

SLOVENIA AT THE JUNCTION OF MAJOR EUROPEAN GEOGRAPHICAL UNITS

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Very few countries, even considerably larger ones, can boast the landscape diversity found in Slovenia since the Alps, the Pannonian Basin, the Dinaric Alps, and the Mediterranean meet and interweave in this small corner of Central Europe (Melik 1954, 1957, 1959 and 1960; Melik 1963; Ilešič 1979; Gams 1986; Orožen Adamič and Perko, Kladnik 1995; Perko 1995; Gosar 1996; Fridl, Marin, Orožen Adamič, Pavšek, Perko, Šimenc and Vertačnik 1996; Ogrin 1997; Perko 1997; Fridl, Kladnik, Orožen Adamič and Perko 1998; Gams and Vrišer 1998; Natek and Natek 1998; Perko 1998; Gams 2001; Perko and Adamič 2001; Perko 2001b). So in spite of its small size, Slovenia is famous for its great natural diversity, variability, and transitional characteristics. Many geographers have observed that Slovenia is a natural geographical laboratory.

The **Alps** are the largest and highest mountain chain in Europe. Along them runs the divide between the North Sea and the Mediterranean Sea and the dividing line between the Continental and Mediterranean climates. Covering about 200,000 km², the Alps are more than 1,200 kilometers long and in some place up to 250 kilometers wide. They run from France in the southwest to Austria in the northeast. The southeastern part of the Alps extends into Slovenia.

The **Pannonian Basin** lies between the Alps to the west, the Carpathians to the north and east, and the Dinaric Alps to the south. Running about 600 kilometers from north to south and 700 kilometers from west to east, it covers almost twice the area as the Alps. The western margin of the Pannonian Basin extends into Slovenia.

The **Dinaric Alps** are the southeastern continuation of the Alps between the Pannonian Basin and the Adriatic Sea. And form the divide between the Black Sea and the Adriatic. They are 700 kilometers long and almost 200 kilometers wide at the center. They cover less than half the area of the Alps. The northwestern part of the Dinaric Alps extends into Slovenia.

The **Mediterranean** is the area around the Mediterranean Sea. It runs almost 7,000 kilometers from Gibraltar to the Bosphorus Strait, and between Trieste and Durrës on the Adriatic Sea where it runs along the Italian Apennines to the southwest and the Dinaric Alps to the northeast it is almost 700 kilometers long. Covering an area of 132,000 km², the Adriatic Sea is somewhat larger than the Dinaric Alps. The northern margin of the Mediterranean extends into Slovenia.

In Slovenia, geography plays the leading role in landscape research. A pioneering role was played by the geographer Anton Melik, a member of the Slovenian Academy of Sciences and Arts, who published the first regional monograph of Slovenia in four extensive volumes between 1954 and 1960 (Melik 1954, 1957, 1959 and 1960) as well as the first general monograph of Slovenia (Melik 1963).

At Melik's initiative, the Slovenian Academy of Sciences and Arts founded the Geographical Institute in 1946 (formally in 1948), and this institute has carried his name since 1976. Almost half a century later, the Anton Melik Geographical Institute, which now works in the framework of the Scientific Research Centre of the Slovenian Academy of Sciences and Arts, prepared the second regional monograph of Slovenia entitled *Slovenia: Landscapes and People* (Perko, Orožen Adamič 1998) and the *Geographical Atlas of Slovenia* (Fridl, Kladnik, Orožen Adamič and Perko 1998). Three years later, the Institute also prepared the first national atlas of the country, the *National Atlas of Slovenia* (Fridl, Kladnik, Orožen Adamič, Perko and Zupančič 2001), which was published in Slovene and English versions. All three books contain chapters on regionalization and the typification of landscapes in Slovenia with numerous maps. The Institute has also published numerous other publications about Slovene landscapes.

Table 1: Some basic characteristics of landscape types in Slovenia.

