

Chapter One

Background and Introduction



The Carpathian Mountains encompass many unique landscapes, and natural and cultural sites, in an expression of both geographical diversity and a distinctive regional evolution of human-environment relations over time. In this KEO Report, the “Carpathian Region” is defined as the Carpathian Mountains and their surrounding areas. The box below offers a full explanation of the different delimitations or boundaries of the Carpathian Mountain region and how the chain itself and surrounding areas relate to each other.

The Carpathian Mountains are the largest, longest and most twisted and fragmented mountain chain in Europe. Their total surface area is 161,805 sq km¹, far greater than that of the Alps at 140,000 sq km. Stretching between 49°47’14” and 43°28’25” latitude North and 16°58’37” and 26°38’46” longitude East, their extension over 6° of latitude and 10° longitude has led to their exhibiting a great diversity of natural conditions.

Their total length of 1,500 km is greater than that of the Alps at 1,000 km, the Dinaric Alps at 800 km and the Pyrenees at 500 km (Dragomirescu 1987). The Carpathians’ average altitude, however, of approximately 850 m. is lower compared to 1,350 m. in the Alps. The northwestern and southern parts, with heights over 2,000 m., are the highest and most massive, reaching their greatest elevation at Slovakia’s Gerlachovsky Peak (2,655 m.).

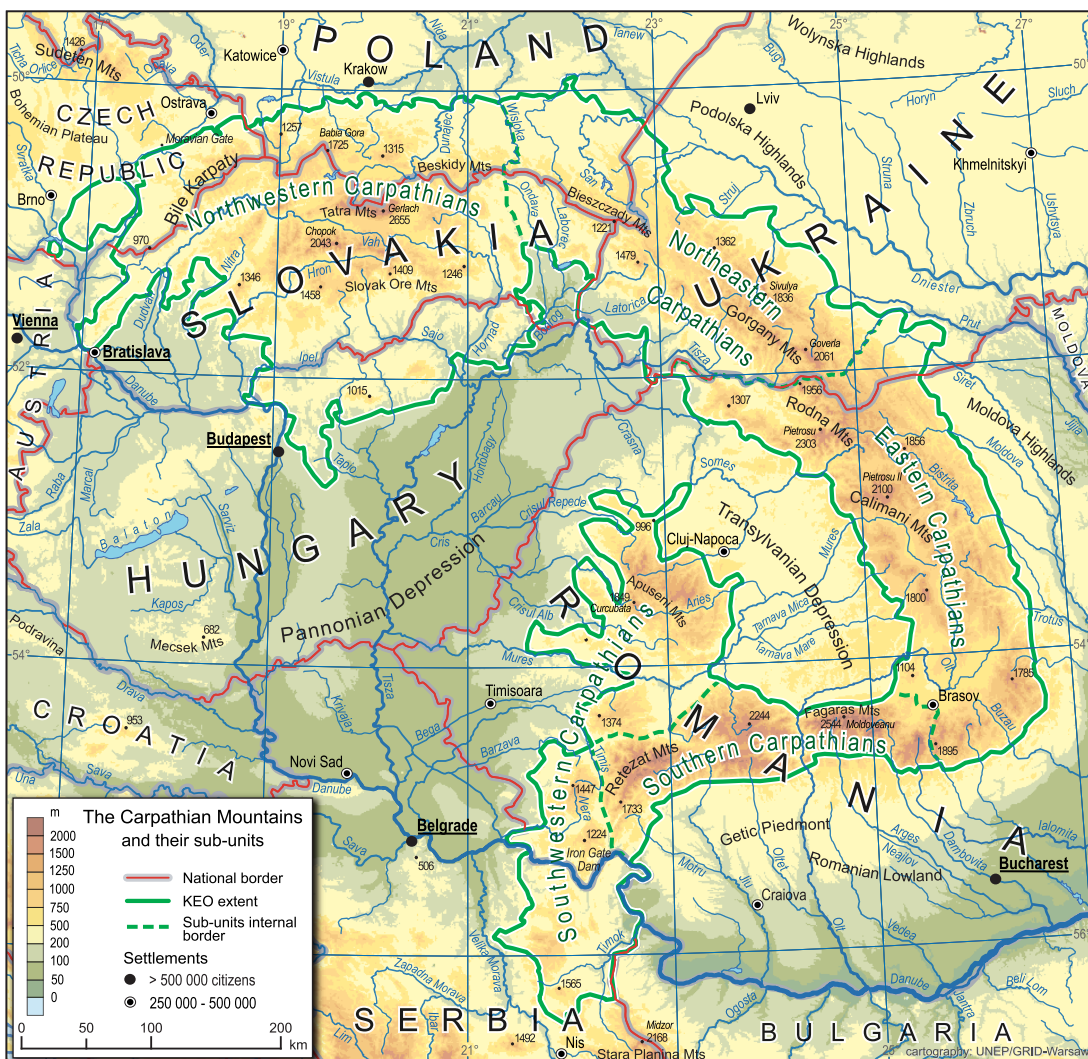
Stretching like an arc across Central Europe, they span seven countries starting from the Czech Republic in the northwest, then running east and southwards through Slovakia, Poland, Hungary, Ukraine and Romania, and finally Serbia in the Carpathians’ extreme southern reach (see Map 1.1, and Table 1.1 for country areas and populations in Carpathians). By some definitions, the westernmost tip of the Carpathians occurs in eastern Austria (“Hainburger Berge” Hill near Vienna; 480 m).

Table 1.1 Area and Population of the Carpathians by Country (EURAC 2006)

Country	National Proposals to the CFC			
	Area (sq. km.) in the Carpathians	Percentage of total Carpathians’ area	Inhabitants in millions	Percentage of Carpathians’ total population
CZ	7,124	4.4	1.46	8.4
HU	9,626	6.0	1.77	10.2
PL	17,263	10.7	3.47	19.9
RO	69,872	43.11	4.87	27.9
SK	35,050	21.66	3.80	21.8
Serbia	761	0.47	0.06	0.4
UA	22,109	13.66	1.98	11.4
Total	161,805	100	17.41	100

¹ The surface corresponds to the Carpathian countries’ National Proposals to the CFC (EURAC 2006).

Map 1.1 The Carpathian Mountains and their sub-units



The Carpathians represent the prolongation of the Alps to the east and northeast, from which they are separated by the Vienna Basin (see Map 1.2). Most of the Carpathians are located in the middle and the lower parts of the Danube River Basin, with the remainder in the Dniester, Vistula and Oder basins.

North of Vienna on Czech territory, the limit between the Carpathians and the Bohemian Plateau and Sudeten Mountains is represented by the Outer Carpathian Depressions (Dyjsko-svratecký úval, Moravian Gate Hornomoravský úval, Vyškovská brana), which are drained by the upper courses of the Morava and Odra rivers. To the south, the Carpathians extend into Serbian territo-

Map 1.2 The Carpathians in Europe



ry up to the Timok Valley, which separates them from the Stara Planina Mountains (> 2,000 m.).

The Carpathians' "outer" mountain side dominates to the east and south the East-European and Moesian platforms, which extend onto Ukrainian and Romanian territories, and which have shaped the arc-like pattern of the Carpathian Mountain chain. The Eastern and Southern Carpathians are bordered by the hilly region of the sub-Carpathians and by the large Getic

Piedmont to the south. On the "inner" mountain side, the large Pannonian Depression separates the Carpathians from the Alps and the Dinaric Mountains.

The Inner and Outer Carpathians are geological units which differ from the point of view of their geological evolution. The Inner Carpathians comprise crystalline, calcareous and conglomerate rocks, and include the Tatra Mountains, Eastern Carpathians and Southern Carpathians.

The Outer Carpathians (also called the Flysch Carpathians) are composed of sedimentary rocks (turbidite) and are located in the “external” part (northern and eastern) of the Northwestern, Northeastern and Eastern Carpathians.

In Romania, the Transylvanian Depression, although a mountain form (orogen) by geological structure, is considered to be a plateau surrounded by various Carpathian ranges with respect to altitude, make-up, landscape and density of settlement.

Different Delimitations of the Carpathian Mountains Region

For the purposes of this KEO Report and analyses contained herein, the “Carpathian Region” is defined as the Carpathian Mountain Chain and its surrounding areas. The territory surrounding the Carpathians consists mainly of sediments of Carpathian origin whose formation is connected with the evolution of the Carpathian Chain itself. Sediments are eroded from the Carpathian area and transported by rivers to the lower, surrounding territories. The area includes folded hilly regions, piedmonts and depressions, among them the Transylvanian Depression. These environs are affected by the mountainous region, and natural and anthropogenic phenomena occurring therein, and in turn exert influences on the mountain zone itself. For example, the Carpathian Mountains are a significant orographic barrier influencing the climate and precipitation of the larger region, and river outflows have a major influence on the surrounding hilly regions and plains. One counter-example of influences on the Mountains is emissions from industrial sources, transport and urbanization in commercial and population centres located in close proximity, which have impacts on the flora and fauna of the Carpathian Mountains. Economic activities practiced in the mountain region are complemented by those of the lowland and urbanized population, who exploit the Carpathians’ natural resources. Thus the mountains themselves and surrounding areas must be viewed as a complex, holistic, unique environmental system.

