

# BIOGEOGRAPHY, DEMOGRAPHY AND MANAGEMENT OF *URSUS ARCTOS* IN THE WESTERN CARPATHIANS

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**Abstract:** During the 1930s the brown bear (*Ursus arctos*) population in the western Carpathians was endangered and numbered <60 animals. Following total protection during 1932–60 and harvest management since 1960, this population gradually increased in both number and range. Now, about 600 animals inhabit approximately 12,500 km<sup>2</sup> in Slovakia. Within this area 8,000 km<sup>2</sup> is optimum habitat and supports >0.6 bears/10 km<sup>2</sup>. In addition 2,500 km<sup>2</sup> supports <0.6 bears/km<sup>2</sup> with the remaining 2,000 km<sup>2</sup> having only transient bear occurrences. Harvest has been allowed since 1960, and population dynamics are significantly influenced by harvest regulations. From 1960 through 1980, 291 bears were harvested. Of these 230 (79%) were males and 61 (21%) were females. This excessive harvesting of males changed the sex and age structure of the population, allowed excessive population growth, and reduced natural selection pressure. During 1981–91 the growth coefficient of the population averaged 11.2%. Some improvement was noted after the establishment of a selective harvest regime. Of 176 bears harvested during 1981–91 weighing <100 kg, 36% were males and 64% females. On the basis of these data, yearly quotas were designed to encourage the harvest of subadult animals weighing <100 kg. Although this harvest design was not strictly observed, from 1981 through 1991, 441 bears were harvested, of which 281 (66%) were males and 160 (34%) were females.

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The Western Carpathians are an important area for the brown bear population in the Carpathian range. The Western Carpathians are the most western mountain range containing brown bears in Central Europe, and the population persisted here when bears were extirpated elsewhere. Although excessive harvest during the early 1930s rapidly decreased numbers, during this period bears also settled in most parts of the central mountain ranges of the Western Carpathians, where they survived in inaccessible areas seldom disturbed by humans. This population became a source of bears to recolonize neighboring areas.

## GEOGRAPHIC EXPANSION

Bear numbers in the Western Carpathians began to increase after complete legal protection was established in 1932. By 1950, brown bears occupied all the central mountain ranges. During the 1970s the population expanded into some of the peripheral mountain ranges of the Western Carpathians. The range of permanent bear population expanded approximately 40 km to the northwest, 50 km to the east, and into the mountains of Poland's Carpathians. (Janík et al. 1986).

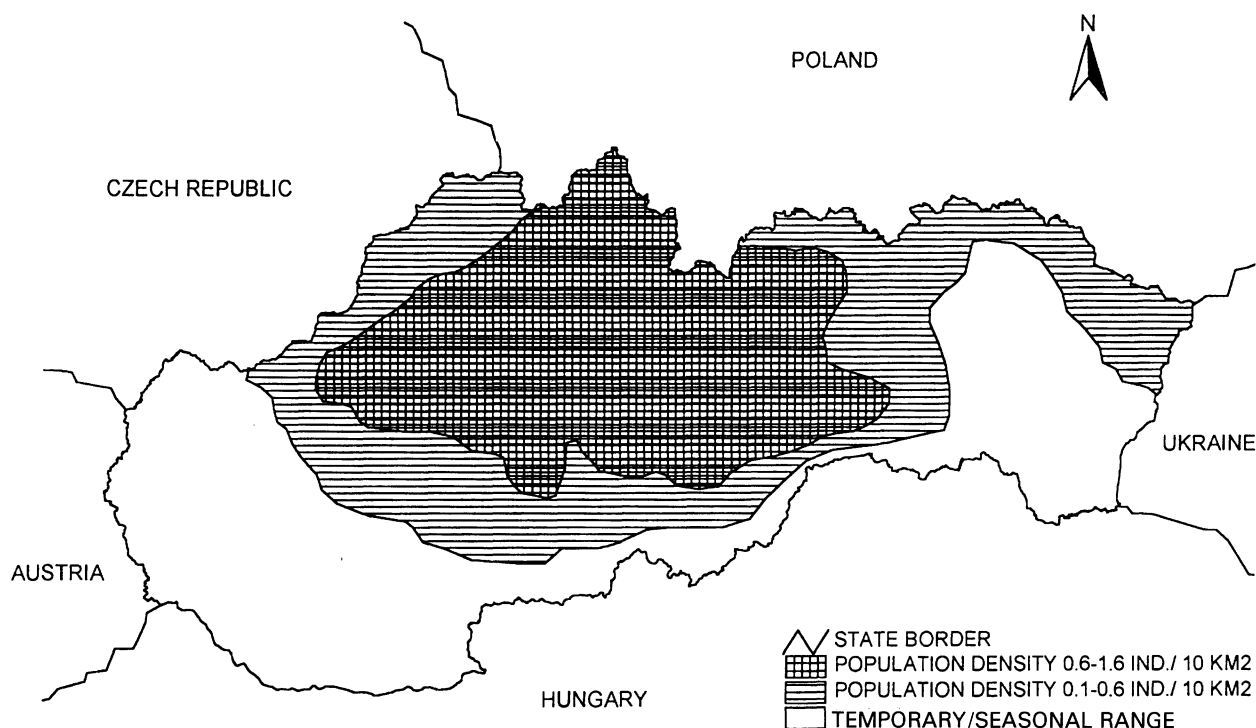
At present, bears inhabit 12,500 km<sup>2</sup> of forest and mountainous pastures in the Slovak part of the Western Carpathians (Fig. 1). In this area, optimum ecological conditions for brown bears occur in natural coniferous and mixed coniferous–deciduous forest communities (Nováková and Hanzl 1970). These communities exist at >800 m in elevation and are made up of mountain spruce (*Picea abies*), subalpine dwarfed pines (*Pinus mugo*), great sycamore (*Acer pseoplatanus*), rowan

