure 20. Bear management system of the Abruzzo Region, Italy.

in the Apennine Mountains. The ANP is an autonomous organization with its own administration, although the surrounding area is administered by the IFS and private landowners.

The ANP was founded in 1922 by a private initiative and became a national protected area in 1923. The first bear management plan (*progetto urso*) was designed in 1960 in cooperation with the WWF. The goal of the plan was to preserve and increase the present brown bear population. This goal was not achieved, however, because the population experienced a constant decline in size from about 70 to 100 animals in 1970 to about 45 to 50 in 1983 (Boscagli 1986, Zunino 1981).

Park rangers take care of the feeding stations, the planting program and the monitoring of damage. In spite of a law passed in 1990, which required that all ANP

rangers be provided by the IFS, rangers are still hired though the park. All interviewees stated that there is a power-struggle between the ANP administration and the IFS.

Bear management of ANP.-- A supplementary feeding program (*campania d'alimenatre de l'usro*) was started in the late 1980s with the goal of keeping bears inside the park to save them from being shot. In 1991, 78 ha of crop fields and 1,504 fruit trees were planted in the park (Boscagli 1994). Unlike in American national parks, farmers are allowed to graze their livestock inside the park boundaries, and towns are present in the park. Most apiaries have electric fencing around them, which 2 of 5 interviewed wildlife managers reported to be moderately successful. The farmers do not receive any subsidies for preventive measures, such as fencing bee hives.

In the 1990s, the feeding program was expanded from only feeding sites to fruit tree and grain-field plantations in the forests and high meadows. A map of the general location of each feeding station and supplementary plantation is published every year and is accessible to everybody. The land for these plantations and feeding sites is often leased from private owners.

Bear management of the IFS.-- The IFS of L'Aquila province has a separate management plan from the ANP, which includes feeding programs and research projects with radio-collared animals. There is no cooperation with the park, however, and one interviewee stated that people even work against each other. One such case occurred when a dead bear was found by an ANP ranger on IFS land. If a dead animal is found, it is supposed to be sent to the Veterinarian Institute (*Instituto Zooprofilattico*) of the region in Teramo. Park authorities refused to do so and kept the carcass.

Bear damage compensation in ANP.-- The park introduced a compensation system as early as 1923. From 1968 to 1974 the WWF paid for damages in and around the park. Compensation for livestock damage or apiary destruction within the park is still included in the park's budget, which is supplied by the Ministry of Agriculture. Damages within the park are rare, but no specific data were released by park authorities.

Bear damage compensation of the IFS.-- If a shepherd or farmer who lives outside the park loses livestock or apiaries to bears (or wolves or feral dogs), a forester inspects the

damage and fills out a compensation form. The carcass must be found before compensation can be paid, but the full market price (determined by the Ministry of Agriculture) is paid. All interviewees agreed that claims are processed very slowly. If the annual budget for compensation is exhausted, claims are put into the next fiscal year and new ones get pushed back. Often it takes 4-10 years for the farmers to get the money. The regional IFS administration maintains a central data system for all claims that are paid in the Abruzzo region.

In 1992 and 1993, the IFS wanted to improve compensation laws by paying damages only when it was proven that adequate protection measures had been applied. For example, the law required one shepherd per 100 sheep, and that sheep be put into an enclosure at night. The new law caused much frustration and complaints from the shepherds, and was abolished again in 1994 (Fico, IFS Veterinary Institute, pers. comm.).

Problem Bear Management of the ANP and IFS.-- No special program has been designed by ANP or IFS to deal with problem bears. Few livestock depredation problems or aggressive approaches to humans have occurred.

Sweden

Only one person was interviewed, but damage statistics, maps and extensive literature on the bear population, legal status, and management were available.

Organizations involved in the management of brown bears and their duties.-- *Governmental Organizations:* Bear management in Sweden is mainly a governmental responsibility (Figure 21). Administrations of Swedish counties (county councils) are responsible for bear damage compensation claims. Bear harvest plans are coordinated by the Swedish Environmental Protection Agency (EPA), the county councils, the Swedish Hunting Association (SWHA), and the Norwegian Directorate of Nature Management (NINA, see below). Problem bear management also involves all the above agencies, but

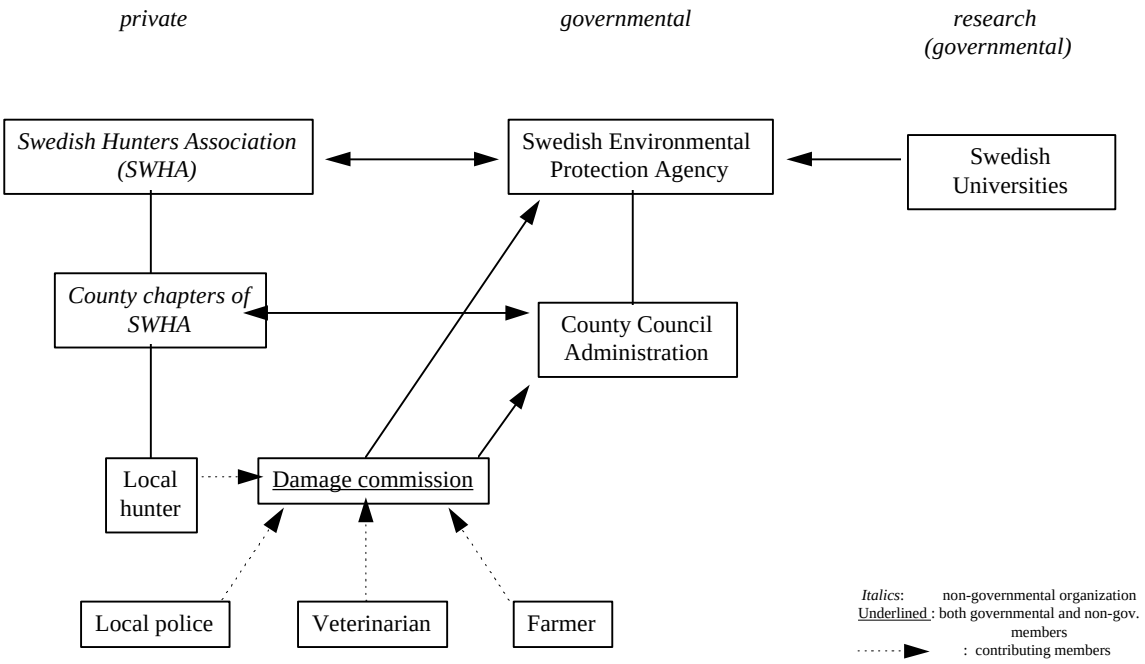

Figure 21. Bear management system in Sweden.

the final decisions are made by the Swedish Environmental Protection Agency (Bjärvall, Swedish Environmental Protection Agency, pers. comm.).

Non-governmental organizations: The SWHA provides a representative to local damage commissions (Figure 21). They also are consulted for setting harvest limits and when dealing with problem bear management.

Brown bear management history.-- The Swedish EPA started an interview survey of hunters throughout the country in 1975 to determine the distribution and abundance of the brown bear. Survey results indicated that there were 4 bear core areas left in Sweden where females and reproduction still occurred. Following the survey, the hunting laws were changed to a quota system that allowed each county to harvest a specific number of bears per year (see below). The quota, which was not to exceed 50 bears per year, was

set in cooperation with the provincial council governments and representatives of the SWHA (Bjärvall, Swedish EPA, pers. comm.).

To get more detailed information on the bear population, a brown bear project was started in collaboration with the Norwegian government in 1984. The study showed that annual harvest had been about 5.5 ± 2.0 % of the population and that the population was still increasing 1.5% on average every year (Swenson et al. 1995).

Current bear management.-- *Hunting:* Beginning in 1992, the harvest of females was restricted to 1/3 of the total annual harvest. Hunting had to be stopped once this quota was reached, even if males could still be shot. For example in 1994, the harvest quota was 50 individuals, but only 29 bears were harvested before 16 females were shot (Swenson et al. 1995). The annual harvest quota is set by the Swedish EPA, the SWHA, the county councils and the NINA in Trondheim (Bjärvall, Swedish EPA, pers. comm.). Poaching is not perceived as a threat to the population on a national level, but can affect the population at the local level, especially in the reindeer areas in the north (Swenson 1995, Bjärvall, Swedish EPA, pers. comm.).

Conservation: Historically, brown bears occurred throughout Sweden, but had almost disappeared by 1930 because of intensive hunting efforts and a bounty system (Swenson et al. 1995). The recent increase in the bear population is partially attributed to human population decline in rural areas of central and northern Sweden, a parallel decrease of domestic livestock, and an increase of moose numbers (Swenson et al. 1995a).

The national policy goal for the protection of bears is to increase the population to 2,000 animals. This goal could be lowered, however, if human-bear conflicts increase (Bjärvall, Swedish EPA, pers. comm.). Currently, bears cause few problems in Sweden (Chapter 2).

Brown bears do not receive any consideration in forest management planning in Sweden. Much of the nation's forests have been transformed to single-aged monoculture with large clearcuts and an extensive road system (Swenson et al. 1995). The brown bear population does not seem to suffer from these actions and has been reported to be increasing over the last 50 years.

Bear Management Plan.-- A written document for bear management exists only for the northern areas of Sweden in connection with reindeer management. This plan was designed in cooperation with the local reindeer farmers and the SWHA in 1991, and seems to be perceived well (Bjärvall, Swedish EPA, pers. comm.). Guidelines for the management of bears in the rest of Sweden exist, but are not written in a complete document as a 'management plan' (Bjärvall, Swedish EPA, pers. comm.).

Compensation System.-- Until July 1995, the compensation system was divided. The northern part of the country, which includes the counties of Norbottens, Västerbottens, Jämtland and Västernorrlands, was administered by the county councils. The central and southern parts (remaining counties) were administered directly by the EPA. When a farmer found damage to livestock or property he called either the county council (*Länsstyrelsen*) representative or the Swedish EPA (*Naturvårdsverket*) for a claim form. The damage had to be verified by a local police officer, veterinarian or member of the SWHA. The completed form, verification statement and pictures had to be sent to the EPA or the county council. The amount that should be paid for the claim was approved by the Swedish Farmers Association. Compensation for reindeer required that the animal was found. Sheep that were not found were compensated, if a kill by predators had been verified in the area before.

Since July 1995, the county councils of central and northern Sweden handle damage compensation. The Swedish EPA is no longer responsible, but helps to answer questions. Problems occur because the county councils do not have carnivore specialists at the moment who are trained in evaluating carnivore damage. In 1997, $ 4,000,000 US were allocated for wildlife damage compensation in Sweden (Bjärvall, Swedish EPA, pers. comm.).

A new compensation system for reindeer has been recommended by the EPA, which proposes that damage compensation for missing reindeer should be paid if carnivores were observed in the area. This proposal was designed in cooperation with the reindeer farmers and the EPA (Bjärvall, Swedish EPA, pers. comm.).

Problem bear management.-- Very few problems concerning brown bear habituation and damage have occurred in Sweden. Three incidents in 1996 were handled by aversive conditioning and radio-collaring one bear, and killing another one after it had been seen on a local golf course by several people (Bjärvall, Swedish EPA, pers. comm.). There is no written protocol on how to proceed. Decisions on what to do in a problem situation are discussed between the EPA, SWHA and the counties.

Norway

Organizations involved in the management of brown bears and their duties.-- Bear management in Norway is purely governmental. The Directorate for Nature Management (DN) has the main responsibility, but individual counties deal with the daily management such as damage compensation, population monitoring and public education. Non-governmental organizations are not directly involved in the management of brown bears in Norway, but have a strong lobby to influence decisions at NINA and the Ministry of Environments and Agriculture (Figure 22). Specific duties of these organizations are:

Governmental Organizations: The Norwegian administrative system for managing brown bears follows a governmental chain of command. The Ministry of Environment, the highest link in the chain of command, has legal responsibility for bear management. Within the Ministry, the Directorate of Nature Management (DN) is responsible for all specific questions concerning management decisions, interpretation of the management plan, contracting with the Norwegian Institute for Nature Research (NINA) for research projects, budget allocation to the counties, and the collection of all yearly damage reports. There are 18 counties in Norway, which are equivalent to states in the USA or Germany.