The different delimitations of the Carpathian Mountain chain found in the specialist literature depend on the criteria used and the purpose of research. Most authors focus essentially on geomorphological criteria along with altitude. In some delimitations, complex environmental criteria and human activities are included.

In one of the first delimitations of the Carpathian Mountains found in a French Atlas, the following sub-units are depicted: Karpates Occidentales, Karpates Orientales and Alpes de Transylvanie (Levasseur 1886). In a synthesis of the physical and human geography of Central Europe, Jean Tricart, the well-known French geographer, highlighted the discontinuous character of oro-

graphic knots with peaks of over 2,500 m. and differentiated three orographic “ensembles”: the Tatra, the Maramures and the Transylvanian Alps (George and Tricart 1954a,b).

In one of his works published in Romanian, V. Mihailescu (1963), basing his considerations on geographical criteria, geomorphological and population aspects, distinguished the following Carpathian groups: 1. North-Western Carpathians; 2. Median Carpathians; and 3. South-Eastern Carpathians (3a-Eastern Carpathians, 3b-Southern Carpathians and 3c-Western Carpathians).

One of the classifications most frequently used and based on geomorphological and geological criteria is that of the Polish geographer Kondracki (1978), who distinguishes the following main groups: the Western Carpathians (Outer and Inner); the Eastern Carpathians (Outer and Inner); the Southern Carpathians and the Western Romanian Carpathians. The Carpathian area is shown to also include the surrounding hilly regions and depressions, among them the Transylvanian Depression.

In a synthesis on European mountainous space, the Hungarian geographer Székely (1968), integrating the Carpathian Chain into the Alpine-Himalayan mountain system, distinguished the following sub-divisions: the North-Western Carpathians, the North-Eastern Carpathians, the Eastern Carpathians and the Southern Carpathians. A similar delimitation is made also in this KEO Report (see Map 1.1), although in this case the Southern Carpathians are sub-divided into two units.

In the World Wide Fund for Nature’s (WWF’s) Carpathians Ecoregion Initiative (CERI), the delimitation of the Carpathians is based on complex criteria, mainly geomorphological (elevation, slope, exposition, geology) and ecological. The Ecoregion stretches along 210,000 sq. km. between Vienna and the Danube Gorges (i.e. the Iron Gate Dam between Romania and Serbia), including the Transylvanian Depression and much of the outer hilly regions (see Chapter 3, section 3.2, Map 3.4).



1.1 Main Geographical Features

Altitudinal Zones

The very existence of the Carpathian Arc in Central Europe induces significant regional differentiations and a wide diversity of geographical conditions, due to the impacts of varying influences: oceanic in the west, Baltic in the north, continental in the east and Mediterranean in the south.

There are three major Carpathian altitudinal zones: the High Mountains (>1500 m.), Middle Mountains (600-1450 m.), and the Lower Mountains and Intra-montane Depressions (300-800 m.). Overall, the Carpathians are dominated by middle and low mountains (see Map 1.3).

High Mountains

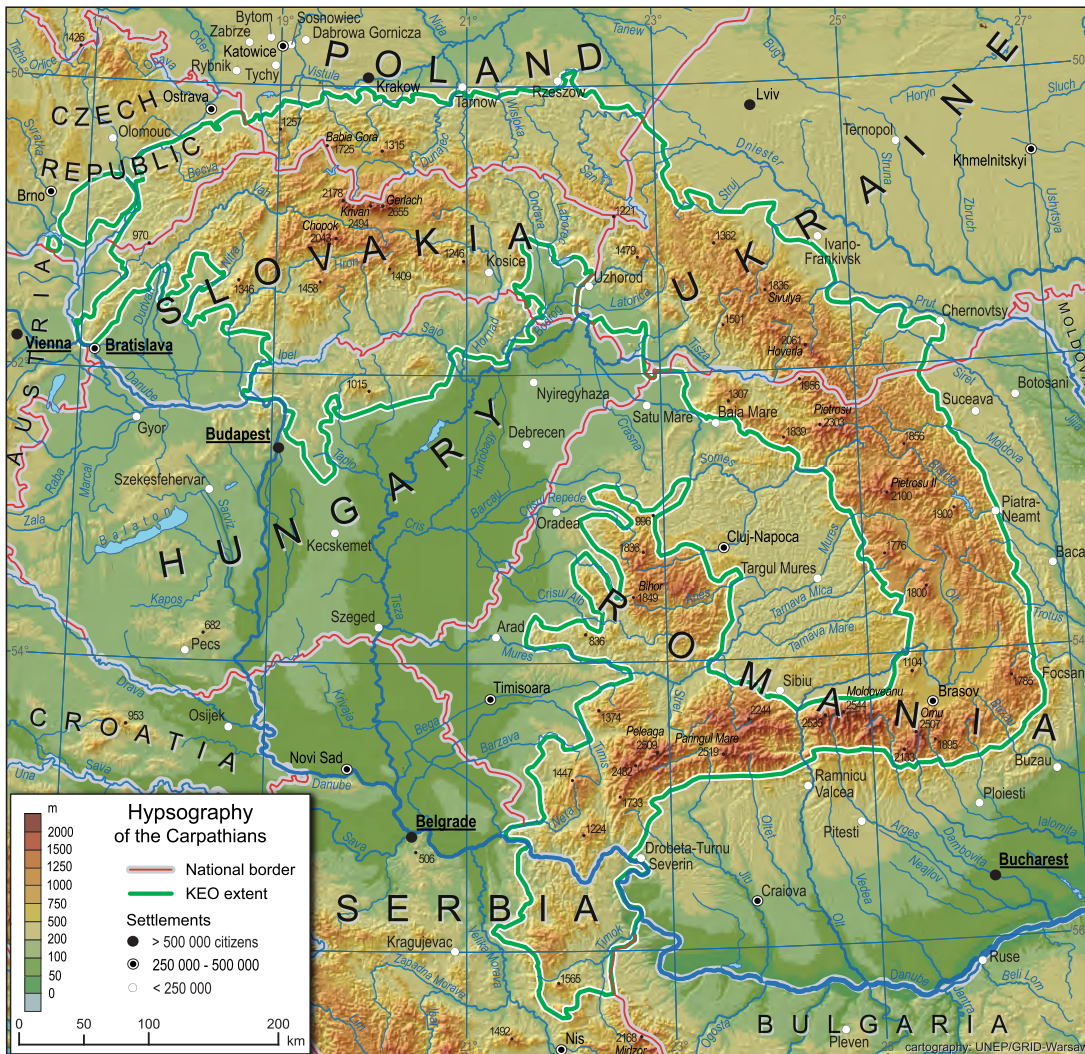
The high mountains begin above the timberline at 1,500 m in the Northwestern Carpathians, 1,600 to 1,700 m in the Eastern Carpathians and 1,800 m in the Southern Carpathians. This altitudinal zone consists of the **alpine belt** and the **sub-alpine belt**.

The **alpine belt** was molded by Pleistocene glaciation (cirques, troughs) with sharp crests and steep slopes affected by weathering, rockfall and snow avalanches. It is well-developed in the Tatra Mountains and the Southern Carpathians. The alpine belt itself is traditionally further divided into three altitudinal levels: sub-nival, with local perennial snow patches; alpine meadow; and dwarf pine. The Southern Carpathians in particular include old denuded surfaces with moderate slopes.

Alpine belt soils are dominated by inceptisols, entisols and cryogenic soils. The alpine pastures consist of plant communities with grasses and sedges, including many grass species (see Chapter 3, sections 3.1-3.3 for more details).

The **sub-alpine belt** (1100-1400 m in the north, 1400-1900 m in the south) consists almost exclusively of Norway spruce forests and dwarf pines underlain by podzols and brown acid soils. In the Bieszczady Mountains, Bukovské Vrchy,

Map 1.3 Hypsography of the Carpathians



Polonina Rowna, Polonina Krasna and Swidowiec in the Eastern Carpathians, there is no sub-alpine zone, and the timberline of dwarf beech, at a height of approximately 1,200 m, directly borders the alpine meadows and thickets of green alder.