Landscape types	Surface area (ha)	Proportion of surface area (%)	Mean elevation (m)	Mean inclination (°)	Most frequently occurring rock	Most frequent vegetation	Solar energy received (MJ/m ²)
Alpine mountains	306,148	15.1	1,054.5	24.5	limestone 51.5%; carbonate gravel and conglomerate 17.4%	beech 36.9%; high-mountain vegetation 18.7%	3705
Alpine hills	466,008	23.0	582.4	16.9	older volcanic rocks with tuff 20.9%; metamorphic rock 16.9%	beech 31.7%; beech, chestnut, and oak 30.6%	3953
Alpine plains	81,928	4.0	373.3	4.0	carbonate gravel and conglomerate 74.2%; clay and silt 9.3%	red pine 39.3%; beech 25.4%	4080
Alpine landscapes together	854,084	42.1	731.6	18.4	limestone 23.9%; carbonate gravel and conglomerate 17.4%	beech 33.4%; beech, chestnut, and oak 18.9%	3877
Pannonian low hills	299,428	14.8	288.7	8.8	marl 29.7%; clay and silt 27.8%	beech, chestnut, and oak 86.5%; beech 4.6%	4131
Pannonian plains	129,663	6.4	196.0	0.8	silicate gravel 58.4%; clay and silt 31.5%	English oak 27.3%; hornbeam and English oak 25.1%	4178
Pannonian landscapes together	429,091	21.2	260.7	6.4	clay and silt 28.9%; silicate gravel 21.3%	beech, chestnut, and oak 77.1%; red pine 4.7%	4146

Landscape types	Surface area (ha)	Proportion of surface area (%)	Mean elevation (m)	Mean inclination (°)	Most frequently occurring rock	Most frequent vegetation	Solar energy received (MJ/m ²)
Dinaric plateaus	380,918	18.8	667.7	13.7	limestone 58.9%; dolomite 29.4%	beech and fir 40.4%; beech 23.5%	3947
Dinaric valleys and corrosion plains	189,715	9.4	403.3	6.6	limestone 46.3%; clay and silt 23.2%	hornbeam and fir 32.4%; beech 16.5%	4122
Dinaric landscapes together	570,633	28.2	579.8	11.4	limestone 54.8%; dolomite 26.6%	beech and fir 34.9%; beech 21.9%	4005
Mediterranean low hills	106,090	5.2	305.8	11.1	flysch 72.6%; clay and silt 11.9%	sessile oak 31.9%; downy oak 30.7%	4373
Mediterranean plateaus	67,300	3.3	426.0	7.7	limestone 82.1%; flysch 10.9%	beech and hop hornbeam 74.7%; downy oak and hop hornbeam 19.8%	4381
Mediterranean landscapes together	173,390	8.5	352.4	9.8	flysch 48.6%; limestone 38.7%	beech and hop hornbeam 32.7%; sessile oak 22.0%	4376
Slovenia	2,027,198	100.0	556.8	13.1	limestone 29.5%; dolomite 14.6%	beech 23.9%; beech, chestnut, and oak 23.9%	4012

Also active in the field of landscape studies has been academician Ivan Gams, author of the university textbook *Essentials of Landscape Ecology* (Gams 1986) and several textbooks on the Slovene landscapes with maps of the regionalization of Slovenia (Gams and Vrišer 1998; Gams 2001).

Based on the predominant natural features, Slovenia is divided into the Alpine, Pannonian, Dinaric, and Mediterranean landscapes (Perko 1997; Perko 1998; Fridl, Kladnik, Orožen Adamič, Perko and Zupančič 2001; Perko 2001a; Urbanc 2002).

Alpine landscapes

The **Alpine landscapes** lie in northern Slovenia, cover two fifths of its territory, and are subdivided into mountain, hill, and plain landscapes.

The **Alpine mountains** in northwestern Slovenia are largely composed of carbonate rock, primarily limestone and dolomite. Rivers carved deep valleys that glaciers reshaped during the Ice Ages. Above the forest line, which runs at an altitude of around 1,600 m, a fifth of the surface is covered by dwarf pine, while below it, four fifths is covered by thick forest. Beech, beech-fir, and spruce forests dominate. The density of settlement is three times smaller than the Slovene average. Only the wider valleys are more densely populated, while extensive high mountain areas are completely uninhabited. The population here is increasing only slightly.

The most imposing mountains are the Julian Alps around Mount Triglav (2,864 m), Slovenia's highest mountain. Below it is the Triglav glacier, the southeasternmost glacier in the European Alps. Triglav



Figure 1: Alpine landscapes: in the background, the Julian Alps, the Karavanke mountains with Mount Stol (2,236 m), and the Kamnik-Savinja Alps converge; in the foreground is the Sava Plain (Savska ravan) with forest-covered conglomerate and cleared gravel river terraces near the small town of Radovljica in the northwestern part of the Ljubljana Basin (photography Marjan Garbajs).

