

COMPARISON OF DYNAMICS OF REFORESTATION IN KARSTMEADOWS (*CARICI-CENTAUREETUM RUPESTRIS* HT.31) AT TWO ALTITUDES

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Keywords

karst meadow/*CARICI-CENTAUREETUM RUPESTRIS* Ht. 31/*OSTRYO-QUERCETUM PUBESCENS* (Ht.50) Trinajstic 74/*SESLERIO-OSTRYETUM* Ht. et II-ic 50/reforestation/DCA/karst/ Slovenia/ Yugoslavia.

Abstract

Compared were thirteen 5m transects of the Karst plateau (about 500 m a.s.l.) and Karst uplands (about 1000 m a.s.l.) (SW Slovenia /YU). On Karst plateau *CARICI-CENTAUREETUM RUPESTRIS*, the most widespread grass association of karst region, grows together with the primary forest *OSTRYO-QUERCETUM PUBESCENS* (Ht.) Trinajstic 74, and on the Karst uplands with secondary forest *SESLERIO-OSTRYETUM* Ht. et II-ic 50. The transects were subject to multivariate statistic package - modified version of DCA (Detrended Correspondence Analysis), CANOCO program (ter Braak, 1988). The gradient of the Karst plateau was shorter and more conjugate while that of the Karst uplands longer and more disjointed. Therefrom one may infer that the reforestation of the Karst plateau is faster than that of the Karst uplands.

Introduction

The problem of reforestation in karst meadows led us to compare transects of reforestation at two different above-sea-levels, namely, a lower (about 500 m) and a higher (about 1000 m) above-sea-level. In both cases the transects were of a length of 5 m. Transects began to be taken in the forest and were completed in the meadow. The transition of forest species to forest-edge species, and from these to meadow species was recorded. The results as obtained and diagrammed reveal similarities and differences between single records. It is possible to observe which vegetal species group together. The present investigation should permit us to draw some conclusion concerning the dynamics of reforestation in karst meadows.

Study area

Records were taken in an area considered the Slovene part of Cicarija (Slavnik, Mala Plesivica, Velika vrata) and at its roots i.e. Podgorska planota and Sezansko-Komenski kras (Fig. 1).

The Karst plateau is a flat or slightly hilly plateau of prevailingly eocene limestone, abounding in swallow-holes, doline, precipices, and other karstic features. The altitudes range between 350 and 650 m. In the swallow-holes the soil mantle is deeper, colluvial, the vegetation more mesophilic, in the open areas the soil cover is shallow, here and there even rocky (above all where not overgrown with forest).

From geological point of view Cicarija is a slip of Učka. It consists mainly of limestones and dolomites. In the Slovene area the peaks reach slightly above 1000 m (Slavnik 1028 m, Mala Plesivica 953 m, Ruzsuzica 1082). This, too, is a world of deep swallow-holes. Here and there wind erosion (northeastern) was exposed the bedrock, leaving little soil on the surface. In doline, ravines, and swallow-holes the soil is deeper and covered with larger forests. The soil type in question is rendzina with A and C horizons. In the swallow-holes and ravines the soil mantle is deeper (brown colluvial soil), including A, B, and C horizons.

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The climate of the Karst plateau is mediterranean. The precipitation is modest, mainly in spring and autumn. Summers are dry and hot. In winter a strong northeastern lowers the temperatures and dries up the earth. In Cicarija a greater elevation is responsible for an increase in precipitation. In winter snow persists at levels above 800 m, however, on the Karst plateau it does not fall every year, and even when it does, it melts away already in a day or two. Thus, one can say that in Cicarija there prevail sharp (continental) winters but dry and hot summers, which applies also to the Karst plateau.

The Karst flora is composed above all by Euro-Siberian, Eurasian and central European elements on one, Illyrian on the other and Mediterranean on the third side.