Middle Mountains

The middle mountains zone lies between 600 and 1100 m in the north, and 650 and 1450 m in the south, also corresponding with the forest belt. The great diversity of relief is related to the underlying geological structure, while the main process on the forested slopes is the formation of soils on debris-covered terrain.

There are large climatic variations between the upper and lower parts of the middle mountains. On average, annual temperatures range between 1.5^o and 2^o C in the upper parts and between 4^oC to 6^oC in the lower parts. Precipitation ranges from 1,000 to 1,400 mm in the upper and 600 to 800 mm in the lower parts.

The Central European and Boreal forest ecosystems found there comprise the greatest area of the Carpathians. The three vegetation belts within the middle mountains are spruce, deciduous mixed with conifers, and beech (Pădurile României 1981).

Low Mountains and Intra-Montane Depressions

The altitudinal zone with low mountains and intra-montane depressions (from 300 to 800 m) have a landscape severely affected by human activities. Large slope areas exhibit sheet and gully erosion and mass movements. Annual average temperatures vary between 6°C and 9°C,

with temperatures from May to August between 16°C and 18°C and the growing period lasting 180 to 190 days. Average annual precipitation is from 600 to 800 mm., and the main soil types are brown podzolised soils and podzol soils.

Forests of the foothill zone were to a large extent replaced by arable fields and meadows, so that only small forest islands have remained among farmlands.

Rivers and Lakes

About 90% of the rivers which drain from the Carpathians flow into the Black Sea. Many, such as the Vah, Tisza (with its tributaries the Mureş, Someş and Criş), Olt, Siret and Prut lie within the Danube River Basin. In the east, the main river running into the Black Sea is the Dniester. To the north, the Vistula and the Oder flow into the Baltic Sea.

The high mountain zone includes numerous lakes situated in cirques and glacial valleys. The largest glacial lakes, such as Morskie Oko (35 hectares), are located in the Northwestern Carpathians, an area where Quaternary glaciers have their broadest extent. The Eastern and Southern Carpathians host over 200 glacial lakes, mostly in the Retezat (Bucura, Zănoaga) and Făgăraş Mountains. The Sfânta Ana lake is situated in a volcanic crater. Some small lakes are formed in karst depressions (Ighiu lake in the Apuseni Mountains) or in landslide-dammed locations (Lacul Roşu in the Apuseni Mountains).

Many water storage reservoirs are found on rivers, the largest occurring on the Danube at the

Iron Gate Dam between Romania and Serbia. Others include the Bistriţa, Argeş and Olt in Romania, the San in Poland and the Osana in Slovakia (as an example, see Figure 1.1).

Figure 1.1 The Eastern Carpathians, Izvorul Muntelui storage-lake



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Table 1.2 Carpathian River Basins and their characteristics (EURAC 2006)

River	Total drainage area (km ²)	Drainage area within the Carpathian Ecoregion (km ²)	Proportion of the total Ecoregion (%)	Affected Carpathian countries	Estuary
Danube	817,000	180,095	85.7	All Carpathian Countries	Black Sea
Vistula	194,000	21,054	10.0	Poland, Slovak Republic, Ukraine	Baltic Sea
Oder	125,000	1,772	0.8	Czech Republic, Poland	Baltic Sea
Dniester	76,860	7,336	3.5	Ukraine	Black Sea

Climate

Overview

The climate of the entire Carpathian Mountains arc is temperate-continental, with more extreme conditions (continental climate) increasing as one moves from west to east.

Temperature, precipitation and wind (major climatic indicators) change with altitude. The high mountain zone has a cold and moist climate with temperatures of +2°C to -2°C and precipitation of 1,800 to 2,000 mm/year in the Northwestern Carpathians. In the Eastern, Southern and South-eastern Carpathians, precipitation ranges from 1,400 to 1,600 mm/year. The highest quantities of precipitation in the Carpathians are recorded in the High Tatra Mountains at 2,000 to 2,400 mm/year.

Snow cover is present 150 to 220 days of the year in the high mountains. The present Carpathian climate no longer favours the presence of mountain glaciers which were active during the Pleistocene. Currently, some small perennial patches of snow do occur in the Tatras, as well as in the Rodna Mountains. The area of perennial snow is currently shrinking due to rising average annual temperatures in the Carpathians, an apparent sign of climate change in the region (see Chapter 3, section 3.6).

The Carpathian Mountain chain also functions as an important obstacle to the circulation of air masses over Europe. By their position, the Carpathians act as a barrier between the harsher continental climates of the east and the milder, oceanic ones in the west, boreal in the north and Mediterranean in the south. These general characteristics vary in terms of radiation and the circulation of air masses, directly reflected in plant associations and in soils, and indirectly in all the natural components of the mountainous environment.

Climate change

The Third Report of the Intergovernmental Panel on Climate Change (IPCC) revealed that 20th century global warming registered a rise of temperature of $0.6 \pm 0.2^\circ\text{C}$. The last decade of the 20th century is considered to be the warmest since instrumental observations began (1861). There is strong evidence that global temperature increase in the 20th century surpassed natural climate variability over the last thousand years. Natural changes featured a warm period (11th-14th centuries) and a cooling interval known as the Little Ice Age (15th-19th centuries). According to the most recent projections of the IPCC, the average temperature on Earth could rise from 1.4 to 5.8°C above the 1990 level by 2100, with higher values expected in the Northern Hemisphere (IPCC 2001).

In the Alps, the timberline may advance by up to 500 to 600m (100 m with every 0.6°C temperature rise). Extrapolating these data to the Carpathians may be instructive. In 20th century Romania, the annual average temperature rose by 0.2°C , at a much faster pace after 1960 (Busuioc 2003). A temperature increase might result in the modification of altitudinal belts, mainly in the possible extension of the temperate forest realm.

Global warming has intensified extreme phenomena such as torrential rainfalls, lengthy droughts and sudden snowmelt. Such extreme phenomena, along with enhanced erosional processes, landslides and floods are often further augmented by deforestation in various Carpathian areas. Flooding as a hazard has some of its most serious impacts on settlements, transportation and agriculture. Floods are generated by prolonged heavy rainfall, snowmelt or both. Local flash floods resulting from heavy convective rains are frequent in summer but are restricted to small catchments, particularly in the Eastern Carpathians.

Geological History and Geomorphological Units

Overall Geology

The Carpathian Mountains, the eastern continuation of the Alps, are a young mountain chain (Demek 1983). The present-day relief is the outcome of the alpine orogenesis, although Palaeozoic and Mesozoic landforms exist as well. Compared with the Alps, the Carpathians have lower altitudes and are more fragmented by tectonic depressions and transversal valleys.

The major factors which have contributed to the formation of the Carpathian-Pannonian system are the convergence of the Adriatic and Eurasian plates, collision with the Alps and lateral escape of crustal wedges towards the east and north, subduction and rollback of the Eurasian plate and the shape and structures of the Eurasian margin with its northwest trending faults (Visarion and Sandulescu 1988).

The Carpathian Folded Belt consists of a complex Alpine nappe pile of crystalline units and Upper Palaeozoic-Mesozoic sediments, with a Lower Cretaceous-to-Tertiary sedimentary cover. The structure itself includes the domain of the regions active during the Mesozoic and Cenozoic, regions folded in the Alpine Orogenesis (Sandulescu 1984).

Five Mountain Groups

Transversal valleys and low mountain areas and depressions divide the Carpathians into the following mountain groups: (1) Northwestern Carpathians in the Czech Republic, Slovak Republic, Hungary and Poland; (2) Northeastern Carpathians in Poland and Ukraine; (3) Eastern Carpathians in Romania and Ukraine; (4) Southern Carpathians in Romania; and (5) Southwestern Carpathians in Romania and Serbia.

(1) The Northwestern Carpathians represent the highest part of the Carpathian Arc and consist of mountain ranges and massifs separated by intra-montane basins. Their central part is formed by the Tatra Mountains with altitudes

over 2,000 m built of crystalline and Mesozoic sedimentary rocks. Slovakia's Mount Gerlachovský is the highest at 2,655 m. The High Tatra Mountains show a typical alpine relief with extensive glacial landforms. The outer part is shaped by flysch mountains with altitudes of 1,000 to 1,700 m and characterised by a folded nappe structure, while the inner part is represented by the volcanic massif of the Central Slovakian Mountains. In the south, one finds the Mátra and Bükk mountains surrounded by low piedmont areas alongside the contact line with the Great Hungarian Plain.