National Park was established to preserve the many natural beauties of this area. On the south side, the blue-green Soča River winds through its deep valley toward the Adriatic Sea. Its upper section, the Trenta Valley, is one of Slovenia's most beautiful alpine valleys. Farther south lies Tolmin (population 3737 according to the 2002 census), the only larger town in the central part of the Soča Valley. Picturesque glacial valleys open to the north: Krma, Kot, Vrata, and Planica. The latter is called the »Valley of Ski Jumps« and is the cradle of ski flying, one of Slovenia's most popular winter spectator sports. From the north side of the Julian Alps, the rivers flow to the Black Sea. The Sava Dolinka, which runs past Jesenice (13,429) and its ironworks, and the Sava Bohinjka, which flows from glacial Lake Bohinj, Slovenia's largest natural lake (328 ha), past the cosmopolitan tourist resort of Bled (5,252) and Lake Bled (145 ha), which boasts a small picturesque island with a church, join to form the Sava River. Toward the east, the Karavanke mountains (highest peak Mount Stol, 2,236 m) stretch along the Austrian border, and south of these, the Kamnik-Savinja Alps (Mount Grintovec, 2,558 m). Below Mount Skuta (2,533 m) are remnants of a glacier, and the romantic Logarska dolina valley at the head of the Savinja River is especially attractive.

To the south and east, the broad band of the **Alpine hills** borders the Alpine mountains. These are composed primarily of dolomite, limestone, metamorphic rocks, claystone, siltstone, and flint sandstone and conglomerate. Two thirds of the surface is covered by forest. There is a pronounced prevalence of various beech forests. The density of settlement is twice as much as in the mountains. Isolated farms appear in this region, each typically consisting of a large house and outbuildings surrounded by an unbroken cultivated parcel of land cleared from the forest. In other places, small nucleate villages formed whose buildings stand separately in a random order but as a recognizable compact group, as do the agricultural plots. Increasing numbers of farmhouses are being converted into vacation houses owned by townspeople, some farms are engaged in farm tourism, and remote villages are in decline. The main sources of income are livestock production, forestry, and employment in smaller industrial centers in the valleys. In the western part, which is well known for its lacemaking, are the towns of Idrija (5,878) with its famous but now abandoned mercury mine, and medieval Škofja Loka (12,289). In the mining-oriented eastern part can be found the ironworks of Ravne na Koroškem (7,797), Velenje (26,742) with its lignite mine, and Trbovlje (16,290), the largest of the mining towns in Slovenia's biggest hill region, the almost 100-km-long Posavsko hribovje with its largely exhausted coal deposits.

The **Alpine plains** were formed by rivers that deposited gravel and sand on the bottoms of basins and formed terraces. Older terraces where gravel cemented to form conglomerate have been karstified and overgrown with forest, primarily red pine, while fertile fields cover the younger gravel terraces where mainly potatoes and corn are cultivated. Cultivated fields cover a quarter of all the surface area. Settlements on the plains are large and greatly urbanized. The density of settlement is six times larger than the national average. In the northern part of the Ljubljana Basin, Slovenia's largest basin, the Sava River and its tributaries filled the Sava Plain, where more than a fifth of all Slovenia's population lives on only one thirtieth of its territory. Here are the Slovenia's capital Ljubljana (258,873), the industrial city of Kranj, the fourth largest city in Slovenia (35,587), and several smaller but economically significant towns: Radovljica (5,937), Tržič (3,920), Kamnik (12,197), and Domžale (11,582). The Celje Basin is Slovenia's second largest basin. On its floor, the Savinja River and its tributaries created the Savinja Plain. Here are found Celje (37,834), Slovenia's third largest city, once the seat of the historically important Counts of Celje, and Žalec (4,919), surrounded by vast hop plantations that reflect Pannonian climate influences from the east.

Pannonian landscapes

The **Pannonian landscapes** lie in eastern Slovenia and cover a fifth of its territory. They are composed of densely settled and intensively cultivated areas where forest no longer covers even a third of the surface. They are divided into low hill and plain landscapes.