The Departments for Nature Management (DNM) in the individual county governments (*Fylkesmannen*) are the next link down. They administer a database on all

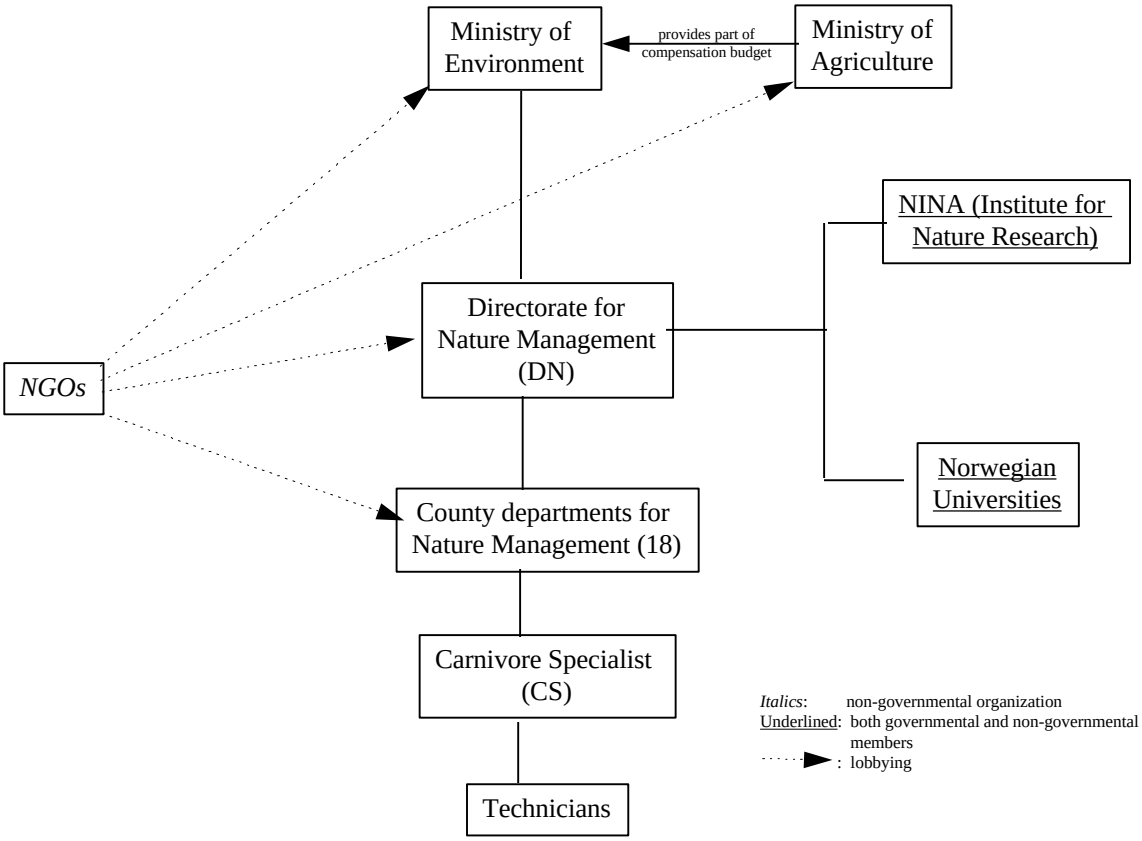

Figure 22. Brown bear management system in Norway.

the damage within the county. The DNM employs a carnivore specialist (CS, *Viltkonsulent*) who is responsible for problem bear management and damage evaluations within the county. Not all of the 18 counties in Norway have a carnivore specialist. Although 9 of Norway's counties have carnivores, there are only 6 carnivore specialists. Consequently, some of them have to take care of several counties.

The DN can issue kill permits for problem bears in advance and let the CS decide when to use them. Under the CS's direction, technicians are trained to evaluate carnivore damages, and compensation is paid. The CS also has research projects, which are often done in cooperation with NINA (Wabakken and Maartmann 1994).

Non-governmental organizations: Other important groups in the management of brown bears in Norway are independent research organizations. Two important research organizations are NINA and the Center for Environment and Development of the University of Trondheim. Together they conduct baseline research on bear population studies, interaction between bears and livestock, bear habitat and other topics. This research is used by the DN for decision-making. For example, NINA revised the bear population estimate from approximately 200 bears in 1986, to the current estimate of 20 to 25 bears (Swenson et al. 1994). Decisions on how many permits to issue for killing problem bears, and how much compensation money to distribute to individual counties are based on the research. Regular meetings and close cooperation between the DN and NINA are facilitated by having the agencies located in the same building in Trondheim.

The influence of NGOs such as the National Sheep Breeders Organization and the National Farmers Association, is also an important factor in the management of brown bears. These organizations reviewed the bear management plan, which incorporated many of their suggestions. The National Farmers Association has strong lobbyists and substantial funding to support campaigns, unlike most of the environmental NGOs. The NGOs also use the media extensively, especially in a negative way. The media are used frequently by both the NGOs and the counties to keep locals informed on decisions regarding bear management. One wildlife manager stated it was a good way to prevent conflict and a good tool for public involvement.

Management Plan.-- In 1992, the Norwegian parliament signed a carnivore management plan which was designed by the Directorate of Nature Management in Trondheim, researchers from NINA, and carnivore specialists of the counties. The DN held hearings in communities within the bear core areas (Figure 3), and sent out the proposed management plan to NGOs for review. The stated goals in the plan were:

1. Norway shall have reproducing populations of all carnivores.
2. Damage by carnivores shall be low in Norway.

The plan also listed several preventive measures, which according to all interviewed wildlife managers in Norway were mostly ineffective, for example sheep herding by guarding dogs. The plan stated that there should be protective core areas, but did not specify where. These areas were established in 1994, after peer review of scientists (e.g. at NINA), NGOs and other associations (e.g. Swedish Sheep Farmers Association).

In 1996, the plan was scheduled to be reviewed and changes to be made based on experiences from previous years. The Department of Agriculture, for example, will have a greater responsibility in advising farmers on how to keep their sheep. The Department of Agriculture had been mentioned in the previous management plan, but its role had not been clear.

Damage compensation.-- Compensation is paid at the end of the year with funds from the Ministry of Environment and the Ministry of Agriculture. An annual budget, which depends on the amount of damage that occurred the preceding years, is divided up among the counties by the DN. Prior to 1993, the DN made compensations directly to the farmers.

Brown bear damages in Norway are inspected by the carnivore specialist (CS) of a county or one of his technicians at the time they occur, and are then put into a data base at the county governor's office. The technicians meet at least once a year for training on how to identify carnivore kills and how to write reports. In verifying carnivore damage, the technicians fill out a standard form which includes pictures of the kills. Farmers file a cumulative compensation application for all carnivore damage they experienced during the year by November 1st and usually receive their money by the end of January. They file all claims at once to avoid confusion and extended paper work. A yearly report on all the damage is written and available to the public.

Usually farmers also get paid for lost sheep if bear-kills have occurred in the area that year. About 75 % of the value of the livestock, which is determined by list prices of the National Sheep Farmers Association, is paid in such a case. Two interviewees stated

that farmers usually are compensated for 90-95 % of all their lost sheep, even though a natural loss to diseases is expected.

Problem bear management.-- The DN issues licenses to kill a bear, usually not more than 2 per year, to some counties at the beginning of the year. Only the counties which have had problems with bears before will get such permits. The system is designed to allow for fast action once damage occurs. If a bear has to be killed in a county that does not get permits in advance, the CS must request permission from the DN.

Once damage occurs, the CS and the DN have to decide what damage is compensible and when to issue a kill permit. The carnivore specialists also have to be sure which bear is doing the damage before they can give permission to eliminate it. When the CS and his technicians have identified the problem bear, the counties may hire professional hunters or, as in most counties, hire a group of local hunters to shoot the animal. Since the permits are issued for a designated time period, the hunters have to act quickly. The duration and location of the permit is determined by the CS.

Austria

Brown bear management system in Austria.-- Management of brown bears in Austria presently is not uniformly organized. Management authority falls under the jurisdiction of the individual counties of the states (Figure 23), which have their own hunting and protection laws (Kaczensky 1996).

Bear management plan.-- A bear management plan detailing strategies for bear recovery and handling problem bears does not exist in Austria, but will be written by the Munich Wildlife Society, the Institute of Wildlife Research in Vienna, and the WWF in

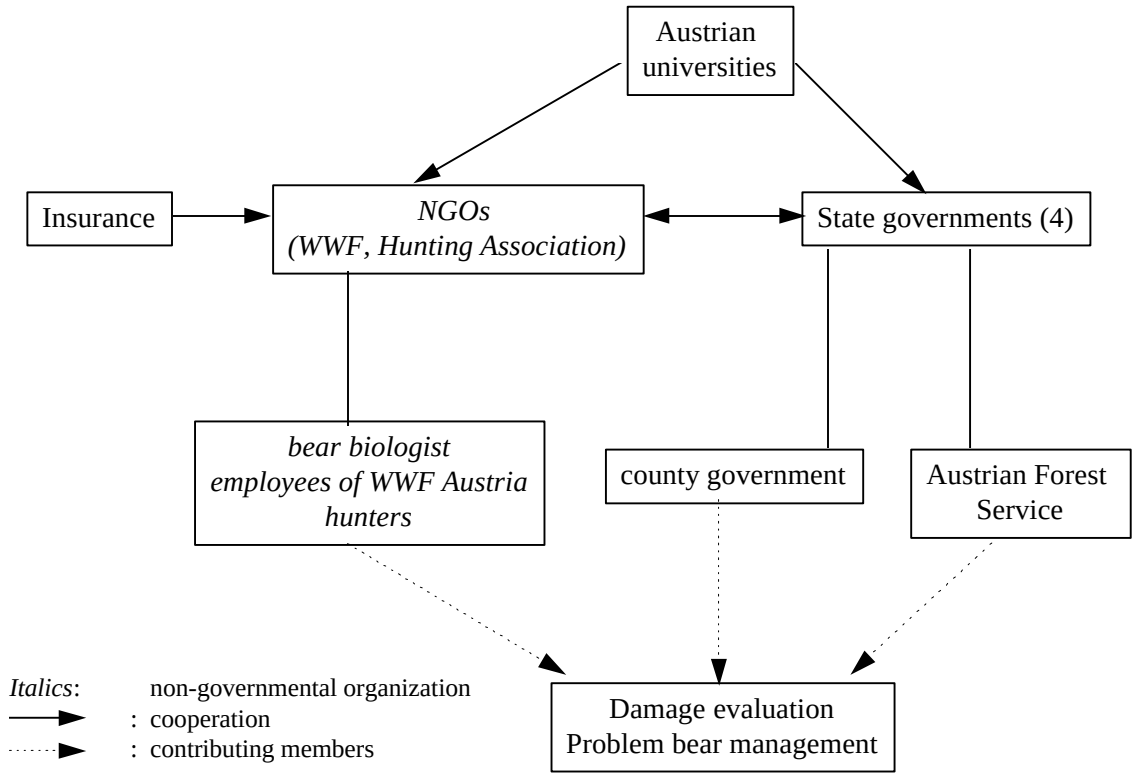

Figure 23. Bear management system in Austria.

1997. Seventy percent of all interviewed farmers and local wildlife managers requested more public information on bear management and reports of recent population developments.

Compensation.-- Each state has an individual system of compensation (Table 19). In Carinthia and Styria, where bears have returned naturally from Slovenia, damage by bears is compensated by a private insurance through the state hunting associations. The WWF Austria pays for an insurance in Lower Austria, where they released bears in the beginning of the 1990s. Upper Austria's compensation fund is supported by the WWF Austria, the Kalkalpen National Park and the hunting association of Upper Austria.

Table 19. Bear damage compensation policies by state in Austria.

State	Compensation payment covered by
Carinthia	Damage insurance of Hunting Association, 100 % reimbursement, no higher compensation for breeding animals.
Styria	Damage insurance of Hunting Association, 100 % reimbursement, higher reimbursement for breeding animals with papers.
Lower Austria	Damage insurance of WWF, 100 % reimbursement, no higher compensation for breeding animals.
Upper Austria	Fund containing ~ $ 10,000 US, paid by WWF (40 %), Hunting Association (20 %), and Kalkalpen National Park (40 %), ~ 50 % reimbursement of market value.

after Kaczensky 1996

Bear damage is reimbursed at 100 % of the market value in all states, except Upper Austria. In Styria, but not Lower Austria and Carinthia, breeding animals are compensated at a higher value.

Damage claims must be confirmed by an authority; which varies among states. Presently, claims are inspected by bear specialist of the WWF (*bear lawyers*), hunters, foresters of the Austrian Forest Service, veterinarians, and policemen. The WWF also pays for electric fencing for beehives in Lower Austria if previous extensive damage was verified. All 9 interviewed farmers in Lower Austria and Styria indicated that they are satisfied with the current system.

