

Plant life



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The vegetation of the mountain slope is very interesting and rich. It is an apparent mixture of different floral elements. There are mixed oldest Mediterranean, Boreal and Central newer floral elements. Illyrian-dominated Mediterranean plants, while the share of Alpine plants is significantly reduced, so Biokovo in the plant-geographical terms should be included in a special Balkan-Apenine region, the Balkan character (according to Kušan, 1969).

It can be said that the vegetation on the entire surface of the mountain slope is degraded. The term "vegetation" or "flora" normally covers two components - the flora and vegetation. Vegetation is a collection of plant communities or phytocoenoses. These are legally built communities in relation to environmental factors and are reliable indicators of habitat conditions. Flora is a collection of all plant species of an area.

It is known that plants are the basis of biological diversity. They are the habitat of animals and a food source to animals and humans, so we can say that without plants, there is no survival. It is therefore extremely important that we get to know them so that we can better protect and preserve them.

Vegetation



Drypis spinosa L. ssp. *jacquiniana* Murb. et Wettst. ex Murb. Lunds. – Coastal thorn elke

Vegetation builds all plant communities of an area, a variety of vegetation, usually in connection with an abundance of flora, abundance of relief (orography), lithological substrate,

and general and special climatic conditions. The Makarska area is characterized by various forms of vegetation, and their general characteristics fit the growing opportunities of the wider geographical area of the Croatian Littoral and East Adriatic coastal area. All vegetation is affected by a warm and dry climate, typical of the Mediterranean area.

Plants which have adapted to the steep rocks and cliffs, rugged and barren terrain dominate Biokovo. Forests have developed on deeper and developed soils of the highest wetlands areas.

The peak area Biokovo has an emphasized strip marked with the dominance of mountain pastures, with a large participation of the rocky surface, while forest remains here are just located in sinkholes.

Towards the the interior of the mountain there are beech forests with little fir trees. The belt of white scrub and red elm is present below the mountainous villages where anthropogenic influences are strengthening.

Unlike the limestone mountain, the riverside is built by flysch (marl, sandstone and limestone) and alluvial fan, and the contact zone of the mountain has many sandbanks.

Except for the sandbanks, it is a cultivated landscape where natural communities are gone, replaced by crops usually consisting of olive groves and vineyards, and artificially cultivated forests of Aleppo pine (red pin in several places in the higher areas).

Vegetation on the coastal slopes of the Park



Moltkia petraea (Tratt.) Griseb. – blue Gentiana

The vegetation on the coastal slopes of Biokovo Nature Park highlights some of the endemic plant communities that will be extracted according to TRINAJSTIĆ (1987, 2000).

As. *Campanulo – Moltkietum petraeae* H-ić. 1963 occupies a large space on the Biokovo, primarily in the littoral, but also part of the hinterland and spreads to the surrounding areas (Šibenik). Only in places such as the Živogošća that community lowers down to the sea level. Most important, abundantly represented and fully constant characteristic of the species endemic to the community highlights the fissures of rocks blue Lasinja - *Moltkea petraea* (Tratt.) Griseb., Which joins the kind *Portenschlagiella ramosissima* (Port.) Tutin (wild fennel). Horvatic (1963) as characteristics of an association he states the *Campanula portenschlagiana* Schult. (Portenšlag's bellflower), but this type is found only in the Biokovo range of associations, ie, insofar as that range as *Campanulo - Moltkietum* where it coincides

with the areal extent of *Campanula portenschlagiana* Schult. (Cf. Ovašen and Eberhardt and Trinajstić 1987).

Ace. Inula - Centaureetum cuspidatae Trinajstić 1980 stenoendemic vegetation communities crags, under which composition Biokovo developed, stenoendemic species *Centaurea cuspidata* Vis. (reddish knapweed) occupies a precipitous, perpendicular, several hundred meters high cliffs of the southern part of Biokovo Podgore over and above the road Makarska - Kozica.