The winegrowing **Pannonian low hills**, which meet the Alpine mountains in the west, are composed of weakly agglutinated rocks, primarily marl, sand, and clay, and are therefore vulnerable to landslides. Dispersed settlements that are not compact are prevalent, with cultivated land between the houses. Homes are most frequently located on the tops of rounded ridges. Below them on the sunny slopes are vineyards, which produce high quality wine, and orchards, while on the shady slopes there is primarily forest, mostly beech, chestnut and oak, which covers a good third of all the surface. Farmers are engaged primarily in winegrowing and fruit growing. In the middle of the vineyards, traditional wooden wind-rattles turn in the wind, driving birds away. Many of the ridge houses have been converted into vacation houses, and the population is decreasing slightly. The largest Pannonian low hill regions are Slovenske gorice and Goričko, Slovenia's most northerly region.

The vast **Pannonian plains** lie between the low hills along the slow and meandering Mura, Drava, and Krka rivers on which numerous mills once operated. Vulnerable to flooding, these plains are of major agricultural importance. Maribor (93,847), Slovenia's second largest city, and Ptuj (18,339), its oldest inland city, are located on the Drava Plain; Murska Sobota (12,437) on the Mura Plain; and Krško (6,994) with its nuclear power plant near, the medieval town of Kostanjevica na Krki (701), and the Krakovski gozd nature reserve – the remains of a once vast lowland swamp forest – are on the Krško Plain. Today, forest covers less than a fifth of the surface of the plains, the lowest proportion in Slovenia; only the more frequently flooded areas are still covered with forests of English oak. In order to exploit the arable land more efficiently, people built their homes and outbuildings only along the main traffic routes. Large long villages arose with buildings evenly distributed in a row on one side or both sides of the road. The large stork nests frequently seen on the chimneys of these single-story houses add a pic-



Figure 2: Pannonian landscapes: in the foreground, the cultivated Drava Plain (Dravska ravan); in the background, first the vineyard-covered Dravinja Low Hills (Dravinjske gorice), behind them the steeper Haloze region known for its frequent landslides, and above it the table-shaped Mount Donačka gora (882 m), (photography Marjan Garbajs).

turesque touch. Vast farming plots extend behind the houses, usually divided into unbroken strips. The farmers are primarily involved in crop farming and raising livestock. Thermal and mineral water rising to the surface at tectonic faults in this region formed the basis for the development of health resort tourism (Rogaška Slatina, Radenci, Čatež, and Šmarješke Toplice).

Dinaric landscapes

In the south, the Alpine and Pannonian landscapes are replaced by the **Dinaric landscapes**, which run from northwest to southeast and occupy the greatest part of southern Slovenia. Dinaric landscapes, primarily the karst valley systems and the interim karst plateaus, constitute a good quarter of Slovenia.

The **Dinaric plateaus** are composed almost entirely of limestone and dolomite and are the most forested regions of Slovenia; forest covers almost three quarters of their surface. Beech and beech-fir forests dominate. Surface waters are rare, and droughts and forest fires occur frequently. The traditional economic branches are forestry and the related wood industries. Small nucleate villages with irregularly distributed buildings are dominant. Because of unfavourable natural conditions, the farms survive on forestry and livestock production. The population density is six times smaller than the Slovene average, and the population is decreasing, even though the majority of households are equipped with modern telecommunication and household equipment.

Dinaric valley systems and corrosion plains where forest still covers two fifths of the surface run between the Dinaric plateaus. The corrosion plains are largely composed of limestone and dolomite,



Figure 3: Dinaric landscapes: in the foreground, the Dinaric karst plateau of Nanos (1,262 m) rises steeply above the Mediterranean flysch Vipava Valley (Vipavska dolina) and the Vipava Low Hills (Vipavska brda); in the background, beyond the Pivka valley system (Pivško podolje) and Postojna, Dinaric plateaus and valley systems alternate (photography Marjan Garbajs).

while in the valley systems is some clay and flysch as well. Farthest east lies Bela krajina, a low corrosion plain with strong Pannonian influences, and the undulating landscape around Novo mesto (22,415), the capital of Dolenjska. Toward the west are valley systems (*»podolje«*) important for traffic with karst poljes that provide the greatest proportion of arable land but also the threat of flooding: Dolenjsko podolje, Ribniško-Kočevo podolje with Kočevje (9,027), Notranjsko podolje with the famous intermittent Cerknica Lake (three hundred years ago, the Slovene polymath Janez Vajkard Valvasor was made a member of the Royal Society in London as a result of his research describing this unusual phenomenon), and Pivško podolje with Postojna (8,548).