Problem bear management.-- Special permits to kill a problem bear may be issued by the county governor if a bear poses a threat to the "culture of the district", or if the bear is an immediate threat to human safety or has killed a person. A study in 1996 by the Wildlife Management Institute of the BOKU University (*Institut für Wildbiologie und Jagdwirtschaft*) in Vienna, Austria, showed that 90 % of the interviewed farmers in Lower

and Upper Austria felt threatened by bears and 70 % of them wanted total elimination of bears in the area.

Problem bear management is hindered by several laws that forbid the use of leg hold traps and poison, and discourage the use of pull-triggered traps. If the use of these traps is needed, extensive bureaucratic obstacles must be overcome (Table 20). The management plan, being written at the moment, aims to facilitate the different laws and interpretations of management authority.

Table 20. Status of legal bear management activities available in Austrian states.

State	Traps	Sedatives	Kill
Carinthia	box or lethal traps	by veterinarian	permit by state and county government
Styria	box trap	by veterinarian	permit by county only
Lower Austria	box trap	by veterinarian	permit by county only
Upper Austria	box or lethal traps	by veterinarian	permit by state and county government

after Kaczensky 1996

Attitudes of local people towards bears in the five study areas

Areas where bears have always been present.-- Bears have always been present in Italy, Sweden, Romania, Austria's state of Carinthia, and southern Slovenia. Interviews with shepherds and local farmers in the Brasov area of central Romania suggested that people believed bears belonged in the Carpathian landscape (Table 21). Only 2 people, a mother with child and a young woman, were afraid of bears. The other 14 answered that they grew up around bears and knew how to behave around them. Similar results were obtained in interview with 2 farmers in Carinthia (Table 22). The difference there,

however, was that the density of bears is much lower and bears are rarely encountered in person.

Areas where bears recolonized naturally.-- Norway and northern Slovenia are study areas where bears have returned naturally from neighboring source populations. Only a few interviews with farmers were conducted in these countries due to time constraints. The 4 sheep farmers interviewed in Norway felt that bears did not belong in the area. Two sheep farmers and 2 bee keepers (n = 4) in northern Slovenia answered in the same manner.

Areas where bears have been reintroduced.-- Central Austria is the only study area where bears have been reintroduced. Eight of 9 farmers interviewed objected to the introduction efforts and were angry at the WWF for doing so (Table 22). Two-thirds of the people interviewed were afraid of bears in the area.

Table 21. Interview results of Romanian shepherds and local people (N = 16) around Brasov, Central Romania.

Question	Yes	No
Do you think bears belong in this area?	15	1
Are you afraid of bears?	2	14
Do you think bears feeding at garbage dumps are dangerous?	5	11

Table 22. Interview results for 9 Central Austrian farmers.

Question	Yes	No
Are you opposed to bear reintroduction?	8	-
Are you afraid of bears?	6	3
Do you think bears belong in this area?	1	8

Comparison between official and actual brown bear management patterns

This section compares the official bear management structure of a country and the realized management situation. Data from interviews of bear management officials and local people (farmers, shepherds, randomly encountered people in the cities and villages) provide the baseline for this comparison. In Sweden not enough interviews were conducted to draw conclusions, and in Norway bear management appeared to follow official guidelines. In some countries, especially Romania, a large discrepancy between official and local opinion on bear management was evident. Other situations involved an agreement on bear management patterns between local people and officials that did not follow the official management plan of the country.

Romania.-- The greatest point of disagreement between local people and official bear managers in Romania was problem bear management and damage compensation strategies. Fifty percent (n = 8) of interviewed officials did not believe that Romania has a problem with garbage-eating bears. However, 100 % (n = 16) of interviewed shepherds and locals reported seeing bears regularly at garbage dumps next to houses and in villages. However, while 67 % of local people believed that bears feeding at garbage dumps are not dangerous and will not harm people, 80 % of interviewed officials agreed that injury to people is a major problem with bears in Romania. All of them agreed that local people are not informed about bears and their management in the region of Brasov, central Romania.

Regarding compensation for bear damage, 50 % of officials believed that insurance was provided to farmers for losses. The remaining officials noted that people can buy private insurance to protect themselves against bear damages. All of the interviewed shepherds confirmed that they have to bring their lost livestock to court and claim compensation or have it inspected by police. In addition, all interviewed shepherds felt that the amount of money compensated is inadequate and often not worth the effort to claim.

Seven of 8 bear management officials had the misconception that local people and farmers/shepherds do not like bears. However, 70 % of interviewed locals/farmers agreed that bears belong in the natural environment of the Carpathians, but mentioned that they

did not like the way bears were managed. Eight of 16 stated that officials do not take any actions against habituated garbage bears or bears that have previously attacked their sheep or bees.

One -half of the interviewed officials stated that the Ministry of Environment must be informed if a problem bear has to be destroyed, whereas the other half observed that bears can be killed as part of the county harvest limit. The 2 local wildlife managers interviewed mentioned that they do not like to shoot problem bears outside the season, since they do not get any money for them, and the pelts are of poor quality at that time.

Slovenia.-- The main difference between the official and actual management structure is that some official bear managers are also members of the Slovenian Hunters Association. For example, a member of the Commission for Predator Management, which determines the harvest limits for bears in Slovenia, can be a member of a local chapter of the Slovenian Hunters Association. In this case, harvest limits for this chapter do not have to be reported from the National Slovenian Hunters Association to the regional chapters and then to the local chapters. The chain of command, especially in damage or problem bear situations therefore can shortened since only one person makes decisions instead of 2 or more.

Eighty-nine percent of interviewed officials (n = 9) mentioned that it is very difficult to get a special permit from the Ministry to shoot a problem bear. One exception was a person who had a good personal relationship with the official who made decisions to shoot a bear.

Central Italy.-- Officially, bear management in the Abruzzo Region should be done by the Italian Forest Service (IFS), including Abruzzo National Park (ANP), where park rangers should be provided by the IFS. The ANP, however, has not followed these guidelines and employs its own park rangers and bear biologists. All interviewed wildlife officials (N = 5), none of whom were ANP employees, agreed that there is no cooperation between the IFS and ANP regarding bear management.

Austria.-- There is no official management structure, and each state has its own bear management approach. In Carinthia, for example, bear management decisions are

officially made by the state government, but the actual decisions are made by the hunters association and then recommended to the government. In central Austria, management decisions are supposed to be made by individual counties, but in 2 problem situations, NGOs were the driving force in making decisions when they were consulted by county officials.

DISCUSSION

Brown bear management in Europe shows some distinct patterns of management approaches, compensation, damage prevention strategies and problem bear management. In the following paragraphs, I will show patterns for management organization (governmental versus NGO-government approach), implementation of management plans, damage management, and problem bear management. I then will attempt to use broad classifications for brown bear management in the individual countries, and evaluate their effectiveness in each country in regard to interviewees' opinions. I will try to point out management problems for each country to help managers in other countries avoid similar problems.

Limitations of data

Obtaining the required data was often difficult, because in most cases several agencies were involved in the management and administration of bear damage compensation. In Slovenia, for example, the southern part of the country is administered by the Slovenian Hunters Association, while the northern area is controlled by the Ministry of Agriculture, Forestry and Nutrition. Data concerning livestock density, land-use and human population demographics were available through the Ministry of Agriculture, the Department of Geography at the University of Slovenia and statistical yearbooks. In addition, most data were in the native language of the study country and not available in English. Problems also occurred when different countries were compared, because they all had a different system of recording data, ranging from reporting bear damage in a

monetary value, to number of incidents recorded, to number of livestock killed by bears. Within a country, data often was not consistent due to inflation or changes in compensation laws.

Interviews in all study countries were not random and not representative samples for the whole country. Time frames available for each country were too short and acquiring a random sample was logistically impossible. In Romania, for example, shepherds are not registered and change locations all summer long. In the Brasov area of central Romania, I interviewed shepherds who lived close to villages as well as shepherds that live high in the mountains to get a broad sample. Interviewees were chosen by random encounters during field trips or while driving along the roads. In Austria, I interviewed farmers whose addresses were provided by the WWF Austria and random encounters while driving to appointments with other farmers. While not completely random, the sample included farmers that had claimed compensation with the WWF insurance, but also farmers who had not dealt with WWF Austria. In Italy it was difficult to obtain information within the ANP because the relationship between the park and the IFS (my host) is poor.

Another limitation is small sample sizes (Table 18). Again, time was a factor that limited sample size. The goal was to cover many countries to get a broad overview. More detailed studies are necessary to obtain a more representative sample of the whole population in each country.

Much information was lost during the translation of the interviews into English. In Romania and Italy I had to rely on interpreters who translated the conversations. In the other countries I understood the language, but translated the conversations of the analysis into English. This study does not attempt to provide a quantitative analysis of opinions in the study areas, but rather a description of the current management situation.

Management Organization

Brown bear management in Europe is either entirely governmental or involves cooperation between governmental and non-governmental organizations (NGOs).

Governmental Organization.-- In Norway, Sweden, northern Slovenia, and central Italy outside the Abruzzo National Park, bears are managed by governmental organizations (Figure 24). Bear populations in all of these countries are small, except in Sweden, where the bear population recovered from a bottle-neck population of about 130 animals to approximately 620 bears in 1991 (Swenson et al. 1994). Sweden resumed a limited hunting season after the population recovered in the 1960s.

NGO-government cooperation.-- Management of brown bears in Austria, southern Slovenia, and Romania is done cooperatively among NGOs and the governments. The 3 countries are distinct in that Austria is focused on preservation of a reintroduced population, whereas Slovenia and Romania manage their bear populations primarily for hunting. In all 3 countries, the national hunters' associations play an important role in the management of bears. They provide damage compensation insurance (except in Romania) and other important aspects of management, such as population monitoring, hunting, and feeding (except in Austria).

Austria has a strong conservation NGO involved in bear management (WWF Austria), which, in fact, drove reintroduction efforts of the species in the 1980s. It also provides a major source of information on bear biology and behavior to the public.

One apparent problem with cooperative management is that it involves more parties in management decisions, and therefore adds more administrative layers. In southern Slovenia, which is managed mainly by the Slovenian Hunters Association (SHA), it has been difficult to coordinate damage reports, to have a uniform compensation system, and to maintain management practices similar to the rest of the country, where the Ministry of Forestry and Agriculture is involved in bear management. The Slovenian government is currently attempting to assume more responsibility to get better control of the bear population in Slovenia. This has to be done in a way that will not alienate

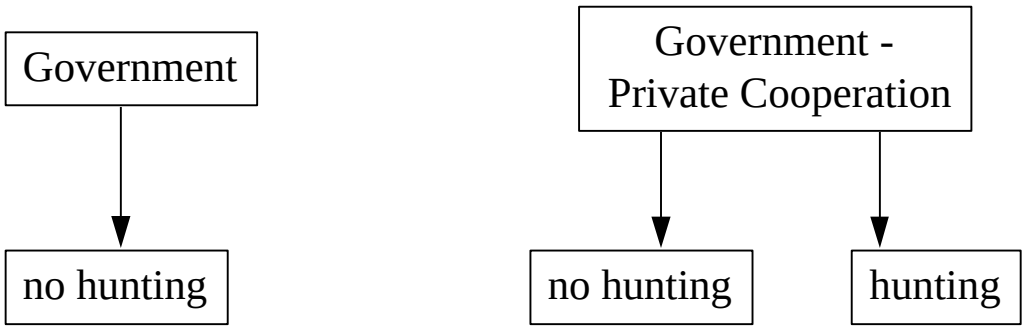

Figure 24. Brown bear management systems in European countries.

hunters, but instead secures their continuous support in management actions such as hunting and determination of bear population estimates.

Norway is also strongly influenced by NGOs, although they do not participate in bear management. The National Sheep Farmers Association has a high level of support in parliament because Norway wants to preserve a rural community and strongly subsidizes farmers to stay on their farms. Their influence is especially apparent in Hedmark county, which, although located in one of the bear core areas, maintains a growing sheep industry that is heavily subsidized by the Ministry of Agriculture. Many farmers are subsidized up to $ 14,000 US for their sheep (NINA unpubl. data). Lobbying efforts from "green" NGOs are too weak to counteract the requests of the National Sheep Farmers

Association. The effort to conserve bears in Norway will have to focus on getting the pro-agricultural NGOs on the side of bear management.

The lessons for Austria should be to keep the hunting associations of the states involved in bear management as much as possible without adding too many bureaucratic layers to the organization. This is especially important with respect to damage compensation insurance. A goal of the management plan, that is currently being written, is to make damage compensation the same in all Austrian states. The support of the hunting associations, who currently pay for damage insurance in Styria and Carinthia, should not be jeopardized as long as the current system is working well. One concern for making damage payments a responsibility of the states is that the states generally do not have the funding for compensation of bear damage. Each state has to be evaluated separately to find the best solution. In the case of Upper Austria, where no regulated compensation system has been set up besides a fund that covers 50 % of recorded damages, a better system has to be found. In my opinion, functioning systems should be preserved, but improved in a way that all states pay equal rates for compensation to their farmers and adjust premiums for breeding animals with papers.