Ace. Drypi - Linarietum simplicis H-ic. Et Domac 1957

At the foot of steep cliffs and steep coastal slopes are numerous developed screes (scree) that are a characteristic geomorphological creation of calcareous mountains. For them, there is an endemic community point. On the basis of floristic and phytosociological studies of Domac (1957) it has been found that Biokovo's point frames a special plant community - as. Drypi - Linarietum simplicis, as a characteristic species of the association he emphasized the species *Linaria simplex* (Willd.) DC. (as *L. parviflora* (Jacq.) Hal.), *Sedum glaucum* WK and *Hieracium waldsteinii* Tausch. (= *H. lanatum* K. W. Et) var. *biokovënsë* Deg. Zahn et.

Ace. Festuco - Koelerietum splendidis H-ic. 1963rd

This is one of the most striking communities of rocky pastures in submediterranean vegetation of the eastern Adriatic coast. It occurs with the degradation of oak and hornbeam forests (as. *Quercus - Carpinetum orientalis*) on flat or gently undulating terrain with well-developed skeletal soil, the surface covered by fine broken stones washed out by rain. This association of the Biokovo area occupies a relatively small area, and most typical contents were detected on the surface of Quaternary breccia above the town Bašković (Veliko Brdo) (Trinajstić 1981).

As. Junipero - Pinetum dalmaticae Domac (1962) 1965.

At an altitude of about 800 to 1500 m northwest of the coastal slopes of Biokovo is this endemic community. Its characteristic species are the **Dalmatian black pine** - *Pinus nigra* ssp. *dalmatica* (Hecht) Franco. It grows in the areas Borovac, Bukovac, Borovik and untruths Stina where it grows singly and in small groups, mostly in inaccessible places on the peaks and ridges protruding towards the west. These areas are allocated to the category of forest reserves. It is considered that these trees relict character on Biokovo. But for these pre-mountain pine forests of Biokovo belt there is the syntaxonomical problem of their origin, and its resolution will require further research says Trinajstić.

Vegetation of the peak areas of the park



Salvia officinalis L. - sage

The peak areas of the central park of nature Biokovo is significant by the following specific and endemic communities separated by TRINAJSTIĆ

As. Carici – Centaureetum rupestris Ht. 1931.

This association is built by the Dwarf Sedge - *Carex humilis* Leyss. and (yellow limestone knapweed) rocky knapweed - *Centaurea rupestris* L., and represents the most important community of vegetation rocky pastures of the Mediterranean-montane vegetation belts and the vegetation zones its eastern Adriatic coast. This association according to Trinajstić (1987) developed on Biokovo in several places, but the typical contents occupy relatively small areas. More common are those that develop on the lower border of the range where composition Sage - *Salvia officinalis* L. is added to the composition.

With several significant species it builds a separate association (subas. *Salvietosum officinalis* Trinajstić 1965). These compositions occupy the largest area on the slopes of the Biokovo hinterland above Kozice that are visible from a distance as a large bare area of 600 to 800 m above sea level.

As. Stipo – Caricetum humilis Trinajstić 1987.

This association develops in the border area of the Mediterranean-and Mediterranean-montane belt of rugged mountainous terrain along the exposed to the Bora on the coastal Dinarides. Under the influence of the Mediterranean climate this particular stand of grassland developed in the composition which is primarily of species *Stipa eriocalis* Borbás = *Stipa pennata* L. ssp. *eriocalis* (Borbás) Martinovský et Skalický and *Carex humilis* Leyss. On Biokovo this community is widespread on the slopes and ridges that rise above Lađan, and develops on shallow brown soils

As. Bromo – Seslerietum interruptae Trinajstić 1965.

This grassland community in our part of the Mediterranean developed in extreme habitats exposed to cold winds (Bora), and in its composition on the low altitude sea levels it unites several mountain elements. Since during the summer it is under the direct influence of the Mediterranean climate, in its composition it unifies a number of Mediterranean elements. Therefore, in terms of phytogeography (cf. Trinajstić 1969.1974) it is designated as the representative of the Mediterranean-mountain belt of the Mediterranean region. On Biokovo it can be found at elevations at about 1150-1350 m in the area Čelišnika and Lađan on shallow soil.

As. *Astragalo – Seslerietum robustae* Trinajstić (1981)

These are stands that develop in the rugged terrain of some parts of Biokovo (Štropac, Raždol, Kuranik, ...) and in the composition the species which have a prominent role are *Sesleria robusta* Schott, Nyman et Kotschy and endemic biokovska subspecies of *Astragalus angustifolia* Lam. ssp. *biokovens* Kušan.