In contrast to the unfriendly surface is the fairy-tale underground world carved out by water. More than seven thousand caves rich with stalactites, stalagmites, and other karst cave formations have been discovered so far below the Dinaric and neighbouring Mediterranean karst regions. Among them are the Škocjan Caves, which have been on the UNESCO list of worldwide cultural and natural heritage sites since 1986 and are famous for the world's largest underground canyon, 2.5-km-long and 130 m high, and the world famous Postojna Cave, which has been visited by several million people. The karst underground is also famous for its fauna, which has adapted to life without light. The best known species is the cave salamander *Proteus anguinus*, which is endemic to the Dinaric karst region and the symbol of Slovenia's natural science.

Mediterranean landscapes

To the southwest, the Dinaric landscapes join the **Mediterranean landscapes**, which occupy something less than a tenth of Slovenia. It is divided into the more densely populated flysch low hills with their vineyards and orchards and the less densely populated lower karst plateaus. Here are found typical Mediterranean settlements with each building attached to the next. The houses are built of stone and have one or two floors. Every village has at least one square with a common stone well, which due to the modern water supply infrastructure today has only architectural value. The settlements located on elevations are the most outstanding. One example is Štanjel, where houses built from local stone run along the contour lines of the sunny side of a hill. This compact village is surrounded by a wall and retains the appearance of a small medieval town. Today it is protected as a first-class architectural monument of the Slovene cultural heritage.

The **Mediterranean plateaus** are composed almost completely of limestone and are therefore pronouncedly karstified. A typical example is the Kras region, which gave name to the science of karstology since it was here on Slovene territory that the study of karst phenomena created by the dissolving of permeable limestone began. Many other Slovene terms have also been incorporated in the international terminology for karst phenomena. The tourist sightseeing of caves began here as well. The oldest tourist cave in the world is Vilenica near Divača, where entrance fees were collected as early as the first half of the 17th century. The grey-white colour of the karst stone complements the white colour of the Lipizzaner horses from the Lipica stud and the intensely red terra rossa soil. The Mediterranean plateaus have the highest amount of sunshine in all Slovenia, receiving on average almost 4,400 MJ per m² yearly.

The **Mediterranean low hills** receive almost as much solar energy. In the extreme southwest they reach Slovenia's 47-km-long Adriatic coast and its great concentration of population and variety of activities. Here are three towns with typical ancient Mediterranean town centers: Koper (23,726), Slovenia's largest port, which ships around ten millions tons of goods annually, the fishing town of Izola (10,381), and the tourist town of Piran (4,143). The Adriatic cuts most deeply in land at the Bay of Piran. On its northern side is Portorož, the largest Slovene tourist center, and there were once vast salt works not far away at the delta of the Dragonja River on the border with Croatia. At present, salt is only extracted from a small portion of the salt pans, while due to their halophyte vegetation and numerous bird



Figure 4: Mediterranean landscapes: in the foreground in the Koper Low Hills (Koprška brda) lies the picturesque Istrian ridge village of Padna (205 m) with its greatly overgrown cultivated terraces; in the background, first the village of Korte and then the Bay of Piran on the Adriatic Sea (photography Marjan Garbajs).

species the abandoned areas are extraordinarily interesting from the point of view of the natural sciences. Also interesting is the nearby precipice at Strunjan, the tallest flysch cliff on the Adriatic coast.

The immediate coastal area of the Koper Low Hills with its vineyards and orchards – in some places the cultivated terraces are unfortunately greatly overgrown – rises rapidly to the high and imposing limestone wall of the karst rim, behind which the extensive karst corrosion plains of Čičarija and Kras begin. The Kras plateau descends in the north to the Vipavska brda region and the fertile Vipava Valley, which is notorious for its violent bora winds. To the west, the Kras plateau extends to the Soča River and the border city of Nova Gorica (13,491) and in the northwest rises again to the flysch winegrowing and fruit growing Goriška brda region, which in turn approaches the Alpine mountains in the north where we began our journey through Slovenia's regions (table 1).

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