Management Plans

Most European countries do not have a "management plan" equivalent to the American national parks' format. Most American national parks that have viable bear populations have a bear management plan that includes behavioral research, population research, other research (e.g., habitat), education (public and employees), management actions (e.g., aversive conditioning, relocation, destruction, closures), law enforcement (e.g., poaching prevention), damage preventive actions (e.g., food storage), regulated reporting of incidents (central agency for reports), and monitoring (Bear Management Plan (BMP) Katmai National Park 1986 and 1990, BMP Gates of The Arctic National Park 1989, BMP Glacier National Park 1981, Bear Incident Management Plan of Yukon Charley Rivers National Preserve 1990).

Italy and Austria have no written policy as yet, Romanian and Slovenia have only a bear harvest plan. Sweden maintains a comprehensive plan for bear-reindeer interaction management, while Norway has a management plan closest to the American format (Table 23).

A problem that has been identified with the Norwegian plan is that it is too loosely defined. One management goal, for instance, is that damage by bears shall be low in Norway, yet "low" is not defined. For some farmers, 2 killed sheep exceed the definition of "low". The focus for the Austrian bear management plan should be on outlining clear goals and achievable objectives that all involved parties fully understand.

Damage management

Damage compensation.-- All European countries evaluated for this study had some form of damage compensation program, but the quality varied widely (Table 24). As mentioned above, the hunting associations of Slovenia and the Austrian states of Styria, and Carinthia use membership fees to pay a private insurance company, which is used to reimburse farmers who experience bear damage. Damages by bears in Norway, Sweden, Romania, and Italy are covered by their respective governments. In all countries, bear damage must be verified by either foresters, bear biologists, veterinarians or other officials (Table 24), and a report has to be sent to the responsible agency.

A variety of problems with compensation were observed. For example, in Italy the yearly budget for compensation is not very large and claims can be pushed back for several years before they are paid. Romania has been struggling with inflation and can pay only a minimal amount that often does not make it worth while to go through the application process. In Norway, compensation claims are paid once a year, thus farmers have to pay for new sheep with their own money and receive reimbursement at the end of the year. Austria should consider carefully if changing to a governmental compensation program might cause budget problems in the future. Private insurance, purchased by the hunting or conservation associations, might be more reliable over the long term.

Table 23. Overview of brown bear management for 6 European countries including population situation, and management tasks.

	Austria	Abruzzo	Norway	Northern Slovenia	Southern Slovenia	Sweden	Romania
Situation							
Introduction of bears?	yes	no	no	no	no	no	yes
Protection status	protected	protected	protected	protected	hunted / protected	hunted	hunted
Population trend	increasing	decreasing	increasing	increasing	increasing	increasing	increasing
Population status:	highly endangered	endangered	endangered	endangered	viable	viable	viable
Management							
Who designed the management plan	being written at the moment by WWF, WGM, IGJ	no written plan, memos	Parliament and Ministry of Environment	Ministry of Forestry and Agriculture	Ministry of Forestry and Agriculture	EPA	Ministry of Environment
What does it contain	no written plan	• protection zoning • research monitoring	• population goal • zoning • damage compensation • education	• hunting quotas • core area • feeding • population estimation	• hunting quotas • core area • feeding • population estimation	• quota hunting • damage compensation • zoning • research	• hunting quotas
Management plan implemented?	no	no	yes	yes	yes	yes	yes
Management tasks							
- reserves	no	yes	no	no	no	no	no
- zoning	no	no	in discussion	yes	yes	no	no
- damage compensation	yes	yes	yes	yes	yes	yes	not really
- hunting system	-	-	-	-	quotas	quotas	female quotas
- feeding	no	in ANP	no	no	yes	no	yes

Table 23. (continued)

	Austria	Abruzzo	Norway	Northern Slovenia	Southern Slovenia	Sweden	Romania
- education/ PR	yes	yes	yes	no	no	yes	no
- defined population goal	(yes)	no	yes	no	yes	yes	yes
Problem bear management:							
Responsible Institution	• county government	• Italian Forest Service	• county government • Directorate for nature management	•	• Ministry of Forestry • Slovenian Hunters Association (SHA)	• EPA	• ROMSILVA
Who is it reported to	• bear specialists	• foresters • police	• carnivore specialist	• foresters • hunters	• foresters • hunters	• carnivore specialist • hunters	• foresters • hunters
Who does the management work	• emergency team	• foresters	• carnivore specialist • hunters	•	• hunters • foresters	• hunters	• hunters • foresters
Hunting							
Who plans amount					Carnivore specialist group	EPA	Ministry of Environment
Methods				•	• elevated stands	• rifle hunting	• elevated stands • dog chase
Amount harvested					~ 40 (10%)	~ 35 (5%)	~ 600 (10-15%)
Research Institutions:	• university • WGM • WWF	• FS • veterinarian Institute	• NINA • university	•	• university • Forestry Institute	• university	• university • ICAS

Table 24. Overview of brown bear damage and compensation for 6 European countries.

	Austria	Abruzzo	Norway	Northern Slovenia	Southern Slovenia	Sweden	Romania
Damages							
What kind	• sheep • bees • fish	• sheep • bees • cows • horses	• sheep	•	• sheep/goats • bees • few cows	• reindeer • sheep	• sheep/goats • bees • few cows and horses • orchards
Peak time	June - August	July - September	August		June - August	July - August	June - August
Damage compensation:							
Present	yes	yes	yes	yes	yes	yes	not really
Proof necessary	yes	yes	yes	yes	yes	yes	yes
Adequate	yes	yes	yes	yes	yes	yes	no
Problems	• Upper Austria only 50% reimbursement of market price	• waiting time too long - up to 8 years	-		-	-	• too little money • too much paperwork • not accessible for a lot of farmers
Who evaluates	• bear specialists • veterinarians • hunters	• forester • veterinarian	• county carnivore specialist • his technicians	• foresters	• hunters • foresters	• carnivore specialist • hunters	• police
Who pays	• insurance of NOGs	• regional FS	• county government	•	• SHA • Ministry of Forestry	• EPA	• county

Table 24. (continued)

	Austria	Abruzzo	Norway	Northern Slovenia	Southern Slovenia	Sweden	Romania
Where does money come from	• membership dues	• FS budget • taxes	• national budget • taxes	• national budget • taxes	• membership dues • national budget	• national budget • taxes	• national budget
Is it used	yes	yes	yes		yes	yes	not often
Damage prevention:							
What kind	• fencing of bee hives	• sheep herding dogs	• fencing • removing sheep from the pastures early • changing from sheep to cattle	• fencing of hives • herding dogs	• fencing of hives • herding dogs	• herding dogs	• herding dogs • fencing of hives
Subsidized	some	no	yes	some	some	yes	no

Damage prevention.-- Most countries studied offer limited financial assistance in damage prevention measures, such as building electric fences around bee hives or paying for hay if sheep are taken down from the pastures early. Most prevention measures that are subsidized are in damage-prone areas where extensive damage has been recorded before. Some parts of Austria, especially Carinthia, do not provide fencing because damage to bee hives is rare, and it would be more expensive to pay for fencing than for the occasional damage. Slovenia is experimenting with a government-owned sheep herd that replaces farmers' sheep directly rather than paying money. Italy and Romania do not provide such services, mainly because of budget problems that hardly allow them to pay for damage compensation. Other preventive methods, such as sheep-guarding dogs or feeding of bears in remote areas, are commonly practiced in Slovenia, Italy, and Romania, but are not subsidized.

Damage payments have been controversial in Austria and the USA (Wagner 1997). The attitude is that carnivore damage is just another risk farmers have to deal with, such as bad weather. Olsen (1991) also reported that damage compensation does not take care of the problem itself, but rather serves to increase the tolerance of farmers to damage. In most US states, damage by wildlife is not compensated. Nineteen states offer compensation programs, but 34 states offer materials to prevent damage, such as fencing of bee hives (Wagner 1997).

In my opinion, in places where the bear has been reintroduced (e.g. Austria), farmers should not be responsible alone to finance this " wilderness status symbol." Studies in the USA have shown that states have the responsibility of managing wildlife for the "good of society," but might pose disadvantages for some people by doing so (Conover and Decker 1991, Conover 1994). The authors also mentioned that the main problem in doing so is that a small group of people may suffer from the majority of damages while the rest receive the benefits of having the wildlife. As shown in Italy, poaching of bears is high due to a malfunctioning compensation system (Fico et al. 1993). The bear population there has been declining and conservation efforts, such as improving the compensation system to stop poaching, should be a top priority.

Problem bear management

In countries where bears are hunted (southern Slovenia, Romania, Sweden), a problem bear can be shot within the legal harvest limit if it is during the hunting season. If the problem occurs outside the season, a special permit has to be issued by the responsible management organization (Table 23). During the interviews, wildlife managers frequently complained that getting a hunting permit to kill a problem bear often takes too long, and the bear escapes from the area before action is taken. In addition, it is very difficult to get a permit for a female with cubs. Meagher and Fowler (1989) hypothesized the brown bear population in Yellowstone National Park might be more endangered by not shooting a mother that causes problems, since the cubs often learn her behavior and end up being shot too. Craighead and Craighead (1971), on the other hand, saw a great threat for the population by killing habituated females and recommend their elimination only in extreme cases of habituation to people.

Countries in this study that do not have a regular hunting season experienced difficult decisions regarding the elimination of problem bears. Most of them have small populations and the elimination of one bear may seriously affect the viability of the population, especially if it concerns a female. In Norway, it has been very difficult to get a permit in the protective core areas along the border because females cannot be shot at all and it is difficult to distinguish a female from a male (Wabbakken, NINA, pers. comm.). The issuance of a license has become much more restricted since bear numbers in Norway were overestimated in the past (Swenson et al. 1995). In 1991, a kill permit was issued after 3 sheep were killed in South Trondelag. In 1995, a permit was issued only after 40 - 50 sheep had been killed (Wabbakken, NINA, pers. comm.).

If a permit is issued, local hunters are involved in the hunt and often do not have the experience to succeed in killing the problem bear (Mysterud 1980). In general, farmers would like to see professionals take care of a problem bear as fast as possible.

An additional problem with issuing kill permits is to eliminate the right bear. At the moment, most studied populations are small enough that local hunters and bear

biologists can locate the offending bear. However, with increasing populations, this task might become more difficult.

One suggestion of the Bear Management Plan Team in Austria for managing problem bears is to create a "bear specialist police", a group of experienced bear biologists, who would be summoned if a problem arose. This group should aim at expanding the number of people who are experienced to deal with a problem bear situation, since not everybody in this group can be on call all the time. Local contacts, who know the individual area, are important in dealing with a situation quickly and efficiently. To avoid frustration of the locals, this group has to be able to react quickly. This task can only be achieved if hunting and trapping permits can be issued quickly on a regional level. It would be difficult to achieve this at the moment since every county has its own laws. Relocation, as a management tool, is not feasible in Austria since the area is too small and bears would be back in their home ranges very quickly. Studies in the USA have shown that bears should be relocated at least 64 km to avoid a return of the bear (Comly 1993). Relocations in Austria could be at a further distance, for example from central Austria to Carinthia, but it would not be a relocation into remote areas as is recommended in USA studies, since Carinthia is also a densely populated area (Table 9). Aversive conditioning has been tried in the past, but takes a lot of time and money to do properly (Knauer et al. 1994, Wagner 1997). If a bear is aversively conditioned early in the process of habituation, it is possible to reverse the behavior at least for some time (Herrero 1985). If a bear has experienced frequent human contact, however, a successful aversive conditioning is unlikely (Herrero 1985, McCullough 1982, Cole 1971 and 1973).

Since there are only a small number of females in the Austrian population at the moment (probably not more than 5), it will be a difficult decision to deal with a problem female bear. If an offending female has caused extensive damage and poses a threat to human safety, it should be eliminated. Decisive actions of this sort should improve public support for bear conservation.

Management problems

Romania.-- Effective management is often hindered by lack of equipment and people. Frequently, game wardens are on foot or horseback and are responsible for an area of 40 km^2 or more. Areas are very remote and difficult to reach quickly. In addition, 50 % of interviewed shepherds complained that hunters and wildlife managers were not very concerned about their problems with bears, but would rather have a large population of bears that could be sold as trophies. One-half of all interviewed officials agreed that they prefer to kill problem bears during the hunting season because the pelt of the animal is better quality and sells for more money. Cooperation between local residents and bear managers was poor.