As. *Edraiantho – Seslerietum juncifoliae* Ht. 1974

This endemic community development in the area from the peak of St. Ilija to the highest peak of Sv. Jura and the peak areas of the coastal side of Biokovo. The composition of this community developed one of the Biokovo endemic *Edraianthus pumilio* (Schult.) A.DC. and endemic species *Minuartia graminifolia* (Ard.) Jav. ssp. *clandestina* (Portenschl.) Mattf., that are of special importance to the mountain.

As. *Scorzonero – Hypochoeretum* H-ić (1956) 1958

This community of grassland vegetation of the Mediterranean-montane belt has been recorded so far only in the Biokovo system, in a sinkhole on the site Vidića kosa (Trinajstić 2000).

Vegetation of inland areas of the park



Lilium cattaniae Vis. – Martagon Lily

The continental vegetation (northern, northeastern and northwestern) areas of the park are characterized by the following plant communities separated by TRINAJSTIĆ (1987, 2000).

As. *Ostryo – Abietetum* (Fukarek) Trinajstić 1983

At the extent of the Mediterranean-montane belt, at altitudes between (850 -) 900-980 (-1120) m is the pine - *Abies alba* Mill. on the side of Biokovo hinterland, along with black hornbeam - *Ostrya carpinifolia* Scop. Are very interesting, relatively thermophilous compositions that were selected in this particular association (Trinajstić 1983a). The phytosociological footage of Trinajstić (1987) derived from Jelovac (850 m), Jelovac area (920 m), Kaoca (1100 m) and Sutvid (1120 m). According to Kušan (1969), the fir forests of Biokovo are a special form of relict Mediterranean montanih forests, belonging to the phytogeographical Mediterranean region. In vertical view, this association does not significantly exceed a height of 1000 m.

As. *Rhamno – Abietetum* Fukarek 1958

This second fir forest community develops in the extent of the pre-mountain belt of beech at altitudes of 1400-1600 m, where the highest plateau of the Biokovo is formed by steep slopes, ledges and torn rocks to the northern exposure of the Biokovo deep sinkholes. This important

forest community, which is currently the only site in the mountain vegetation of Croatia will need to be given special attention. It comes though several large areas between Lađan and Kimet, on the northern exposures along the edge of the deep sinkholes according to Trinajstić (1987). Since the recorded stands were not accessible because of the steep terrain, they were not analyzed in more detail.

As. Doronico – Fagetum Trinajstić 1983

This community is found in the highest parts of Biokovo - Silni Gozd, the greater area of Kadulja and the St. Jure area. The sinkholes which are abundant in this area at altitudes 1300-1600 m have been developed and have till this day preserved the beech forests which are mainly confined to the northern slope of the exposure. The characteristic species of this community are *Doronicum columnae* Ten. (heart-shaped Orchid) and *L. martagon* Liliium (*Lilium cattaniae* (Vis) Vis. - **vrtočlav**, inclusive; *Lilium martagon* L. var. *cattaniae* Vis., inclusive) - **zlatan**, a type in the range of beech forest that is a legally protected and endangered species .

As. Geranio – Anthriscetum fumarioidis H-ić. (1956) 1963

The compositions which develop on Biokovo (hay needle, geranium) *Geranium macrorrhizum* L. (wart chervil) *Anthriscus fumarioides* (Waldst. et Kit.) Spreng. are relatively rare and are found in rocky places in the range of pre-mountain beech forests in the area of the Silni Gozd.

Beech and beech and fir forests



Vošac - beech forest



Kaoci – beech and fir forest

These forests in the park were under the distinct influence of anthropogenic and are significantly degraded, but however in some areas in the park they are still well maintained, therefore, we recommend the coastal reserve beech forest (*Fagetum croaticum seslerietosum* Ht.) On the coastal slope under Vošac (10 ha) at an altitude of 1350 m, and the reserve forests

of beech and fir trees from the continental side of the park on the northern exposures Kaoci (185 ha) and Kimet-Sutvid (806 ha).