(*Sorbus aucuparia*), and beech (*Fagus sylvatica*). In the Carpathians the best habitat encompasses approximately 8,000 km<sup>2</sup>, with bear density ranging from 0.6–1.6/10 km<sup>2</sup> (Fig. 1). The peripheral mountain ranges encompass 2,500 km<sup>2</sup> and support bear densities of 0.1–0.6/10 km<sup>2</sup>. On the remaining 2,000 km<sup>2</sup> bears occur on a temporary basis, especially in the fall when using easily accessible food sources. Excessive disturbance during winter hibernation may prevent bears from inhabiting this area permanently.

An important factor influencing the occurrence and density of brown bears is a network of forest roads and tourist trails. Modeling efforts suggest that in areas with little topographic relief a density of 0.6 km of forest corridors per square kilometer is the maximum that will allow bears to permanently occupy habitat. In areas of variegated relief the maximum density of the road network is 1.2 km/km<sup>2</sup> (Janík 1984).

## POPULATION NUMBERS AND GROWTH DYNAMICS

Estimates of the number of bears in Slovakia at the lowest point in 1932 vary. Žuffa (1932) estimated about 20 animals, but several other publications from this period suggest that the number probably was not <60 (Domin 1935, Duda 1935). After the end of the Second World War the population began to increase. In 1949 the estimated number of bears was 50–80 (Turček 1949); however in 1953 Feriancová (1955) reported 200 bears. In 1964 Šprocha (1964) reported 270 bears. On the basis of questionnaire research in 1966–67 Randík (1971) reported 334 bears.



**Fig. 1.** Recent distribution of brown bear in the Western Carpathians in Slovakia.

Since 1963, the population has been estimated yearly. These estimates are made by qualified forestry employees, and are based on observations of bears throughout the year. However, these data contain errors due to duplicate counts of animals that move between 2 or more forestry areas. In 1991, after eliminating this error by correcting the number of bears appearing temporarily in forestry areas, 600 bears were estimated to inhabit the Slovak part of the Western Carpathians.

Data from many years may indicate the dynamics of the bear population, although estimates for individual years may be inaccurate. From 1932 through 1991, the population growth curve shows exponential growth (Fig. 2). After being protected in 1932, the population grew slowly but steadily until after the Second World War, when growth accelerated. Because of the continuing population growth, it seems likely that the bear population has not yet reached carrying capacity in the Western Carpathians.

Population growth appears to have been significantly influenced by hunting. Until the 1980s, hunting was designed to obtain the best trophies and focused on shooting the largest animals. Of 336 bears harvested during 1958–80, 79% were males and 21% were females. The elimination of many dominant males destabilized the so-

cial structure by reducing sexual and territorial competition. Sexual competition and territoriality among males are the main mechanisms that stabilize the density of a bear population below the carrying capacity of the environment (Janík 1982). A prevalence of females and young animals in the population contributed to high population growth, and may have allowed population density to exceed levels that would be found under more natural circumstances.

## MANAGEMENT

In Slovakia the brown bear is legally protected. From 1932–58 bears could not be legally hunted. In 1962, when the population exceeded 350 animals and damage caused by bears to sheep, bee culture, and especially cattle was prevalent, plans were initiated to reduce the bear population. Shooting was motivated mainly by the profit from trophy hunting. Hunting was regulated by central institutions of the State Administration of Conservation of Nature in cooperation with hunting management institutions, which determined the approximate number of animals in a given locality. Before 1980, the yearly harvest quota fluctuated around 5% of the estimated population, but later the harvest was increased to 8%. By official