Habituation and food-conditioning (Chapter 1) in Romanian brown bears frequently occurs. All of the interviewed shepherds and local people had observed bears feeding at garbage dumps, at garbage cans in the cities or approaching shepherds' camps when people were around. At the moment, habituation is not considered a problem by the authorities and nothing is being done to address it. There are no official records of how many people are injured or killed every year by bears, but interviews with residents in the area indicated injuries to people occur regularly. This may be explained by the belief of 67% of local people that bears feeding at garbage dumps are not dangerous (Table 20). I observed people approaching bears, including mothers with cubs, feeding at garbage cans in Brasov, Romania. The interviewees mentioned that under the communist regime they did not dare complain, and even now do not think that government authorities would change the situation if they complained.

Slovenia.-- Current management problems are 1) that damage is not reported to a central agency, 2) that damage compensation rules for the core bear management area and the outside area differ, and 3) that funding for bear damage compensation by the Ministry of Forestry is inadequate. As in Norway, most wildlife managers (90 %) complained that it takes too long to issue special kill permits for problem bears. In addition, there is no special training for wildlife managers regarding brown bear behavior and management; most managers learn on the job. The government currently is trying to

organize regular training for managers (Adamic, Slovenian Institute for Forest Research and Management, pers. comm.).

The Slovenian brown bear population is currently the only source of bears naturally recolonizing the Austrian and Italian Alps. It also served as a source population for the Austrian restocking program in 1989. Further spreading of the population is hindered, however, by the recent construction of highways, which bisect the migration corridor towards the Alps (Kaczensky 1995).

Italy.-- One primary conservation problem is lack of cooperation between the Abruzzo National Park and the surrounding Forest Service area. Several simultaneous research projects are being conducted by both agencies, but no exchange of research findings has been reported (Posillico, IFS, pers. comm.). The ANP has not published findings of their telemetry study on the bear population.

From 1980 to 1985, 22 bears were killed by poaching and traffic accidents outside the park (Fico et al. 1993). Poaching may be encouraged by the long waiting period for compensation money, which can take up to 8 years. An additional threat to the population is accidental killing of bears by hunters on chase hunts for wild boar. In 1989, a new hunting law was established to reduce this problem. A 600 km^2 buffer zone was established around the National Park, in which game hunting was reduced by one-half and a maximum hunting pressure of 1 hunter per 30 ha was enforced (Boscagli 1994).

Sweden.-- The main preservation problem in Sweden is poaching in the reindeer areas. The government has been trying to reduce poaching by involving reindeer herders in the design of a new management plan with improved compensation regulations (Bjärvall, Swedish EPA, pers. comm.). The bear population is expanding and might cause more damage problems in the future.

Norway.-- The primary conservation problem in the future seems to be the coexistence of sheep farmers and bears. With increasing bear numbers, damage to sheep will inevitably increase. The government still encourages the expansion of sheep farming into the bear core protection areas along the Swedish border, thus guaranteeing an even bigger

problem in the future. As mentioned previously, a frequent complaint is the inefficient handling of problem bear kills by local hunters.

Austria.-- Management problems for Austria arise in the states having different regulations in dealing with problem bears and compensating farmers for damage. Especially in the area of central Austria, where the bear population is split among the states of Lower Austria, Upper Austria, and Styria, previous problems have shown the difficulties that have to be overcome. When a bear was causing problems in 1994, kill permits had to be issued in 2 different states by several different counties individually. Each permit was difficult to obtain and some counties did not issue one at all. The bear ended up being shot 'illegally,' but was reported as 'self-defense' (Styrian forester and WWF Austria, pers. comm.). A common management approach for dealing with dangerous situations is needed. Bureaucracy must be reduced to allow issuing permits faster. Ideally, one permit should be issued per problem bear and not per county the bear could be in. This would have to be organized on a state level with state governments adopting the same guidelines in problem bear management.

Another major problem in brown bear management in Austria is the lack of public education. Many of the people I interviewed in central Austria had no information about bear management. Most interviewees reported that local people were never asked their opinion on reintroducing bears in the area in the 1980s. Not surprisingly, farmers dislike the bear and its managers. Efforts to gain local support should concentrate on informing them of actions taken and educating them about bears and the goals of bear management. What lack of support can do to a population is obvious in central Italy, where poaching rates are quite high and the bear population has been declining.

Management classification

Two main patterns of management are evident for European brown bear management. Broad goals of preservation or conservation determined management patterns of the individual countries (Figure 25). The preservationist approach to management is associated with setting aside and protecting a resource. Usually,

preservationists want to maintain something in its natural state, such as a wilderness area. It was the philosophy of John Muir, founder of the Sierra Club, who wanted pristine wilderness areas set aside as national parks (Owen and Chiras 1990, Meffe and Carrol 1994). With regard to bear management, preservation means that bears are neither hunted nor fed to increase the population. The preservationist approach to bear management was practiced mainly by the countries that had small bear populations, such as Norway, Italy, Northern Slovenia, and Austria (Figure 25). Management philosophies in these countries might change as the populations grow and are stable enough to support bear harvest.

The conservationist approach to management is more utilitarian, aiming for sustained yield of the resource. It is used in a manner that ensures the resource will be available for future generations (Owen and Chiras 1990, Meffe and Carrol 1994). Characteristics of a conservationist approach to bear management are regular hunting seasons and stable or increasing population. An advantage of the conservationist approach, which was demonstrated in Romania, southern Slovenia, and Sweden, is that hunters have a reason to protect bears. The bigger the bear population, the more they can hunt in the future. In all 3 countries, bear management had a strong component of NGO-government cooperation, in contrast to the preservationist approach, in which, with the exception of Austria, government agencies were in charge (Figure 24). Romania and southern Slovenia additionally practiced trophy hunting. However, it differs within the conservation approach by supplementary feeding of bears and artificially increasing the populations.

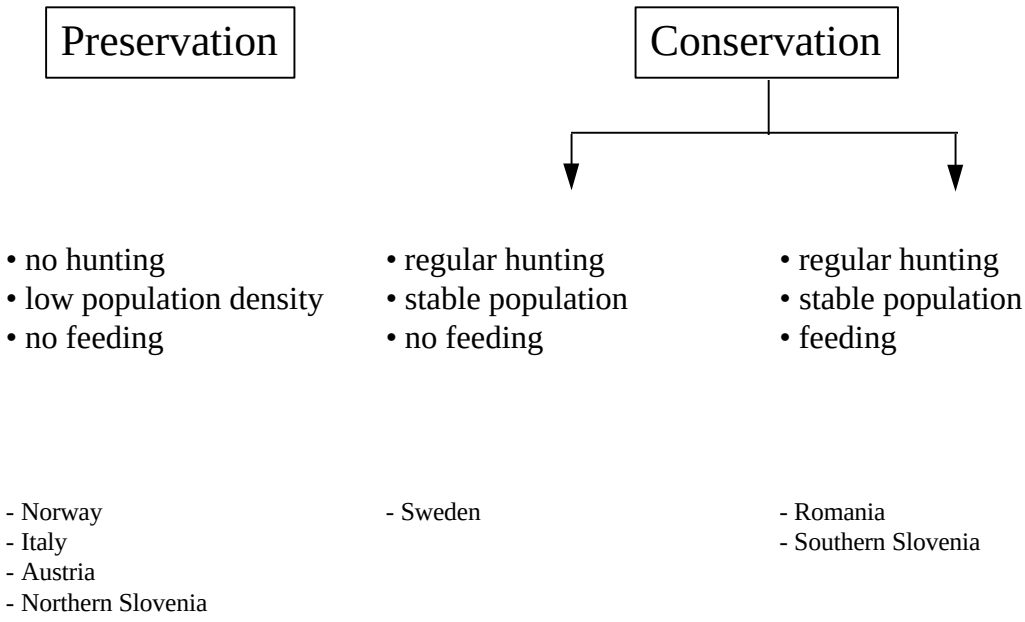

Figure 25. Approaches to brown bear management in five European countries.

CONCLUSION

Successful brown bear management in Europe seems to involve a proper, quick, and easily applicable compensation program for bear damage. People who experience damage by bears must feel confident that the authorities, be it government or non-governmental organizations, will deal with the offending bears quickly and efficiently. Good communication between all parties involved is a must and should be stressed in Austria in the future.

Another key to success seems to be local involvement in management decisions. Wildlife managers, with knowledge of the land around them and contact to local people, can work more effectively and quickly than people unfamiliar with the area. A management plan has to be available for everyone and has to be written in clear terms that avoid confusion.

Brown bear management in Europe differs among countries in governmental-NGO cooperation, hunting practices, bear damage compensation programs, and public involvement. Management goals follow either a preservationist approach, which usually applies to small populations that cannot be hunted, or the conservationist approach with regular hunting seasons and a planned bear population goal.

In countries with a high human population, problems with large carnivores are inevitable. It is important, however, that the local people are not left alone in paying for a "status symbol" that is wanted by the population as a whole.

Chapter 4. Summary and management recommendations to Austria.

This study was designed to provide an overview of the magnitude and seasonal patterns of brown bear damage in several European countries, including Romania, Italy, Slovenia, Norway, Sweden, and Austria. The goal of the study was to describe bear management in these countries by examining the different management strategies for dealing with brown bear damage in each country, how bear management is organized, which organizations are involved, and which duties these organizations fulfill.

Data were collected in two field seasons during the summers of 1995 and 1996. Bear damage data were obtained from interviews with wildlife managers, hunters, and farmers in Romania, Italy, Slovenia, Norway, Sweden, and Austria, and from official records of their bear management agencies. Difficulties in collecting the data included different systems of recording data (e.g., bear damage reported in monetary value, number of incidents, number of livestock killed), and that most data were recorded in the native language of the study country and were not available in English.

Annual economic loss to bears in most study countries was below $ 20,000 US, and bears often accounted for < 10% of all damage by wildlife. However, while damage measured over a whole country or region was minor, the local impact was important (Warren and Mysterud 1995). For instance, one farmer in Norway lost 1/3 of his sheep in one night after 10 years of no bear predation at all (Warren and Mysterud 1995). Most damage incidents involved sheep and beehives in all countries, and mainly occurred between June and August. Preventive measures included electric fencing of bee hives, sheep-guarding dogs in Romania and Italy, supplementary feeding in Romania, Slovenia, and Italy, and preventive husbandry methods such as moving sheep off meadows early in the season or at night, or switching to cattle production in bear-damage prone areas.

All study countries offered a more or less well functioning damage compensation program to farmers. The hunting associations of Slovenia and the Austrian states of Styria and Carinthia used membership fees to pay for a private insurance, which was used to reimburse farmers who experienced bear damage. Damages by bears in Norway, Sweden,

Romania, and Italy were compensated by the respective governments. In all countries, bear damage had to be verified by either foresters, bear biologists, veterinarians or other officials (Table 24) and a report had to be sent to the agency responsible for bear management.

Wagner (1997) reported that most compensation programs in the USA and Canada were established for valuable species (bear, elk and deer) whose populations have increased because of management efforts by state/provincial wildlife agencies. Indeed, experience seems to suggest that a good compensation system is mandatory for the successful conservation of bears in Europe. As illustrated by the situation in Italy, a lengthy, ineffective compensation procedure might increase poaching and impede success of maintaining a permanent bear population in Austria.

The second part of this study was the assessment of the organizational structure of different bear management programs in Europe. Methods included a content analysis of interviews with wildlife managers, farmers, and local people in each country. Time constraints and logistics did not allow for a random sample of interviewees. Much information was lost during the translation of the interviews into English for the analysis.

In each country different organizations were involved in bear management, including private and governmental organizations. In Norway, Sweden, northern Slovenia, and central Italy outside the Abruzzo National Park, bears were managed by government organizations (Figure 24). Management of brown bears in Austria, southern Slovenia, and Romania was a cooperative effort among NGOs and the respective governments. The 3 countries are distinct in that Austria is focused on preservation of a reintroduced population, whereas Slovenia and Romania manage their bear populations primarily for hunting. In all 3 countries, the national hunters associations play an important role in the management of bears. They provide damage compensation insurance (except in Romania), as well as other important aspects of management, such as population monitoring, hunting, and feeding (except in Austria).

In countries where bears were hunted (southern Slovenia, Romania, Sweden), problem bears could be shot within the legal harvest limit during the hunting season.

Countries in this study that did not have a regular hunting season (Norway, Italy, Austria), experienced difficult decisions regarding the elimination of problem bears. Most of them have small populations and the elimination of one bear may seriously affect the viability of the population, especially if it concerns a female.