Mountain pastures and heaths

A smaller part of the Biokovo pen pasture areas are of natural origin (the zone above the forest vegetation). They are generally formed as a result of anthropogenic influences which are complemented by erosion, leaching of shallow soil, and resulted in the domination of the stone skeleton.

In the Submediterranean zone and the zone of rock bands are transitional areas dominated by rocky grasslands Crljenika sedge (*Carex humilis* Leyss.) And prickly knapweed (*Centaurea rupestris* L.) (As. Carici - *Centaureetum rupestris* Ht. 1931). Here are frequently erect shrub thermophilic kositernice (*Ephedra major* Host) and Somine mountain shrubs (*Juniperus sabina* L.) in association with silver (coarse), moor grass (*Sesleria robusta* Schott, Nyman et Kotschy) in sheltered places.

Coastal reefs, places exposed to wind gusts, is covered by the community of the narrow-leaved bellflower (*Edraianthus tenuifolius* (Waldst. et Kit.) A. DC.) And mountain (blue), heather (*Satureja subspicata* Vis.) (As. Bromo - *Seslerietum interruptae* Trinajstić 1965). The highest parts of the coastal zone, elevation as the Biokovo plateau, are overgrown with grass elements ligament narrow-leaved moor grass (*Sesleria tenuifolia* Schrad.). In these rocky pastures on the coastal side of the bushes are (medvjetke) bear grapes (*Arctostaphylos uva-ursi* (L.) Spreng.), And the peaks of the interior mountain are compressa shrubs (dwarf juniper) (*Juniperus communis* L. ssp. *Nana* Syme).

Mountain heaths are related to the pre-mountainous beech forest zone (above 1500 m), the highest parts of Biokovo and deep sinkholes of peak areas. In contrast to the grassy area this part is dominated by radial shrub broom, Metlika (*Genista radiata* (L.) Scop.) - With mountain compressa shrubs (dwarf juniper) (*Juniperus communis* L. ssp. *Nana* Syme).

Since pastures in the nature park today are mostly not used for farming except in some parts, the coastal side of this area, the pine forest is expanding as a pioneer species, either from pine cultures, or from indigenous forests of pine.

Autochthonous forest of Dalmatian black pine



Bukovac - autochthonous forest of Dalmatian black pine



Miletin bor

These forests represent a relict community of *Junipero - Pinetum dalmaticae* Domac (1962), 1965, and were developed on smaller areas of the northwestern slopes of the coastal area between 800 and 1200 m. In the areas of Borovik, Sibenik - Borovac and Bukovac all forest areas under this community were selected in the category of forest reserves of vegetation over an area of about 63 hectares.

The old trees are characterized by a specific habitus disc foliage and white fractured bark. emphasized is aspecifically protected individual tree called *Pinus nigra* ssp. *dalmatica* (Vis.) Franco - called " **Miletin bor** " over Bašković (Veliko Brdo).

Cultures of pine



Baško polje - Aleppo pine forest



Staza - Aleppo pine

They occupy large areas, but mostly outside the park. The coastal area and in contact with the coastal zones of the park is dominated by forests of Aleppo pine (*Pinus halepensis* Mill. - As. Erico - *Pinetum halepensis* Krause et al., 1963). Part of the Forest later developed spontaneously. It is interesting to note that these forest compositions were erected as a culture or developed in the wild, and in some places according to their floristic composition they came closer to some form of natural forests of Aleppo pine.

Cultures of pine surfaces are much smaller and are located within the park. They grow in a cooler submediterranean zone, the zone of hornbeam forests and coastal zones of the beech forest.

Shrublands

Within the boundaries of the park shrubs made considerable areas on the continental side of the mountain. There are two forest communities represented in the lower and warmer zone submediterranean cutters hornbeam (*Carpinus orientalis* Mill.), and in the higher and colder zone submediterranean are thickets of hornbeam (*Ostrya carpinifolia* Scop.). The upper border of hornbeam on the mainland side comes into contact with beech (*Fagus sylvatica* L.) and fir (*Abies alba* Mill.). On the coastal side these surface are very small.

Groves



Groves

They occupy considerable areas in the coastal area and do not fall within the boundaries of the park. They are important as an agricultural and landscape component of the Makarska region. Other agricultural land in this area are also gardens, vineyards and orchards.