(2) The Northeastern Carpathians unfold between the Dukielska Passage (Poland) and the upper sectors of the rivers Tisza and Ceremusch (a tributary of the Prut River in Ukraine). The maximum altitude is found at Goverla Peak at 2,061 m. These are middle and low mountains, fragmented by numerous valleys and depressions and home to many human settlements. Their eastern part, the most extended, consists of Cretaceous flysch and Palaeocene deposits corresponding to the east of the Beskidy Mountains and the 'Forested Carpathians' (Lisyti Karpaty). In the west, the Vihorlat Mountains display several isolated summits with Neocene volcanic features.

(3) The Eastern Carpathians, which extend between the upper Tisza River in Ukraine and the Prahova River in Romania, present three longitudinal morphostructural sectors. The eastern outer side, with altitudes of 1,000 to 1,800 m, is built of Palaeocene and Cretaceous flysch deposits with a complicated folded and nappe structure. In their southeastern part lies the Vrancea seismogenic area. The central part displays discontinuous crystalline massifs partly covered with sedimentary Mesozoic rocks, reaching its highest altitudes in the Rodna Mountains (2,303 m). The western part, with its highest altitude in the Călimani Mountains (2,100 m), corresponds to the longest Neocene volcanic chain in Europe, with well-preserved extinct volcanoes.

(4) **The Southern Carpathians**, or so-called ‘Transylvanian Alps’, rise from 1,800 to 2,500 m to the 2,543 m Moldoveanu Peak in the Făgăraş Mountains. They extend from east to west between the Prahova and the Timiș-Cerna valleys and are formed predominantly from crystalline rocks with secondary Mesozoic sedimentary rocks. The upper part of the massifs, the Bucegi, Făgăraş, Parâng and Retezat, feature Alpine-type glacial landforms and vast denudation surfaces.

(5) **The Southwestern Carpathians** extend into Romania and Serbia and show a very complex block and fold-faulted structure. They are very fragmented by numerous tectonic depressions and reach altitudes of 700 to 1,500 m. The highest point is Curcubăta (1,847 m) in the northern part (Apuseni Mountains) built of a mosaic of crystalline, flysch and Neocene eruptive rocks. The central and southern parts (the Banat and Serbian mountains) consist predominantly of crystalline rocks with a large karstified limestone syncline.

Landforms and Geological Monuments of Note

The Carpathians are home to many interesting landforms and geological monuments such as the Iron Gate (see Figure 1.2), one of the largest gorges in Europe, caverns and landforms shaped by erosion on volcanic rocks, and massive orographic knots (over 2,000 m) which alternate with middle and low mountains. Certain fossil-rich sites of international importance represent standardised stratigraphic reference points for various geological periods, while a number of other sites are considered natural monuments.

Significant national parks and biosphere reserves include: Duna Ipoly and Bükk and Aggtelek (Hungary); Djerdap (Serbia); Tatra, Pieniny, Babia Gora and Bieszczady (Poland); Retezat, Rodna, Piatra Craiului and Ceahlău (Romania); Tatras, Poloniny and Polana biosphere reserves, Low Tatras, Malá Fatra, Slovensky raj and Pieninský (Slovakia); and Uzhansky National Park, part of the ‘Eastern Carpathians Biosphere Reserve’ which is shared by Poland, Slovakia and Ukraine.

Limestone areas hold many caves, including Dómica and Dobšinská ľadová in Slovakia; Aggtelek in Hungary; and Cloșani, Cioclovina and Scărișoara in Romania. There are also cave glaciers such as the Scărișoara Cave Glacier in Romania’s Apuseni Mountains and the Dobinska Cave in Slovakia, important for reconstructing Quaternary climates. The karst plateau Padiș in the Apuseni Mountains is one of the most complex in Europe.

Figure 1.2 The Danube Gorge in the Iron Gate Natural Park



The Northwestern Carpathians exhibit impressive alpine relief with large glacial cirques and valleys carved by glaciers from the Quaternary Period, some of them on the northern side coalescing with the continental ice sheet. The western side of the Eastern Carpathians presents the longest volcanic chain in Europe, no longer active today, featuring a multitude of fumaroles², mofettes³ and over 2,000 mineral springs used in well-known

² A fumarole is a hole or vent in the ground near a volcano that emits steam and gases such as carbon dioxide, sulphur dioxide, hydrochloric acid and hydrogen sulphide.

³ Volcanic discharges consisting primarily of carbon dioxide, often associated with other vapours, representing the final phase of volcanic activity.

spas. On the eastern and southern side, adjacent to the Carpathians over a distance of 550 km., is a hilly region with altitudes of 300-800 m, consisting mostly of folded and faulted Neocene molasse⁴ deposits with densely populated depressions. On salt deposits there are plateaus dotted with sinkholes, lakes and caves.

⁴ Terrestrial deposits (i.e. non-marine alluvial and fluvial sediments) eroded from a nascent mountain chain and deposited in a foreland basin, especially on top of flysch.

The Southern Carpathians, also known as the Transylvanian Alps, boast the largest alpine and sub-alpine pastures in Europe and environment for intense transhumant sheep herding. The pasture lands, which cover extended hanging plateaus, were studied in the early 20th century by the French geographer Emmanuel de Martonne, who introduced for the first time in Europe the landscape evolution approach of the American geographer William M. Davis.

Biodiversity

From a bio-geographical point of view, the Carpathian Mountains represent a link between the taiga of Northern Europe and the Mediterranean ecosystems of the south. They include the largest pristine forests in Central and Western Europe, with the greatest original European forests located in the Southern and Eastern Carpathians (Romania) and in the Tatra Mountains (Slovakia).

The rich variety of endemic plants and animals, characteristic of Carpathian ecosystems is an essential biodiversity component in Europe. The area has many large carnivores (e.g. the brown

bear, lynx and wolf) facing extinction in other mountain chains in Europe. Many bird species, such as the imperial eagle, Ural owl and black grouse are protected.

The Carpathians were put on the WWF “Global 2000” list of major ecoregions in need of biodiversity and habitat conservation. Since 1999, the Carpathians were also included in the “Carpathian Ecoregion Initiative (CERI)” geared to the integrated conservation of their natural and cultural heritage and sustainable, cross-border development.



1.2 Human Influences in the Carpathians

Historical-Political Background

Early times up to 20th century

Located in the heart of Europe, the Carpathians have since centuries ago been at the contact point of empires, ethnic groups and cultures. The Carpathian area has been part of several states and empires. The current ethnic mix (Czechs, Germans, Hungarians, Poles, Romanians, Serbs, Slovaks and Ukrainians, and minority groups such as the Roma) is the reflection of a turbulent history.

In ancient times, the conquest of Dacia by the Roman Empire in AD 105 was marked by the construction of fortified cities (*davae*), spas and health resorts (e.g. Herculaneum). Even after the Romans' withdrawal south of the Danube from 270-275, their language of Latin-Romanian was to be preserved in the Southern, Southwestern and Eastern Carpathians. The inhabitants of Dacia were known as *Getae* in Greek writings, and *Dacians* in Roman documents.

Beginning in the 4th century, the process of migration of peoples gained momentum. The Huns crossed the Carpathians and settled in the Pannonian Plain. As the Visigoths withdrew from the southern part of the Eastern Carpathians, they left a treasure hoard (the so-called "Hen with the Golden Chickens") containing 22 pieces of gold, found at Pietroasele (in Buzău County, Romania) (Constantiniu 2002). The 6th and 7th centuries marked the massive migration of Slav populations (the Eastern Slavs i.e. Ukrainians; and the Western Slavs i.e. Poles, Slovaks and Czechs) and their gradual settlement across the Carpathians.

During the 8th and 9th centuries, the Carpathian territory with its surrounding plains and tablelands, experienced the passage of other migratory populations including Petchenegs, Cumans and Tartars. Many of these were assimilated with other cultures in the region.

From the 11th to 13th centuries, in order to secure the borders of the Hungarian Kingdom against the inroads of migratory populations, the western side of the Eastern Carpathians was colonized with Szecklers (a population mix of steppe migrants, who had followed the Hungarians on their way to Europe) and Saxons (from Flanders, Luxembourg, the Mosel and Rhine regions, and from Saxony, as brought in by the Hungarian kings) (Atlas Istorico-geografic 1996). From the 16th to 19th centuries, the Kingdom of Hungary fell under Habsburg domination, subsequently forming the dual Austro-Hungarian monarchy which lasted from 1867 to 1918.

The 20th century until present

The First World War mirrored the conflicts smouldering within the multi-national Austro-Hungarian Empire. Czechs and Romanians sought autonomy, the various southern Slavic territories aimed at the unification of their Habsburg-dominated lands with the Kingdom of Serbia (independent, although occupied at the time), and Russia pursued its own political goals in the Balkans (Kinder and Hilgemann 2002a,b). The proclamation in 1916 of the Autonomous Polish Kingdom, which led to its breaking away from the Austro-Hungarian empire without Galicia, and its later evolution illustrate the national aspirations of peoples in the Carpathians.