Brown bear management in Europe included a broad spectrum of goals, ranging from no protection, to regulated hunting, to total protection. Romania, Sweden and southern Slovenia took a conservationist approach, characterized by economic use of their bear population. Romania and southern Slovenia also fed bears, which could be viewed as a utilitarian management scheme. All of these countries had viable bear populations. The second management approach, classified as the preservationist approach, was observed in Norway, Italy, Northern Slovenia, and Austria. This management strategy was characterized by year-long protection of bears, low population numbers, and no feeding of bears.

Bear management recommendations for Austria

A well-functioning brown bear conservation program in Austria will have to include:

- Comprehensive public education
- A quick action procedure in case of a problem bear and/or bear damage
- Standardized compensation programs in all Austrian states
- Communication and cooperation among individual states
- Centralized data base on bear observations and damages
- Clear formulation of goals and objectives in future management plan

A management priority in Austria should lie in public education to gain support for brown bear conservation. Interviewed farmers in central Austria indicated that they were against reintroduction of bears and did not believe that bears belong in the cultural

landscape of Austria. I believe that this strong opposition of the local populations stems from a lack of public information and involvement during the reintroduction of bears in the 1980s. Several farmers and foresters mentioned that they were never asked their opinion about reintroducing brown bears to that area and "heard it on the radio" that bears had been released. Not surprisingly, they felt that responsible authorities did not care about their concerns.

A second important aspect to make brown bear conservation successful in Austria seems to be a quick action procedure for dealing with problem bears. Surveys conducted by the Wildlife Management Institute of the BOKU University (*Institut für Wildbiologie und Jagdwirtschaft*) in Vienna, Austria, showed that in 1993, 85 % of the local people in the Mariazell area of central Austria thought the bear was an asset to the area; in 1994 and 1995, only 67 % and 45 % respectively, felt the same way. The drop in local support for the presence of bears was probably related to a peak in bear damage in the summer of 1994. Bureaucratic obstacles kept authorities from quick management actions, such as trapping and radio-collaring the offending animals or issuing a kill permit when damages kept increasing. A facilitation of the bureaucratic process to speed up management procedures is essential to reduce damage and gain public support.

Related to quick action in a bear problem situation is a well-functioning compensation program. The states of Lower Austria, Upper Austria, and Styria in Central Austria each have separate damage compensation programs (Table 19). In the border area between Styria and Lower Austria, farmers in Lower Austria were not satisfied that Styria paid more money for a sheep killed by a bear. Damage insurance in Styria and Carinthia is financed by the state hunting associations and seems to work well. Insurance programs for damage compensation should be consistent across all Austrian states with the same premiums for killed sheep, destroyed bee hives and other damages. The programs do not necessarily need to be operated by the same institutions, such as the state governments. A suggestion by the bear management plan team is to standardize all insurance programs. Support of the hunting associations should not be jeopardized in doing so, and the well

functioning systems in Styria and Carinthia should be maintained, but modified to achieve the goal of having the same insurance program in all states.

Lack of communication between states or even agencies within states has been a problem, as the high bear damage situation of 1994 illustrated. Styria did not issue a kill permit for a problem bear that was causing problems in the border zone to Lower Austria, which had issued permits in the affected counties. As the offending bear crossed the border from Lower Austria into Styria, it could not be removed. A council of representatives from all states, who would be authorized to make a mandatory decision for their state in consensus with the other states, could solve the lack of cooperation.

To be effective in bear management and monitoring of the bear population, Austria needs a centralized data base for all bear damages and bear observations. The above mentioned council of representatives could serve as liaison to each state for providing the data. The future bear management plan of Austria should avoid mistakes that have been observed in Norway. A clear formulation of goals and objectives to avoid misinterpretation should be a priority.

LITERATURE CITED

Adamic, M. 1991. The status and management of the brown bear in the Republic of Slovenia. Report. Forestry Research Institute. Ljubljana, Slovenia.

Almasan, H. 1994. The status of the bear in Romania. Wildbiologie International 5/10: 1 - 18.

Aste, C. 1993. Untersuchungen zur Lebensraumqualität für Braunbären in Österreich. Boku-Berichte zur Wildforschung und Wildbewirtschaftung 5. Vienna, Austria.

Babbie, E. 1992. The Practice of Social Research. Sixth ed. Wadsworth Publishing Company, Belmont, California. 493pp.

Bear Incident Management Plan: Yukon - Charley Rivers National Preserve. 1990. United States Department of Interior. National Park Service.

Bear Management Plan: Gates of the Arctic National Park and Preserve. 1989. United States Department of Interior. National Park Service.

Bear Management Plan: Glacier National Park. 1981. United States Department of Interior. National Park Service.

Bear Management Plan: Katmai National Park and Preserve. 1990. United States Department of Interior. National Park Service.

Bear Management Plan: Katmai National Park and Preserve. 1986. United States Department of Interior. National Park Service.

Berce, M., and C. Strumbelj. 1992. Problems arising from the protection and breeding of the brown bear in the central protected area in Slovenia. Proc. Brown bears in the countries of the Alps and the Adriatic Sea. Ljubljana, Slovenia.

Boitani, L. 1992. Wolf research and conservation in Italy. Biol. Conserv. 61:125-132.

Boscagli, G. 1986. Brown bear mortality in central Italy from 1970 to 1984. Proc. Int. Conf. Bear Res. and Manage. 7: 97 - 98.

Boscagli, G. 1994. The central Italy bear population: an outline of interventions to save them. Status Report. Proc. Int. Conf. Bear Res. and Manage. 9: 532 - 539.

Calvert, R., S. Slate, and P. DeBow. 1992. An integrated approach to bear damage management in New Hampshire. Proc. 11th East. Black Bear Workshop: 15 pp.

Camarra, J.J. 1986. Changes in brown bear predation on livestock in the western French Pyrenees from 1968 to 1979. Int. Conf. Bear Res. and Manage. 6:183-186.

Clevenger, A.P., F.J. Purdy, and M.S. de Buruaga. 1990. Status of the brown bear in the Cantabrian mountains, Spain. Int. Conf. Bear Res. and Manage. 7:1-8.

Cole, G.F. 1971. Preservation and management of grizzly bears in Yellowstone National Park. BioScience 21(16): 858 - 864.

Cole, G.F. 1973. Management involving grizzly bears and humans in Yellowstone National Park, 1970 - 73: an interim report. US Department of the Interior, NPS.

Comly, L.M. 1993. Survival, reproduction, and movements of translocated nuisance black bears in Virginia. M.S. Thesis. Virginia Polytechnic Institute and State University. 113pp.

Conover, M.R. 1994. Perceptions of grass-root leaders of the agricultural community about wildlife damage on their farms and ranches. Wildl. Soc. Bull. 22:94-100.

Conover, M. R., and D.J. Decker. 1991. Wildlife damage to crops: perceptions of agricultural and wildlife professionals in 1957 and 1987. Wildl. Soc. Bull. 19:46-52.

Cozza, K., R. Fico, and L. Battistini. 1995. Wildlife predation on domestic livestock in central Italy: a management perspective. Biezczady Symposium Report Papers.

Cozza, K., R. Fico, L. Battistini, and E. Rogers. in prep. The damage-conservation interface illustrated by predation on domestic livestock in central Italy.

Craighead, J.J., and F.C. Craighead Jr. 1971. Grizzly bear - man relationship in Yellowstone Nat. Park. BioScience 21:845 - 857.

Craighead, J.J., J.S. Sumner, and J.A. Mitchell. 1995. The Grizzly Bears of Yellowstone: their ecology in the Yellowstone Ecosystem, 1959-1992. Island Press, Washington, D.C. 535pp.

Dandaletche, C. 1989. Biological and symbolic importance of the brown bear for nature conservation in Europe. IN: Situation and protection of the brown bear in Europe workshop. Council of Europe, Strasbourg, France.

Fabbri, M, G. Boscagli, and S. Lovari. 1983. The brown bear population of Abruzzo. Acta Zool. Fennica 174:163-164.

Fico, R., G. Morosetti, and A. Giovannini. 1993. The impact of predators on livestock in the Abruzzo region of Italy. Rev. sci. tech. Off. int. Epiz. 12(1):39-50.

Garshelis, D.L., and M.R. Pelton. 1980. Activity of black bears in the Great Smoky Mountain National Park. J. Mamm. 61(1):8-19.

Genov, P., and R. Gancev. 1987. Der Braunbär in Bulgarien: Verbreitung, Anzahl, Schäden. Zeit. für Jagdwissens. 33(3): 145-52.

Gutleb, B. 1995. Verbreitung, Situation und Entwicklungschancen des Braunbären in Kärnten. WWF Brown bear end report. WWF Austria.

Gutleb, B. 1995a. Die Braunbären Kärntens. WWF yearly report. WWF Austria.

Hell, P. 1990. The situation of the brown bear in Czechoslovakia. Aquilo Ser. Zool. 27:47-50.

Herrero, S. 1985. Bear attacks: their causes and avoidance. Nick Lyons Books, Winchester Press, Inc. Piscataway, N.J. 287pp.

Hinde, R.A. 1970. Behavioral habituation. IN: Horne, G., and R.A. Hinde. Short - term changes in neural activity and behavior. London & New York: Cambridge Univ. Press: 3 - 40.

Holmes, B.R. 1994. Bear management incidents at Brooks Camp, Katmai Nat. Park, AK. Annual report National Park Service, Anchorage, AK.

Huber, D. 1990. The brown bear in Yugoslavia. Aquilo Ser. Zool. 27: 63 - 65.

Huber, D. 1993. Animal Victims of Croatian Homeland War, 1990 - 1992. Faculty of Veterinarian Medicine, University of Zagreb, p. 123 - 127.

Hyngstrom, S.E. 1994. Black bears: Damage prevention and control methods. In: Prevention and Control of Wildlife Damage (1994), USDA publication.

Ionescu, O. 1993. The management of brown bears in Romania. IN: Proc. Council of Europe: Management of small populations of threatened mammals, Sofia, Bulgaria, p. 56-60.

Jope, K.L. 1985. Implications of grizzly bear habituation to hikers. Wildl. Soc. Bull. 13: 32 - 37.

Jorgensen, C.J., R.H. Conley, R.J. Hamilton, and O.T. Sanders. 1978. Management of black bear depredation problems. Proc. East. Workshop Black Bear Manage. and Res. 4:297-321.

Kaczensky, P. 1995. Bears and highways in Slovenia. International Bear News, Vol. 4., No. 1, p. 17.

Kaczensky, P. 1996. Large Carnivore - Livestock conflicts in Europe. NINA/NIKU report. Trondheim, Norway.

Knauer, F., P. Kaczensky, J. Rauer, and H. Digruber. 1994. Bärenprobleme in Mariazell -Beurteilung der Situation und Vorschläge zur Lösung. WGM report.

Knauer, F. 1993. Braunbären im Trentino - Simulation der MVP und Vorschläge zum Schutz. Master's thesis (in German), University of Munich, Freising, Germany. 42pp.

Knight, R.R., and B.M. Blanchard. 1982. Yellowstone Grizzly bear investigations. Report of the interagency study team. United States Department of Interior. National Park Service.

Kolstad, M., I. Mysterud, T. Kvam, O.J. S rensen, and S. Wikan. 1986. Status of the brown bear in Norway: Distribution and Population 1978 - 1982. Biological Conservation 38:79-99.

Mattson, D.J., Blanchard, B.M., and Knight, R.R. 1992. Yellowstone grizzly bear mortality, human habituation, and whitebark pine seed crops. J. Wildl. Manage. 56(3): 432 - 442.

McCullough, D.R. 1982. Bears, behavior, and humans. Wildl. Soc. Bull. 10: 27 - 33.

Meagher, M., and S. Fowler. 1989. The consequences of protecting problem grizzly bears. IN: Bear - People Conflicts. Proceedings of a symposium on management strategies. Northwest Territories Department of Natural Resources: 141-144.

Meffe, G.K., and C.R. Carroll. 1994. Principles of Conservation Biology. Sinauer Associates, Inc. Sunderland, Massachusetts.

Mertzanis, G. 1989. Consideration on the situation of the brown bear in Mediterranean areas.. IN: Situation and protection of the brown bear in Europe workshop. Council of Europe, Strasbourg, France.

Mysterud, I. 1980. Bear management and sheep husbandry in Norway, with a discussion on predatory behavior significant for evaluation of livestock losses. Proc. Int. Conf. Bear Res. and Manage. 3:233-241.

Nordic Council of Ministers. 1983. Representative Nature Types of Nordic Countries. Oslo, Norway.

Nicolae, S. 1994. Particularitati ale biologiei ursului brun. (in Romanian). MS thesis, Dept. Biology, University of Bucharest, Romania.

O'Brien, J.M., and R.E. Marsh. 1990. Vertebrate pests of beekeeping. Proc. 14th Vertebr. Pest Conf. :228-232.