Red List of Threatened Plants Biokovo

In the area of the park and in contact zones observed were the following endangered species taken under NIKOLIC T., eds TOPIC J. (2004): Vascular Flora. U Čivić, K. et al. techniques.: The Red List of threatened plants and animals of Croatia. State Institute for Nature Protection, Zagreb, 15-46.

Lokaliteti uz pojedine taksone navedeni su prema literaturnim podacima, a za neke treba utvrditi postojanje na Biokovu i točne lokalitete.



Cerastium grandiflorum Waldst. et Kit. - carnation



Anacamptis pyramidalis (L.) Rich. – red Orchidea



Fibigia triquetra (DC.) Boiss. ex Prantl - triangular sijedac



Orchis provincialis Balb. ssp. *pauciflora* (Ten.) Camus - Orchid



Campanula portenschlagiana Schult - Portenšlagova bellflower



Moltkia petraea (Tratt.) Griseb. Blue Lasinja



Portenschlagiella ramosissima (Port.) Tutin - wild fennel

In the category of least concern (LC) regarding species that are on Biokovo include *Eryngium alpinum* L. - **alpski kotrljan** from the family Apiaceae and *Iris illyrica* Tomm. - Illyrian iris of the family Iridaceae. Alpine kotrljan grows on mountain meadows and pastures and the grooves between the juniper where snow lies long. The species is under the Law on the Protection of Nature in 1976. Protected in all natural sites. Illyrian iris is an endemic species which is the most frequently on Biokovo on top of and around Vošac and in the surroundings of Kozice.

With these two species that attract attention in bloom it is important to mention the type *Moltkia petraea* (Tratt.) Griseb. - Blue Lasinja of the family Boraginaceae that Illyrian-Balkan endemic species, which is on Biokovo on rocky cliffs and on slopes. Occasionally it descends much lower, even to the sea (Omis, Vrulja, Cook, Nugal). Is a perennial vegetable that is propagated through one-directional mericarps. It blooms from May to July when its intense blue (blue) color dominates.

Erythronium dens-canis L. – **pasji zub** of the family Liliaceae on Biokovo is widespread in beech forests and communities on the central mountains and on Rilić. It is herbaceous perennials, bulbs. It grows in vegetative bulbs and seeds are spread by ants. From April to May it is highlighted by the color of their flowers in beech forests.

Narcissus radiiflorus Salisb. – **zvjezdastocvjetni sunovrat** of the family Amaryllidaceae grows between the Biokovo mountain tops (Šibenik, Raždol, Štropac, Troglav, Vošac, Lađan), in continental areas above Kaoca, and abounds in Lokva around the mountain house "Slobodan Ravlić." The habitat of this species are submountain mountain meadows and rocky areas of the mountain vegetation, cracks in the forest areas, wet meadows, especially on deeper soils in sinkholes. It is a perennial, propagated by the underground stem and seeds. It blooms in May and June, in the of middle of July in the mountain area. Because of the prominent flowers it is exposed to congregation in accessible areas.

Saxifraga paniculata Mill. – **metličasta kamenika** from the family saxifrage on Biokovo mountain tops grows from St. Ilija to Kimet. It grows in clumps pudgy ground rosette from which their stem is forced. Propagation is by seed, but is abundantly spread by twigs. Populations are made of numerous examples. At many sites, a significant decline in abundance is noticed. In particular, it decreases to reach areas due to the fact they are picked because of their pudgy decorative rosettes in clusters for horticultural purposes (botanical gardens). The species is sensitive to environmental condition changes.

Portenschlagiella ramosissima (Port.) Tutin – **razgranjena portenšlagija, divlji koromač** from the family Apiaceae endemic is a species that grows in the Biokovo area on the coastal side (especially above Makra and Kotišine), and is wider spread in the Cetina canyon, near Zadvarja, Dovanj, Prosik, Vrulja, and on the cliffs at Nugla they descend to the coast. Its habitat are cracks often on vertical cliffs of the northern or northeastern exposure, sometimes on old walls and stone walls. On the islands they often come quite close to the coast, at an altitude of 5-30 m. It is a perennial plant, propagated by seed, but rarely blooms and fructuates. After ripening the plant seeds die. The number is reduced if there is habitat destruction.