The treaties concluded at the end of the First World War sanctioned, among other territorial changes, the foundation of Yugoslavia and Czechoslovakia. During the interwar period, some border changes took place in the Carpathian area between Hungary and Czechoslovakia (Linchutz 2000, cited by Jansky et al. 2004).

For a short period of time (1940-1946), Northern Transylvania was annexed by Hungary under the 1940 Vienna Diktat. Bessarabia and Bucovina were occupied by the Soviet Union and integrated into its territory. After the Second World War, the redrawing of borders left most of the Northeastern Carpathians under Soviet rule.

Major historical and political changes took place during the last three decades. The Carpathian countries were members of the Council for

Mutual Economic Assistance (COMECON) and the Warsaw Military Pact (except for Yugoslavia), and Ukraine was part of the Soviet Union until breaking away in 1991.

With the rise to power of the communist regimes, the natural resources of the Carpathian countries such as wood and ores began to be forcibly exploited by Soviet-dominated enterprises. The collectivisation of agriculture, intense deforestation and implementation of centrally-based joint plans within the COMECON framework had profound negative effects on the Carpathian environment.

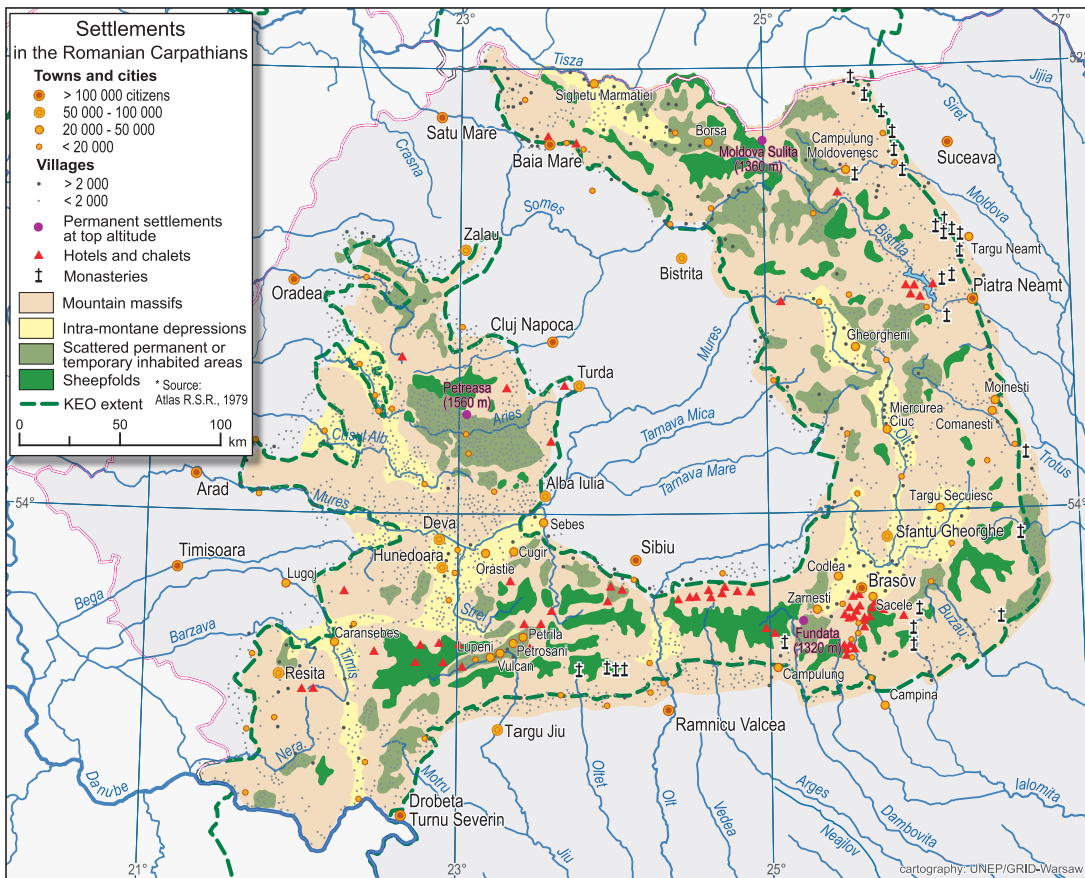
All the Carpathian countries, albeit at a different pace, have undergone a significant political, economic, social and environmental transformation in the past 15 years. In most countries, radical political changes occurred in 1989 to 1991 that resulted in free elections in various forms and the establishment of pluralistic democracies and separated branches of power.

In 1993, following a political decision, Czechoslovakia was split into two independent countries, the Czech Republic and Slovak Republic. In 1991, Ukraine broke away from the Soviet Union. During the 1990s, the former Yugoslavia gradually lost its territorial integrity, and a series of Balkan wars took place.

Since the early 1990s four countries (the Czech Republic, Hungary, Poland and Slovakia) began their integration process with the European Union that culminated in membership on 1 May 2004; Romania joined the EU on 1 January 2007. Serbia is participating in the stabilisation and association process, while Ukraine is a part of the EU's recently developed "Neighbourhood Policy".

Today, the seven Carpathian states continue to experience various forms of transition from centralised communist to free market economies. They shelter 16 to 18 million people, where lowlands and valley corridors have high population densities and intensely utilized trans-Carpathian traffic routes. Numerous settlements are located on summits and plateaus up to 1,600 m, but densities are significantly greater at 500-1,100 m altitude (see Map 1.4).

Map 1.4 Settlements in the Romanian Carpathians



Cultural Heritage

Overview

Many traditions, artefacts, ruins, archaeological sites and monuments have been preserved from the many peoples, cultures and empires that have come and gone in the Carpathians since prehistoric times. Interestingly, the multitude of passes, depressions and valley corridors facilitated inter-ethnic contacts and helped to develop and reinforce common ethnographic elements. Many sites are used for touristic purposes (see Map 1.5).

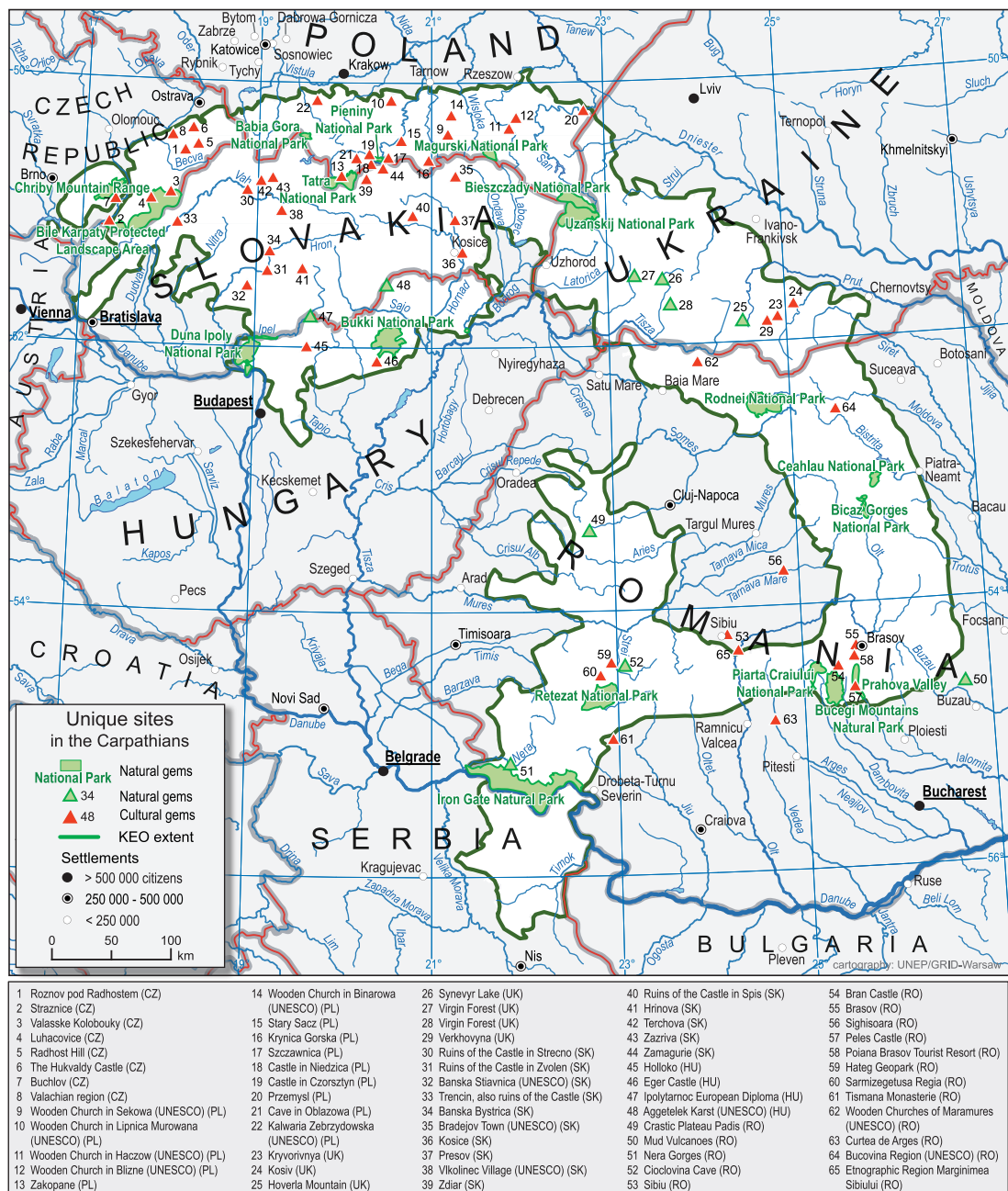
A complete human mandible, dated over 35,200 years ago, was discovered in Peştera cu Oase (Cave with Bones) in the Banat Mountains. This is the oldest fossil remnant of a modern human