Olsen, L. 1991. Compensation: giving a break to ranchers and bears. Western Wildlands 1:25-29.

Owen, O.S., and D.D. Chiras. 1990. Natural Resource Conservation: An Ecological Approach. 5th ed. MacMillan Publishing Company. New York, NY.

Peeke, H.S, and L. Petrinovich. 1984. Habituation, sensitization, and behavior. Academic Press., FL.

Pulliainen, E. 1989. Regional Reports: Northern Europe. IN: Situation and protection of the brown bear in Europe workshop. Council of Europe, Strasbourg, France.

Rauer, Georg. 1995. Stürmische Heimkehr - der Braunbär in Österreich. Stapfia 37: 251-254.

Rösler, R. 1989. Regional Reports: Central and Eastern Europe. IN: Situation and protection of the brown bear in Europe workshop. Council of Europe, Strasbourg, France.

Sagør, J.T, J.E. Swenson, and E. Roskraft. 1995. Is it possible to reestablish a reproducing brown bear population in Norway and concurrently limit the losses of free-ranging sheep? Biol. Conservation.

Simonic, A. 1992. The legal protection of the brown bear in Slovene territory: past and present, and some suggestions for the future. Proc.: Brown bears in the countries of the Alps and the Adriatic Sea. Ljubljana, Slovenia.

Singer, W. 1995. Biene und Bär. Bienenvater 9:369-371.

Sørensen, O.J. 1990. The brown bear in Europe in the mid 1980's. Aquilo Ser. Zool. 27:3-16.

Sørensen, O.J., J.E. Swenson, and T. Kvam. 1994. The brown bear in Norway. Unpublished NINA report, Trondheim, Norway.

Statistical Yearbook of Austria. 1995.

Statistical Yearbook of Italy. 1995.

Statistical Yearbook of Norway. 1990.

Statistical Yearbook of Romania. 1993.

Statistical Yearbook of the Republic of Slovenia. 1995.

Swenson, J.E., F. Sandergren, A. Bjärvall, A. Söderberg, P. Wabakken, and R. Franzen. 1994. Size trend, distribution and conservation of the brown bear population in Sweden. Biol. Cons 70:9-17.

Swenson, J.E., F. Sandegren, A. Bjärvall, A. Söderberg, P. Wabakken, and R. Franzén. 1995. The near extinction and recovery of the brown bears in Scandinavia in relation to the bear management policies of Norway and Sweden. Wildl. Biol. 1:11-25.

Swenson, J.E., F. Sandegren, A. Bjärvall, A. Söderberg, P. Wabakken, and R. Franzén. 1995a. The brown bear in Sweden. unpublished paper.

Thorpe, W.H. 1963. Learning and instinct in animals (2nd ed.). London: Methuen.

United States Department of Agriculture (USDA). 1991. Sheep and goat predator loss. National Agricultural Statistics Service. 12pp.

USDA. 1992. Cattle and calves death loss. National Agricultural Statistics Service. 23pp.

Vaughan, M.R. and P.F. Scanlon. 1990. The extent and management of damage by black bears. Trans. 19th IUGB Congress, Trondheim 1989.

Wabakken, P., and E. Maartmann. 1994. Sluttrapport for bj rn-sau prosjektet I Hedmark 1990 - 1993. (in Swedish) NINA forskningsrapport 058.

Wagner, K.K. 1997. Preventive predation management: an evaluation using winter aerial hunting. Ph.D. Diss. Utah State University, Logan, UT. 108 pp.

Wanitschek, E. 1996. Jagd - und Wildmanagement in Österreich und Norwegen: ein Vergleich. M.S. thesis at BOKU University, Vienna, Austria.

Warren, J.T., and I. Mysterud. 1995. Mortality of domestic sheep in free-ranging flocks in Southeastern Norway. J. Anim. Sci. 73:1012-1018.

Weber, P. 1990. Status report on the brown bear in Romania. Aquilo Ser. Zool. 27: 59 - 62.

WWF Austria. 1991. Forschungsbericht: Braunbär 1. Vienna, Austria. (in German).

WWF Austria. 1994. Forschungsbericht: Alles über die Bären in Österreich. Vienna, Austria. (in German).

Zunino, F. 1981. The dilemma of the Abruzzo bears. Oryx 16(2):154-156.

Zunino, F. 1989. Management of small populations of bears in protected areas. IN: Situation and protection of the brown bear in Europe workshop. Council of Europe, Strasbourg, France.

Zunino, F, and S. Herrero. 1972. Status report of the brown bear in the Abruzzo region (Italy), 1971. Biol. Conservation 33(3):

LIST OF APPENDICES

Appendix 1. Contacts for interviews in study countries.

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Koren, Iztok. Zavod za Gozdove oe Tolmin, Tumov Drevored 17, 5220 Tolmin, Slovenia. Tel. (++386) 65 81212, FAX: (++386) 65 81266

Krze, Blaz: Slovenian Hunters Association, Zupanciceva 9, 61000 Ljubljana, Slovenia. Tel. (++386) 61 214950, FAX: (++386) 61 217994

Simonic, Anton: Ministry of Agriculture and Forestry. Parmova 33, 61000 Ljubljana, Slovenia. Tel.: (++386) 61 323643, FAX: (++386) 61 313631

Ozbolt, Iztok. Zavod za Gozdove Slovenije, Vecna pot 2, 61000 Ljubljana, Slovenia. Tel. (++386) 61 1235432, FAX: (++386) 61 1235361

Strumbelj, Ciril: Gojitveno Lovisce Medved, Reska 35, 1330 Kocevje, Slovenia. Tel. (++386) 61 851451, FAX: (++386) 61 854540
Berze, Marko:

Sweden
Bjärvall, Anders. Naturvårdsverket, 17185 Solna, Sweden. Tel. (++468) 799 1000

Appendix 2. Interview guide for wildlife managers.

1. Which organizations are involved in the management of brown bears in (*name of the area*)?

2. Who designs the management plan?

3. What does the management plan contain?
behavioral research
population research
other research (e.g. habitat)
education (public and employees)
management actions (e.g. aversive conditioning, relocation, destruction, closures)
harvest levels
law enforcement (e.g. poaching prevention)
preventive actions (food storage, fencing of bee hives)
regulated reporting of incidents (central agency for reports)
monitoring

Are local managers able to modify the plan, if they aren't involved in the design? In what way?

4. a) What is the relationship of *name of the area* to the organization (e.g. Forest Service) that writes the bear management plan?
have them rate

1	2	3	4
good cooperation with regular meetings	good cooperation with irregular meetings	cooperation with yearly reports	no cooperation

. b) please specify how cooperation is organized

5. Who are the people involved in various aspects of the bear management (e.g. handling damage claims, research, education, aversive conditioning, ...) in *name of the area* ? What are their duties?

a) permanent rangers:
b) park biologist:
c) local hunters
d) game wardens
e) foresters
f) NGOs

g) other

6. What is your role in the bear management of .....?

7. What is the decision-making process when, for example, a bear has to be destroyed (i.e. who has the ultimate responsibility)?

8. What are the strengths of your management approach?

9. Do you have any suggestions what could be improved with the current plan?

10. Are bears fed?

What is fed
how often
by whom
why
where

11. What kind of problems do you have with bears?

	incidents / year
property damage	
beehive damage	
livestock depredation	
trespassing through towns/	
breaking into houses	
personal injury	
garbage	
other	

12. What actions are taken to prevent :
(e.g. electric fencing around hives, education of farmers, ...)

property damage
beehive damage
livestock depredation
trespassing through towns/
breaking into houses
personal injury
garbage
other

13. Does the state promote or subsidize preventions? In what way?

14. When do these problems occur most? List each separately. (certain months, e.g. right after hibernation ?)

15. Where do these problems occur? (can you point out on a map?)

16. Who are these problems reported to? (Can I get reports?)

17. Do you read these reports? Why or why not?

18. What is the reporting rate? *(How will they know if not reported?)*

19. Is damage compensated by the state? If yes -
- How does it work? Problems?
- Have to have proof?
- enough money, are people content with the system .

20. Is the public informed about *bears* and their *behavior* (public lectures, brochures, school, ...)

21. Do the locals know what is done to *manage* bears (public lectures, brochures, etc.)?

22. If a management plan exists, do people adhere to the plan (do they support your organization in enforcing management regulations)?

23. What conflicts - if any - occur with locals?

24. Do people accept the presence of the bear, for example positive newspaper articles, or complaints to the agency about bear problems.

25. Were bears introduced ?

26. If yes - how did the ... react?

	1 strongly favored	2 favored	3 neutral	4 disliked	5 strongly disliked
local farmers					
local others					
local officials					
local media					
national farmers					
national others					
national officials					
national media					
tourists					
other					

27. Please explain each group in more detail.

Concerning the biology of the bear:

28. What are the seasonal shortages in food abundance?

29. Do they coincide with damage reports?

30. What is the population status of the bear? are numbers increasing, stable, decreasing? obtain density data, how reliable are these numbers (*how were they measured?*)

31. What is the conservation status of the bear here?
    a) is it hunted? - if yes: certain times, sex, weight, who hunts and how is the hunt organized?
    b) protected year round
    c) poaching estimate

Appendix 3. Interview guide for farmers and shepherds.

1. What do you do if a bear has taken livestock or has damaged property?

2. What measures do you take to prevent damage?

3. Does the state provide information/help with these measures?

4. What do you like / dislike about bear management in general?

5. What do you like about the compensation program?

6. Do you have suggestions on how to improve it?

7. How quickly is your report / compensation processed?

8. Do you get adequate compensation?

9. Do you think bears belong in the area?

1	2	3	4	5
strongly favored	favored	neutral	disliked	strongly disliked

Why, or why not?

10. Do you observe bears at trash dumpsites?

11. Do bears approach your camp/farm?

VITA

Sybille Klenzendorf

Sybille Klenzendorf was born in Oldenburg, Lower Saxony, Germany on October 22, 1971. She grew up in Forst, Baden-Würtemberg, Germany, where she graduated from Schönborngymnasium Bruchsal (German High School) in 1991. Sybille spent a semester in Owatonna, Minnesota, USA, as part of an exchange program between the states of Minnesota and Baden-Würtemberg.

Her family moved to the Washington D.C. area in 1991, where Sybille completed her Bachelor of Science degree in biology at George Mason University in 1994 (cum laude). She then started her Master of Science in Wildlife Sciences at Virginia Polytechnic Institute and State University in the fall of 1994.

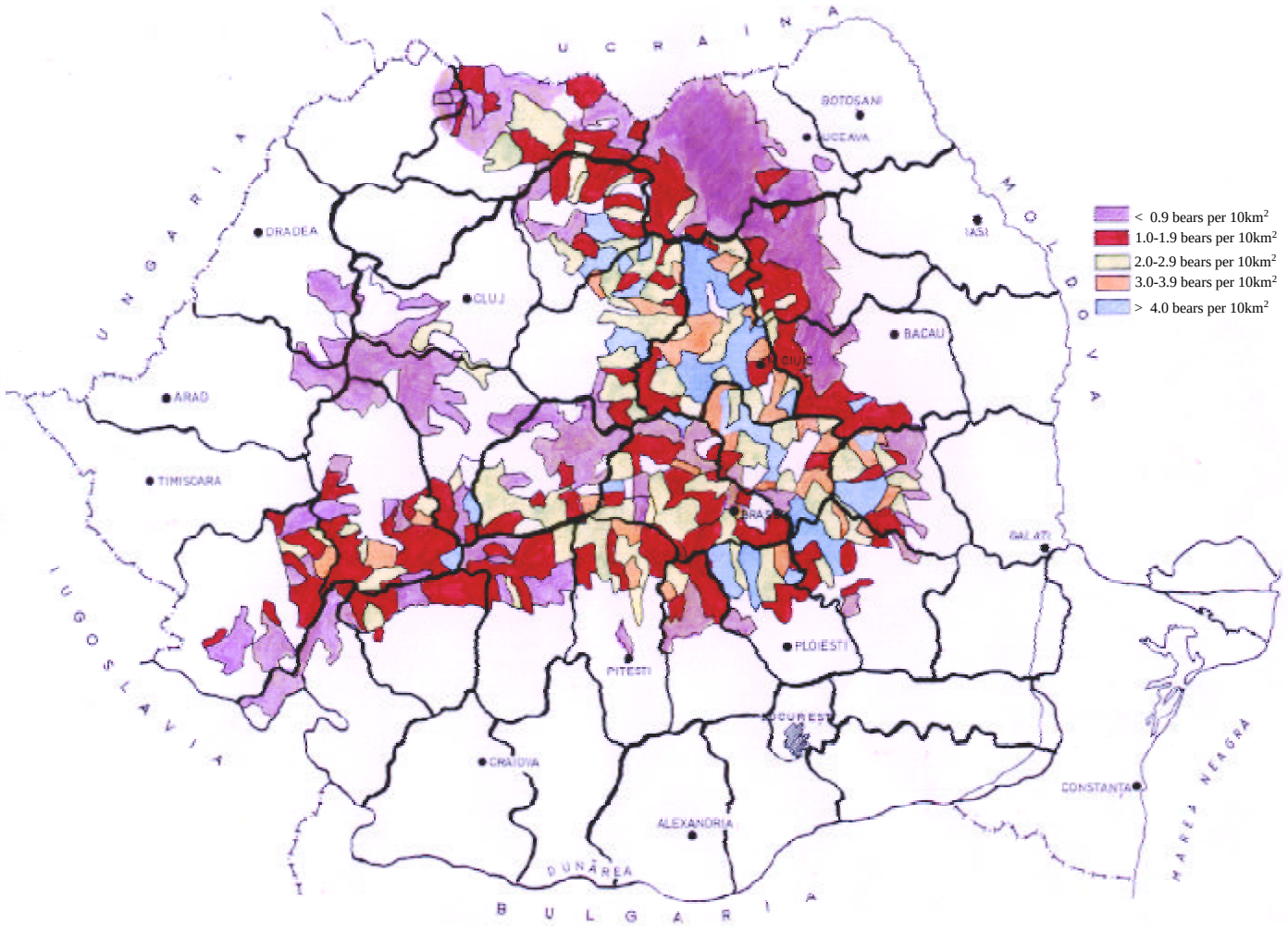

Figure 2. Brown bear densities in Romania in 1991 (after Ionescu, unpublished data).