Senecio doronicum (L.) L. – **divokozjački staračac, planinski kostriš**, from the Asteraceae family grows in the area of Kozjak and St. Jure. It grows in protected notches which for a long time during the winter are not covered with snow and on grasslands in protected areas in winter covered with snow, and on the slopes of the shallow limestone soils, but also on deeper soils. It is a perennial herbaceous species that reproduces by seed. The fruit is a one-seeded Roška. In favorable environmental conditions - the mountain grasslands and notches they have a good coverage area.

The above types are emphasized by ŠUGAR I. eds (1994): Red Data Book species of Croatia. The Ministry of Construction and the Protection of the Environment Institute of Nature Protection, Zagreb, 1-522 and are not found in NIKOLIC T., eds TOPIC J. (2004): Vascular

Endemics of Biokovo – dwarf and crawling bellflower



Edraianthus pumilio (Schult.) A. D.C. – dwarf bellflower, Biokovo bellflower

The dwarf bellflower and the crawling bellflower are two endemic species specific to Biokovo so we have to mention them.

***Edraianthus pumilio* (Schult.) A. DC. - The dwarf bellflower and the Biokovo bellflower** are of the family Campanulaceae and stenoendemic relict species. The first was described by Portenschlag Ledermeyer (1820) based on the findings of Biokovo. The species is widespread in the gorges of mountain peaks (St. Ilija, Šibenik, Raždol, St. George, Troglav, Lađan, Ravna Vlačka), and is endemic on Biokovo. Most populations are located in the pre-mountainous band between 1400 and 1700 m above sea level, in some places lower in the continental area.

According to the distribution, it falls within the sphere of tertiary relict elements of the Balkan provinces of the oromediteranske region and its high Dinaric sector makes it a characteristic species of the Biokovo area (Kušan, 1969; Trinajstić, 1986). It inhabits exposed and bare limestone or dolomite cliffs where it grows in crevices of rocks laid horizontally on a rough stone or erosion on the shelf. The type is heliophilous and is submitted to large fluctuations in temperature and humidity. The recent habitat for this kind is refuge, its less favorable habitats compete with other species (Martinis, 1971). The extent of its range on Biokovo is the pioneer species in the initial stages of various communities *Seslerion juncifoliae* and is specially characterized by the community *Edraiantho Seslerietum juncifoliae* (Horvat, 1974). It is a perennial plant of a pillowy shape, and it reproduces by seeds. In a culture it is difficult to maintain, except in mountain gardens. It grows singly or in small groups. The construction of asphalt roads and TV repeaters in St. Juri have partially or totally destroyed some populations.



Edraianthus serpyllifolius (Vis.) A. DC. – crawling bellflower (author: D. Mihelj)

***Edraianthus serpyllifolius* (Vis.) A. DC.** – **crawling bellflower** from the family Campanulaceae is an endemic species which was first described by R. Visiani (1829). Biokovo is the locus classicus of this type and the only known locality. This Dinaric endemic on Biokovo is prevalent in a small space between the tops of St. Jure and Troglav (Wettstein, 1887; Solic, 1981). Two special forms: *f. angustifolius* Lakušić and *f. Albus* Šolić are described from this site. On Biokovo this kind is at the lower altitude limit of 1550 m above sea level. By its general distribution it belongs to a group of tertiary relics of the oromediteranske Balkan provinces of the region and its high Dinaric sector (Trinajstić, 1985). On exposed limestone reefs it grows in cracks and lar rocks and shallow rendzina within the bonds of narrow-leafed mountain moor grass swards (*Seslerion juncifoliae*). In some places it grows in the mountain vegetation (Lakušić, 1974; Šilić, 1984). The crawling bellflower is a perennial herbaceous plant with an appressed bush-type shape. Propagation is by seeds. The culture is more difficult to maintain, except in mountain gardens. On Biokovo it grows in groups or individually in their small areal extent. The total number is small. Construction of roads and TV repeater on top of St. George destroyed part of the population, which according to recent observations is gradually restored, but in other places there are no detectable changes.