in Europe (Quiles et al. 2006). Many bear (*Ursus Spelaeus*) skeletons can be seen in Peştera Urşilor (Bears' Cave) in the Apuseni Mountains, while the Haţeg Geopark in the Southern Carpathians shelters dinosaur fossils.

The Carpathians and their surroundings have proved to be an attractive environment for settlement and human economic activities for ages. Major economic activities have been wood processing, mining, animal husbandry and agriculture, the latter mostly practiced in lowlands and mountain depressions (see Figure 1.3).

The first elements of a Carpathian culture date back to the Palaeolithic and Neolithic Ages.

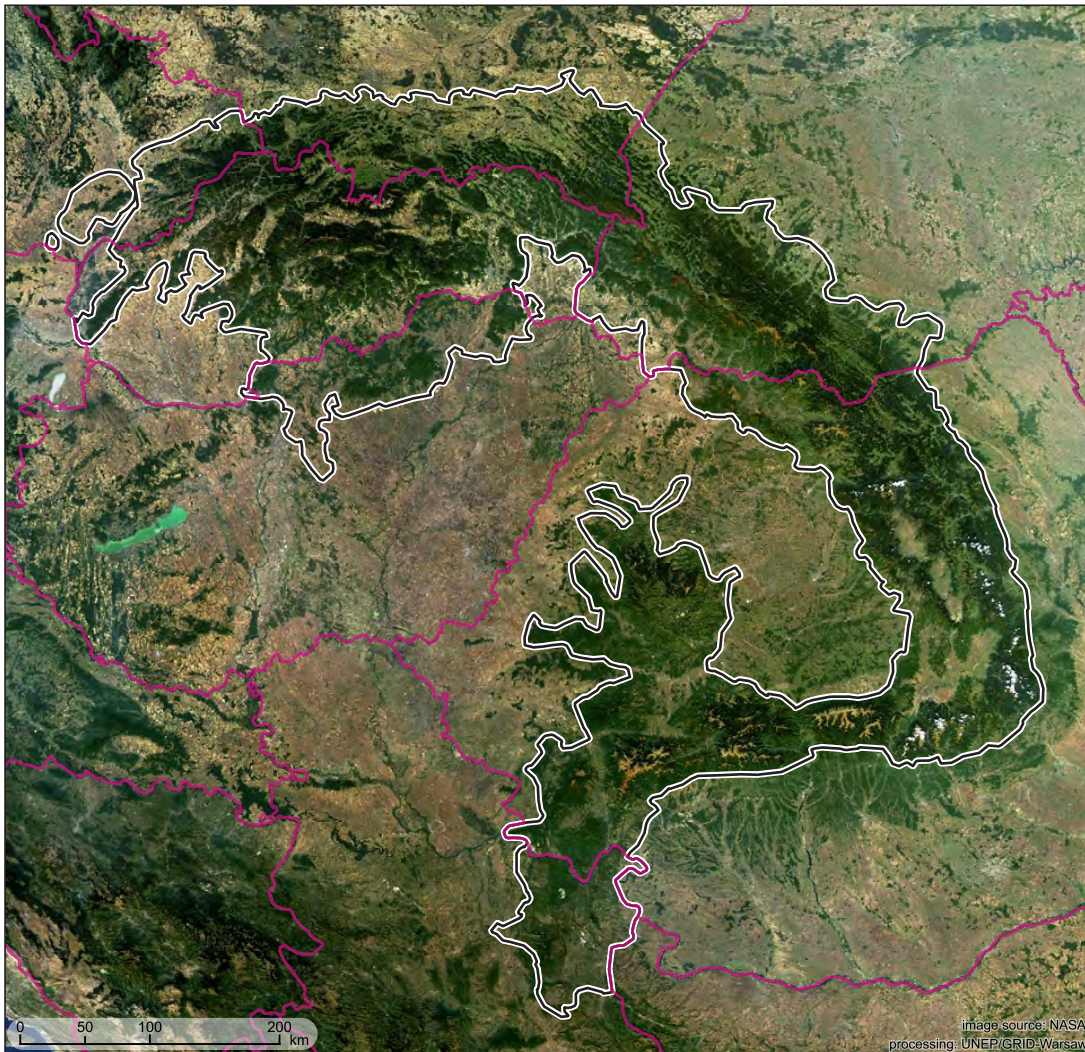
Map 1.5 Unique sites in the Carpathians



Lower Palaeolithic stone items such as chopping tools, as well as pottery, bronze and iron objects have been discovered in various mountainous and depression sites in the Carpathians. Highlights include the 22,000 year-old *Venus of Mosavany* statuette found carved into a mammoth tusk in Slovakia (Lacica 2002). Another is *Sarmizegetusa*, in the former Geto-Dacian capital located in the Southern Carpathians, home to a solar monument similar to the one found at Stonehenge.

Many remnants from Roman times have been preserved including the ruins of Roman settlements and roads. In the Northwestern, Southern and Southwestern Carpathians, Roman fortified cities (*davae*), mines and spas (e.g. Herculanium) can be found. At Drobeta Turnu Severin are the ruins of the bridge built in 103-105 by Apollodorus of Damascus at the point where the Romans crossed the Danube downstream of the Iron Gate (see Figure 1.4).

Figure 1.3 The Carpathians seen from space



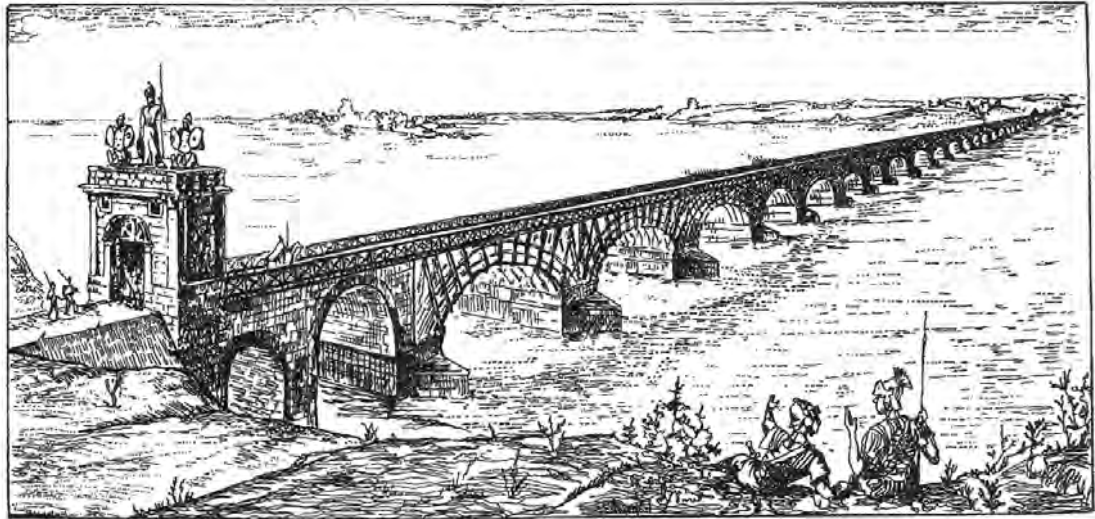
In medieval times, traditional occupations included raising livestock, coal mining and agriculture, one result of which was forest area reduction. From the 12th to the 15th centuries, population density was about nine to ten inhabitants per sq km, concentrated mostly on the hill-sides. Beginning in the 14th and 15th centuries, Wallachian shepherds inhabited the northern Carpathians, in the territories of what are today Poland and Slovakia. This was also the time of the Carpathian civilization of woodworking and the related development of handicrafts.