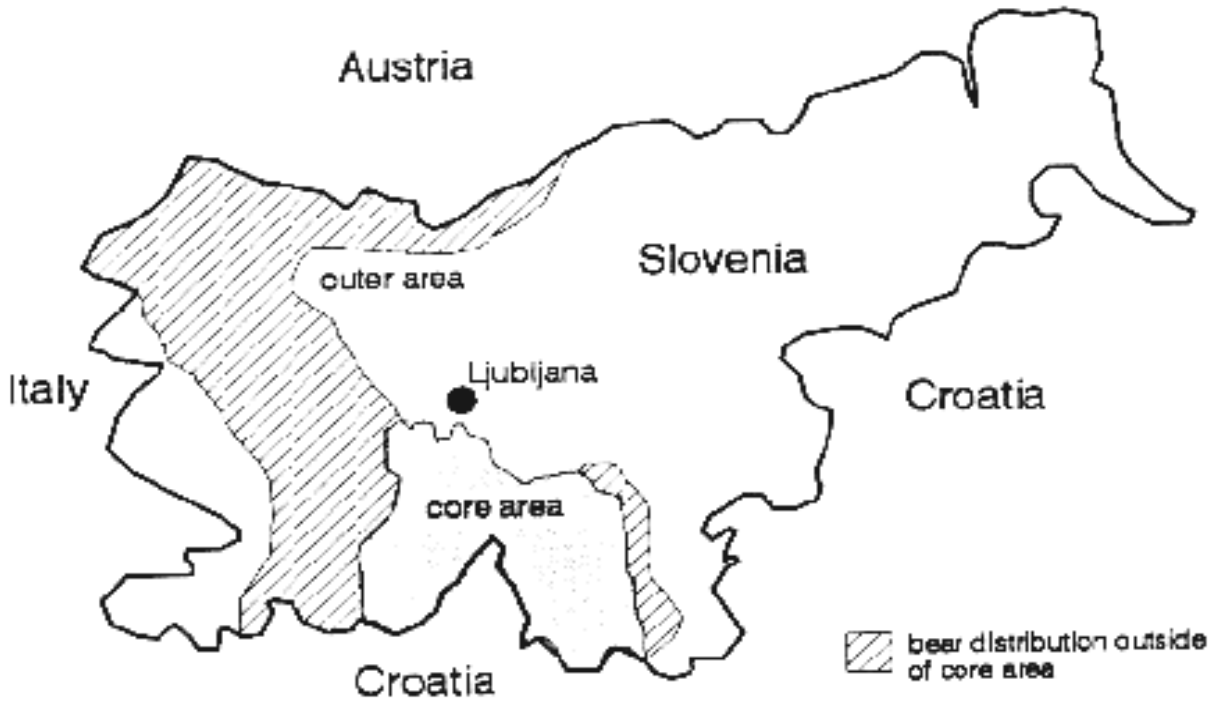

Figure 3. Bear management core area and bear distribution Slovenia (after Kaczensky 1996).

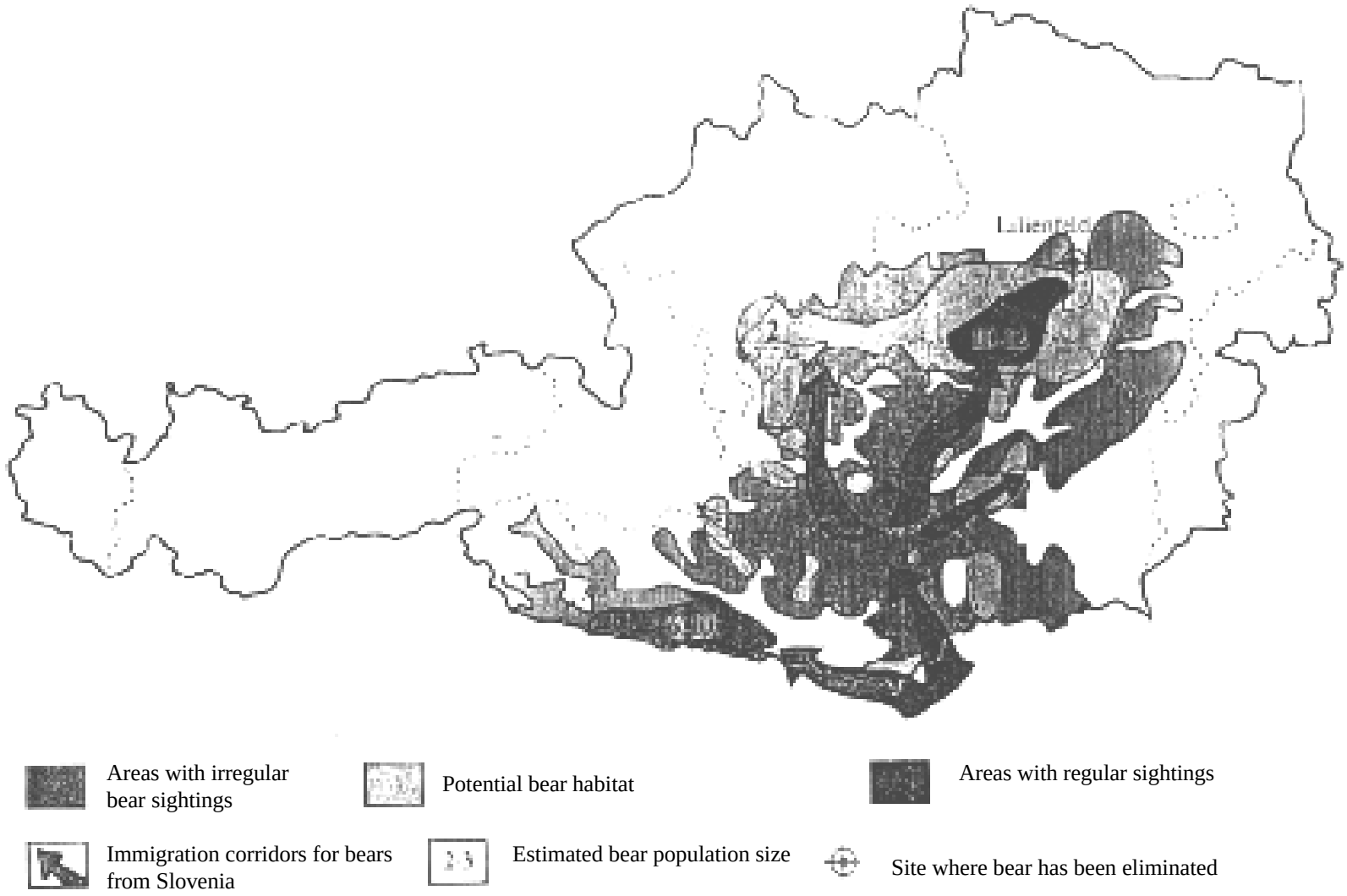

Figure 6. Bear population distribution in Austria, illustrating potential bear habitat, areas with an established bear population, and immigration corridors for bears form Slovenia (after C. Aste, B. Gutleb, and G. Rauer, WWF Austria, pers. comm.)

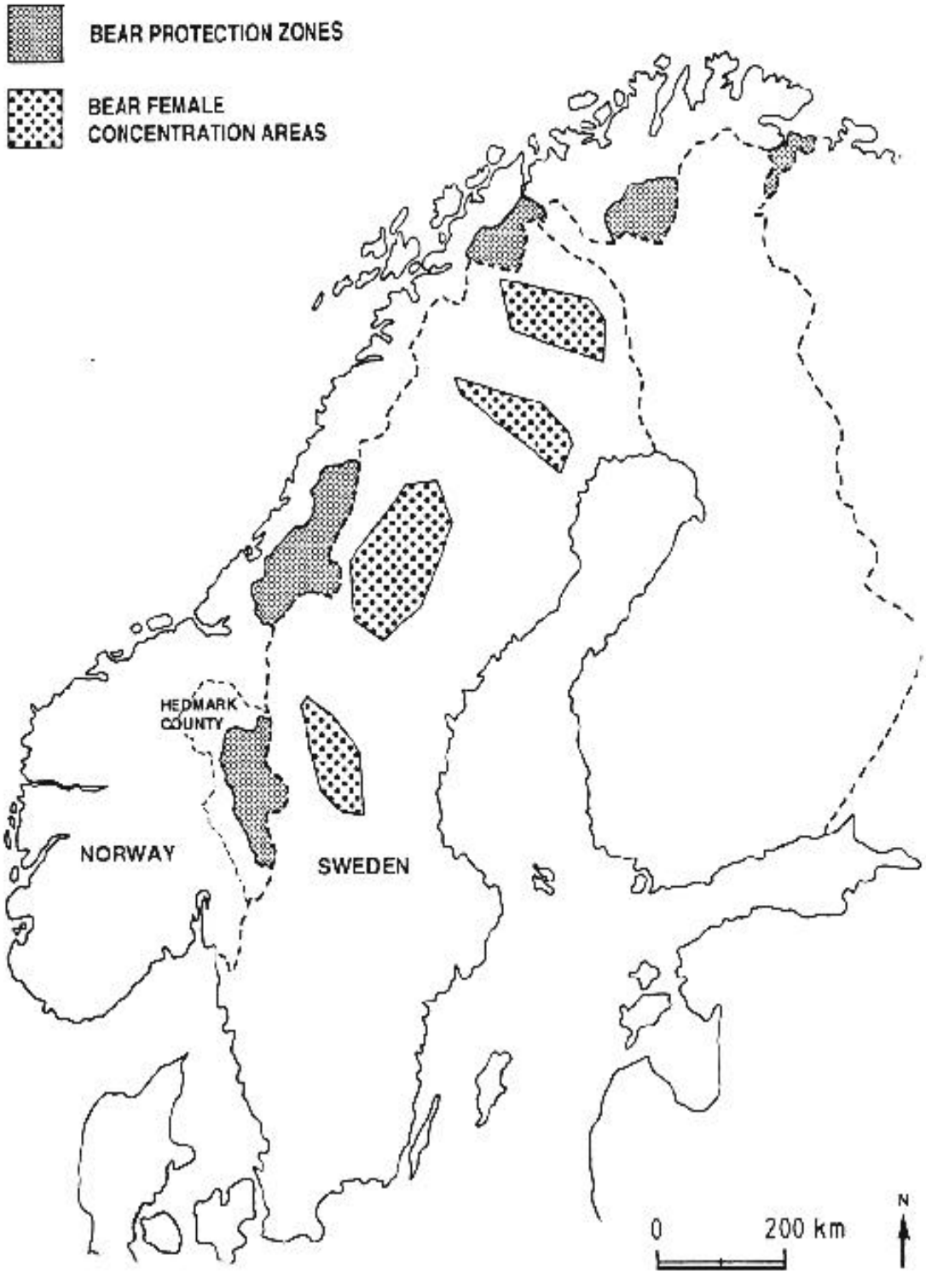

Figure 5. Bear protection zones and female core areas in Norway and Sweden (after Swenson et al. 1994).