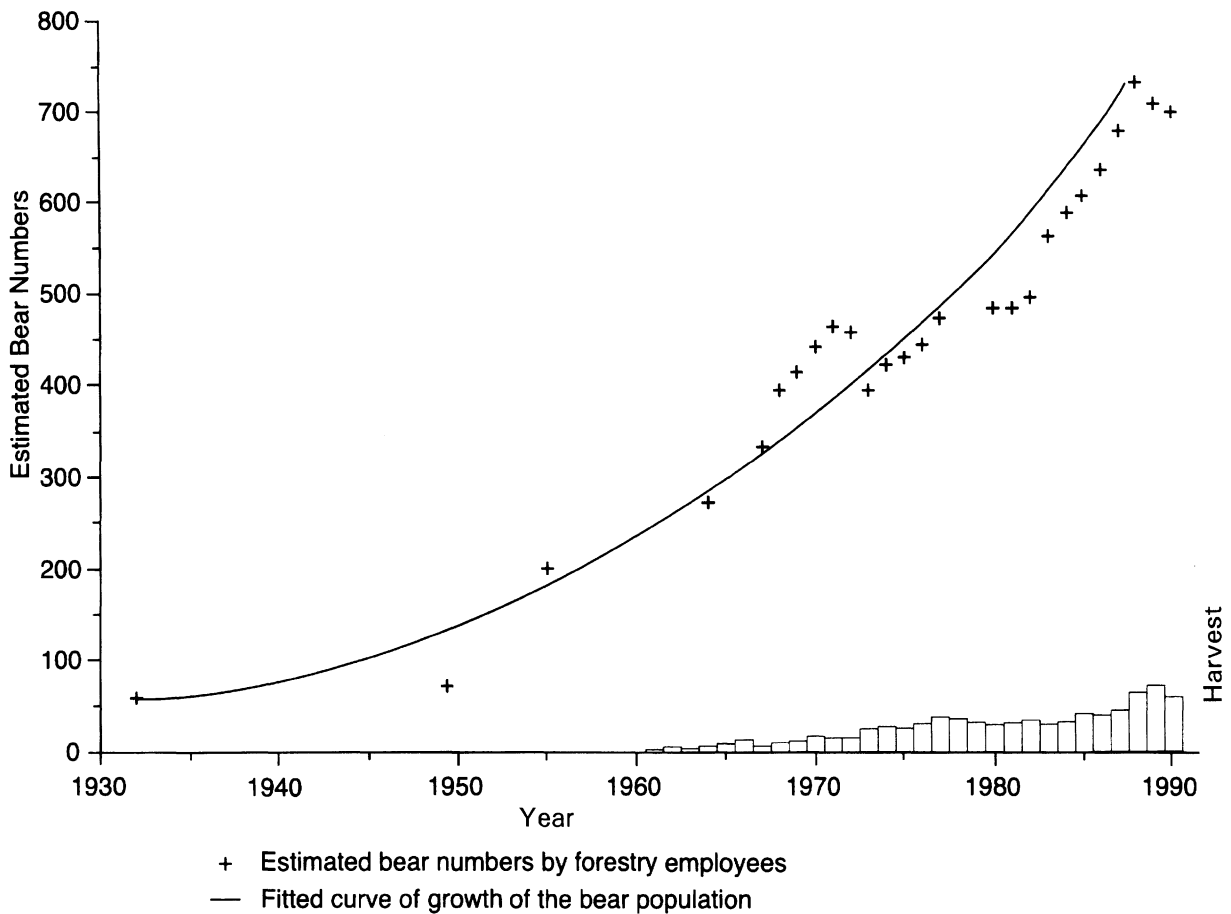


Fig. 2. Population growth and harvest of the brown bear in Slovakia during 1932–91.

reports and documentation of bear harvest from 1960 through 1980, 291 bears were legally harvested in Slovakia. Of this number, 230 (79%) were males and 61 (21%) were females. This high harvest of older males drastically changed the age structure of the population. By observing model areas, we found that in the population there were more females and young bears and a shortage of adult male bears (Janík, 1982, 1987).

To bring the age structure of the population closer to natural conditions, the focus of the hunt was changed in 1980. Data from bears harvested before 1980 indicated that of 176 animals weighing <100 kg 63 (36%) were males and 113 (64%) were females. A hunt structure was designed in which 65% of the bears harvested would weigh <100 kg, and 35% would weigh 101–150 kg. This hunt structure targeted smaller animals in the population (i.e., females and subadults). Bears weighing >150 kg could only be hunted if they were injured or in some way handicapped. Preference would also be given to

eliminating individual animals, or sometimes entire families that had become accustomed to feeding on garbage stored close to hotels and mountain cottages or that continually attacked sheep or cattle. When selecting the localities for hunting, as well as individual bears for harvest, professional field personnel from the State Conservation of Nature closely worked with the individuals hunting.

The introduction of this hunting system encountered problems because hunters were primarily interested in trophies (big furs and skulls). Despite these conflicting interests, we achieved positive results. Of 441 bears harvested during 1980–91, 281 (63.5%) were males and 160 (36.54%) were females. But of 176 bears weighing <100 kg only 63 (36%) were males and 113 (64%) were females. Thus, fewer males and more females were removed from the population compared to previous harvests. Over time, this management should shift the population back toward a more natural structure. However, over the long term, targeting of females and sub-

adults in the population (i.e., smaller bears) could also impact population growth and reproductive potential if too many females are eliminated.

According to the concept of area system of ecological stability approved by the government, important biotopes should be incorporated in a regional, national, and supra-national network of core areas that are gradually declared national parks or protected landscape areas. More than 50% of all forest areas in the territory of Slovakia have been included into these categories of management to date. Connecting corridors between these core areas are at present being identified, and protective measures are being developed to provide for movements of large mammals, including bears.

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