The first paper mills appeared in the Carpathian lowlands in the 16th century. In the 17th and 18th centuries, when wood increasingly became an export commodity, extensive tree-cutting

became a common practice. This intensified after the Adrianople Peace Treaty of 1829, which concluded the war between Russia and the Ottoman Empire, when wood and wooden products were in great demand abroad. Another period of severe deforestation was connected with post-1920 land reforms that led to the expansion of pastures and arable land.

The villages in the Bile Karpaty, a Protected Landscape Area and Man and Biosphere Reserve situated in the east of the Czech Republic along the border with Slovakia, preserve many old Wallachian traditions such as folk dancing and music, and musical instruments such as the *cymbalo* (dulcimer).

Figure 1.4 The bridge built by the Romans downstream of the Iron Gate (Southwestern Carpathians), A.D. 103-105 (Istoria Românilor 2001)



Traditional settlements

In many existing Carpathian settlements, the ethnographic traditions of the Hungarians, Poles, Romanians, Ruthenians, Slovaks, Szecklers, Transylvanian Saxons and Ukrainians can still be observed. Traditional village architecture is

features, as well as original ethnographic and folklore elements.

In Roznov pod Radhostem, Straznice and Valasske Klobouky in the Czech Republic, there are open air museums of folk architecture. In Hungary, the Old Village of Hollókő and its surroundings and Tokaj Wine Region Historical Cultural Landscape are important tourist destinations. In Poland, old wooden churches, including the Orthodox churches in Bieszczady and Beskid Niski and traditional wooden architecture in Zakopane, exemplify Polish wood culture.

Figure 1.5 Traditional handicrafts, potters from Horezu town



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fitted to local landforms. Rural settlements in the Carpathian Mountains contain numerous elements of traditional architecture such as old houses and wooden churches with specific local

In the Slovak Carpathians there are many villages such as Liptovská, Teplička, Detva, Hriňové, Terchová, Zamagurie with a traditional agriculture and attractive cultural landscapes. Eastern Slovakia is home to Vikolinec village, a UNESCO cultural heritage site, and wooden churches from Osturná, Ždiar and Podbiel with open air museums.

In the Ukrainian Carpathians, the Hutsul culture is well preserved in Kryvorivnya, a village in the Kosiv centre of folk handicrafts and in Verkhovyna town (former Zhab'ya – the capital of Hutsulshchyna). Some villages in Romania's Apuseni, and the Vrancea and Maramureş mountains, are famous for their artistic and artisanal products (see Figure 1.5).

Sibiu through the ages

The present town of Sibiu, Romania, sits atop the former site of the Roman settlement known as Cedonia. In 1191, Saxon colonists founded a new town there and named it Cibinium, after the name used by the Roman population who inhabited these places in earlier centuries. In 1223, the town was baptised Villa Hermanni and in 1366 it became known as Hermanstadt. In the 15th century, it became the capital of the Transylvanian Saxons and was known as a major handicraft and trading centre surrounded by fortified walls and bastions. In 1599, the Romanian Prince Michael the Brave defeated the Hungarian army near this place and for a short time united Transylvania with Wallachia and Moldavia. In the 18th century, the town had four printing-houses, and the renowned Brukenthal Museum was founded in 1817.

Sibiu, the Cultural Capital of Europe in 2007, today has many Renaissance and Gothic style buildings, some of them with important cultural functions such as the History Museum, Old Town Hall and Franciscan Church with Gothic architecture. It is home to the largest German community in Romania, and has a highly multi-ethnic character with Magyars, Slovaks, Ukrainians and Roma living side by side with Romanians and Germans. South of the town in the Southern Carpathians, people from numerous settlements (Răşinari, Sălişte, Jina, etc.) are engaged in shepherding, a very old tradition there.

Castles and monuments

Mountain depressions and valley corridors shelter medieval castles and ruins. In the Southern Carpathians, castles are seen at Sinaia and Bran (Figure 1.6), built in a variety of styles (Gothic, Baroque, Renaissance, Neo-Classical). Many other monuments dating to the Middle Ages can be found in the medieval cities of Braşov and Sibiu.

Figure 1.6 The Bran Castle in the Rucar-Bran Corridor



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In Poland, medieval monuments in the cities of Stary Sacz and Przemysl, the traditional spas in Krynica Gorska and Szczawnica and the castles in Niedzica and Czorsztyn (from the Pieniny area) are important cultural heritage sites.

In the historical centers of some of the mountain towns in Slovakia such as Banská Štiavnica, Bardejov, Banská Bistrica, Prešov, Bratislava and Levoča, there are attractive medieval monuments such as the Church of Our Lady, Barbican, Bratislava Castle and the Old Town Hall. Some of the most important medieval castles and ruins are located in Devin Spiš, Zvolen and Krásna Hôrka.

The Hukvaldy castle, the second largest in the Czech Republic, was destroyed by fire in 1762, but the gothic castle of Buchlov is well-preserved. Cultural heritage sites, such as Lednice-Valtice Cultural Landscape and Castle and Gardens of Kromeriz (Czech Republic) are particularly valuable due to their architecture and setting.

In Hungary, the Eger castle is well-known as the site of one of the largest battles against the Ottomans. The Castle of Diósgyőr (near Miskolc) belonged to the then-queens of medieval Hungary. Sárospatak (at southern foothill of Zemplén Mountains) is known by its famous Rákóczi castle and fortification built in the early 13th century by King Endre I.

Religious traditions

In many places, religious festivals contain elements of pre-Christian traditions. In the Czech Republic on Radhost Hill is the statue of Rade-gast, the pagan god of crop abundance and harvest.

In the Southern and Eastern Carpathians people preserve numerous pre-Christian beliefs, praying to the Geto-Dacian gods to bring or stop the rain, chase away disease and evil and secure abundant crops. Many cultural-religious traditions connected with transhumant shepherding are practiced by local peoples mainly during two seasons: in winter, when the Wolf (the embodiment of darkness and cold) reigns supreme, and in summer, when the Horse (the personification of light and warmth) is master of the realm (Ghinoiu 2005).

The presence of the primeval forest has engendered many traditions and legends which Mircea Eliade, a famous Romanian historian of religion, fiction writer and philosopher, named “Cosmic Christianity”. Cosmic Christianity is a peasant-centred religion and popular theology built on the significance of religious folklore and reflecting the life of common people. Cosmic symbols and folkloric themes such as Water, Tree and Vine were passed on to the Church, giving them sacramental meaning. Illustrative, too, is a Christian-linked liturgical service held in the open and not in a church, invoking one’s living in harmony with nature.

The Monasteries of Bucovina

In Romania, the original painted churches of Bucovina, as well as Tismana and Horezu monasteries, and the peasant strongholds and fortified churches found at the contact line with the Transylvanian Depression, are sites of great cultural value.

Many monasteries and churches from Bucovina, a province in the north of the Eastern Carpathians, such as Voroneţ, Moldoviţa, Suceviţa, Humor and Arbore, are listed as UNESCO Mankind Heritage protected sites. Frescoes, representing biblical scenes, saints, apostles and martyrs cover the inner and outer walls of these monuments. The churches were built using a triconch plan with a combination of Byzantine and Gothic vaults (the ‘Moldavian vaults’) (Vătăşianu 1974). The painted frescoes used tempera to preserve their 15th-century brightness, thereby making an original contribution to world art.

The best-known monastery is Voroneţ built by Ruling Prince Stephen the Great in 1488, known for the exquisite beauty of its blue paint (the ‘Voroneţ blue’) which won it the name of “Sistine Chapel of the east”.

The Humor Monastery depicts the Devil in the guise of a woman, the painter having drawn his inspiration from a local legend, while the Putna Monastery (1466-1470) boasts an impressive 17th-18th century decoration, the hall-mark of Moldavian Baroque. The Monastery houses a museum displaying important exhibits of Eastern Christianity.

The fortified Moldoviţa Monastery (1532) has a famous painting on its northern wall that is “The Siege of Constantinople”. Numerous rural settlements, known for their outstanding ethnographic and handicraft traditions, are found in the neighbourhood of the Monastery. One of them, Marginea Village, is famous for its black pottery.



1.3 Modern-day Impacts on Environment and Current Responses

Impacts from the Communist Period

Carpathian countries inherited severe environmental problems from more than 40 years of communist rule, as their economies were heedless of environmental impacts and thus far more polluting than in the rest of Central and Western Europe. Many environmental “hot spot” zones were created having extreme pollution loads, environmental degradation and related human health risks. The Stalinist period which lasted until 1956 was especially harmful, encouraging Central European countries to choose their “own road to socialism” with an overriding slogan of “man is master of nature”.

The industrial structure of these countries was dominated by over-sized and heavy industry. Steel, chemicals, mining, heavy machinery and energy were dominant economic sectors in this region, while the military-industrial complex enjoyed special priority. Some of the chemical works and metallurgy plants were located in narrow, poorly ventilated Carpathian mountain

valleys or basins. Nearly every town had at least one environmentally-harmful factory. Another typical result of the ill-planned industrial structure was a high, inefficient consumption of energy, mainly generated by low-quality and highly-polluting fuels. In addition, there were no incentives to introduce efficient or environmentally-friendly technologies. Degraded areas around mining sites and heavy pollution produced by the chemical and steel industries were also common.

“Industrial(-scale) agriculture” also degraded the environment. Hygienic problems stemmed from large-scale breeding farms which were not adequately equipped with sewage systems, protective green space or other mitigating infrastructure. The heavy use of industrial fertilizers and pesticides had serious impacts on life in soils, underground waters and the entire biosphere, including the health of local inhabitants.

The previously-existing process of deforestation was accelerated during the communist era when forest cutting was intended to clear terrain for agriculture and as a necessary step to continue the process of forced industrialization.

In some parts of the Carpathians, another typical feature was Soviet-style urbanization based on large, agglomerated settlements. These mostly

concrete panel block buildings are still one of the most visible urban legacies of the past regime. Conceptual, legislative, organizational and technical ignorance of the scope of problems, such as communal waste, caused the proliferation of thousands of unsanctioned rubbish dump sites. In most countries, there was also a general absence of ecological education.

Current Key Environmental Concerns

In general, human-related pressures on the Carpathians are currently greater than in other mountain ranges of Europe. In addition, in the face of globalisation, the Carpathians exhibit great fragility and the mixed blessing of limited accessibility (Jodha 2005).

This is due partly to the large variations among the countries in terms of development levels, their stage of accession to the EU, economic transition and the management of resources. From a start in 1989, the transition to market economies in the Carpathian countries has posed a specific challenge to mountain areas which is, quite simply put, how can development take place in an environmentally sustainable way?

While there is cause for optimism in regard to a number of environmental indicators for the Carpathian region (such as emissions of major air and water pollutants, air and water quality indicators, industrial and agricultural waste production, clean-up of hazardous and toxic waste sites, and reduced natural resource consumption) which show mainly positive trends, there are many areas where vast improvements remain to be made and many related issues of concern. The following is a list of the current major driving forces and pressures, and associated environmental problems, that need to be addressed:

- Issues related to environmental security, and particularly global climate change and its re-

gional/local manifestations; these include floods, landslides, windstorms (which can have major impacts on forests and infrastructure) and drought.

- Land use change and deforestation, related erosion and links to enhanced effects of or caused by hydro-meteorological phenomena. In some cases, uncontrolled deforestation and illegal logging have resulted in major damage to landscapes.

- Significant development of individual car transport and related environmental impacts.

- Implementation of new construction projects (e.g. large dams, highways, factories, harmful mining technologies, mountain winter-sport resorts).

- A significant rise in the total amount of municipal waste, and enhanced problems of waste management at the local level, stemming from improved economies/increased consumerism and the import and wide utilization of non-recyclable materials.

- In relation to unsustainable land development, the growing pressure of some interest groups (such as developers), combined with the relatively weak position of some environment ministries and other regulatory authorities at the international, regional, national and local levels.

The following Chapter 2 describes these current driving forces and pressures in detail as they occur across the Carpathian region and its varying human and natural landscape.

Existing Responses (e.g. policies and programmes)

Pre-CFC

The state of and development trends in the Carpathian environment, described in detail in Chapter 3, are influenced by such driving forces and pressures mentioned above. On the more positive side, there are also existing legislation, policies and programmes, at the international and European, as well as Carpathian regional and national levels, which are designed to respond to current environmental impacts and problems. These include, among other response measures: international treaties; multi-lateral environmental agreements; European Union (EU) legislation, directives, strategies and funds; national environmental legislation, programmes and strategies; and of course Carpathian regional and local development plans, programmes and strategies, the foremost instrument of which is the United Nations Framework Convention on the Protection and Sustainable Development of the Carpathians (Carpathians Framework Convention, or CFC for short).

The involvement of civil society, including non-governmental organisations (NGOs), academia (universities, academies, schools), pro-active individuals and the mass media is also a positive trend within the Carpathian region. These groups all help to create awareness of environmental issues and sustainable development, and not only generate but disseminate new knowledge and educate the broad public and society in general.

A number of key current policy instruments are introduced here and expanded on in later chapters of this KEO Report. Among the most prominent existing measures are:

The Carpathian Framework Convention

The only instrument focused exclusively on the Carpathian region itself is the Framework Convention on the Protection and Sustainable Development of the Carpathians, elaborated on the Alpine Convention model, at UNEP's initiative,

and signed in Kiev in May 2003. An important role is played by the UNEP Interim Secretariat for the CFC in Vienna, which is working to develop synergies among policy-makers, the general public and different international organizations active in the Carpathian region.

Other legislation and conventions

The new regulations targeting the environment are basic to improving the quality of the environment and to promoting cooperation among the Carpathian countries.

Even though countries of the Carpathian region have adopted new environmental legislation since the 1990s, there are areas in which this legislation is ineffective in preventing environmental damage from taking place, and particularly in protecting natural resources against over-exploitation.

Environmental legislative processes have yielded mixed results. Modern legislation has been adopted and is EU-compatible in the Visegrad countries (e.g. the Czech Republic, Hungary, Poland and Slovakia), and later in Romania as well. In Serbia and Ukraine, however, the degree of compatibility with EU norms differs.

Protected areas in Serbia and Ukraine fall under the EMERALD network of the Pan-European Network of Protected Areas based on the Bern Convention. Both the EMERALD and Natura 2000 (see below) networks are based on the Bern Convention and are interconnected.

The Convention on Biological Diversity (CBD) must also be mentioned as a tool of international cooperation for the Carpathian region, given that the Carpathians are considered to be one of the 200 most important world biomes.

EU-specific

The accession of the Czech Republic, Hungary, Poland, Slovakia and Romania to the EU has

imposed requirements on these countries to adopt all EU legislation (*acquis communautaire*) including those directives related to matters of the environment. This includes the areas of air quality, waste management, water protection, nature protection, industrial pollution control, risk management, genetically modified organisms and nuclear safety. One benefit is that the new Member States to the EU can learn from the collective experience of the earlier EU Members. EU legislation requires that many earlier and current environmental problems be resolved with an eye towards long-term sustainable management of natural resources and the environment.

For the five Carpathian EU member countries, the Directives and Regulations issued by the EU meant a step forward regarding international cooperation on the Carpathians. Noteworthy among such policy instruments are those involving cross-border cooperation, namely the Water Framework Directive and the Birds and Habitats Directives, for which the Natura 2000 Network was established as one response mechanism.

The Water Framework Directive includes primary means and targets for the protection of water resources and aquatic ecosystems. The main water categories must reach a “good quality” state by 2015, based on water resources management of each Carpathian basin and a rigorous monitoring system.

The European Strategy for Soil Protection put forward in 2006 includes actions to prevent future degradation, and also to restore degraded soils.

The European Neighbourhood Policy, based on programmes such as INTERREG III and the

Technical Assistance to the Commonwealth of Independent States (TACIS), are helping extend EU experience into the Ukrainian and the Serbian Carpathians. In view of this policy, the Djerdap National Park in Serbia and the Iron Gate Natural Park in Romania, as well as the Maramureş National Park in Romania and the Marmarosky National Park in Ukraine, and the Eastern Carpathians Trilateral Biosphere Reserve (Ukraine, Poland and Slovakia) will strengthen cooperation at the EU’s borders.

The European Environment Agency (EEA), based in Copenhagen, Denmark, plays a key role in reporting on the state and trends of the (pan)European environment along with the organisation of relevant data and information flows, including much of the Carpathian region. The EEA is a major source of value-added information, reports and analyses (including on policy) for decision-makers in the EU and other European countries.

Protected Areas

Protected areas of global and European interest include 33 national and natural parks and 42 landscape areas and landscape parks totalling 13% of the total Carpathian area.

Sustainable development of the mountain space implies the establishment of systems of protected areas (national parks, natural parks, nature reserves and biosphere reserves). Bringing the management of protected areas in line with international regulations, and primarily with the EU *acquis*, calls for the ecological reconstruction of degraded areas and for permanent efforts to identify and protect valuable landscapes and biodiversity.

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