The Karst region as it is now bears visible traces of the centennial interference of man into these parts. With the exception of the Italian part of the Karst region stretching as far as the sea, and the sun-exposed Karst margins above the flysch world of Kopersko gricevje where more thermophilic associations are developed, from maquis fragments (*ORNO-QUERCETUM ILICIS* II-ic 56(58)) to fragments of association *CARPINETUM ORIENTALIS* II-ic 39, thermophilic association *AMELANCHIERO OVALIS-OSTRYETUM* Poldini (78)82, we can say that the Karst plateau used to be covered with forest-association *OSTRYO-QUERCETUM PUBESCENS*, the most widespread forest association in the mosaic grass-shrubbery-forest of the whole Karst plateau, above all the subassociation *CORNETOSUM MARIS* Poldini 82, representing the most distinctly developed form in this region. *SESLERIO-OSTRYETUM*, a secondary forest association, is common at greater elevation. It is spread above all on shallow, eroded grounds. These are most probably the habitats of beech forests *SESLERIO-FAGETUM* (Hl. 50 Wraber 57(60)), now covering a large part of Cicarija. In certain parts they were cut out completely. These surfaces are now overgrown with *SESLERIO-OSTRYETUM* forests in which *Ostrya carpinifolia* prevails as a pioneer species. At higher levels of Cicarija and particularly so in deeper ravine soil such forest association as *LAMIO ORVALE-FAGETUM* var. geogr. *Sesleria autumnalis* Accetto 89 can also be stated, whereas in the lowlands and in Cicarija hornbeam stands are developed (*ORNITHOGALO PYRENAICI-CARPINETUM* Marincek, Poldini et Zupancic 83).

The meadows (former pastures) are covered mainly with *CARICI HUMILIS-CENTAUREETUM RUPESTRIS*, a generally spread association to be encountered throughout the wide range between the Trieste karst and Dalmatia. It appears as a lowland form, with a prevalence of mediterranean species, and a montane form where the mediterranean species are replaced by Illyrian and central European species. On relatively deep, rather fresh soil of Karst plateau, a relatively more mesophilic association *DANTHONIO-SCORZONERETUM VILLOSAE* Hl. et II-ic (56)-58 is stated. Prevailing on the peaks and wind-exposed sites is *Sesleria juncifolia*, making the subassociation *CARICI-CENTAUREETUM SESLERIETOSUM JUNCIFOLIAE* Hl. 62. The next height belt (peaks themselves) includes fragments of the association *GENISTO-CARICETUM MUCRONATAE* Hl. 56.

Frequent are also stands of *Pinus nigra* by which the Karst region began to be reforested in the previous century whereas its present-day expansion is largely spontaneous.

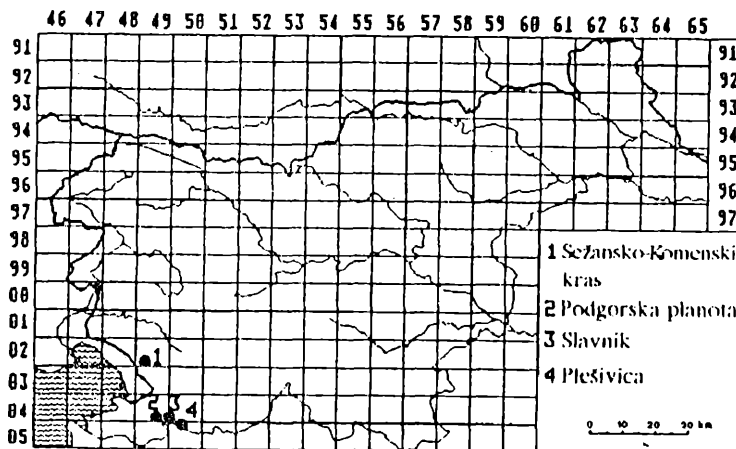


Fig. 1. A geographical map of Slovenia. Black points represent the locations of transects

Material and Methods

Seven transects were selected on the Karst plateau and six in Cicarija. Our choice included fine, well developed transitions from meadow to forest. We decided upon 5 m transects for at a distance of 5 m from the forest the meadow undergoes intensive reforestation (FEOLI et al., 1980). Single planes were 1m long and 2m wide (superficies of 2m). The coverage was estimated upon BRAUN-BLANQUET method. All forest layers were duly considered. The transects were marked with letter (A-G on the plateau and M-S in Cicarija), single meters with numbers 1 in the forest to 5 in the meadow (App.1). Locations of the transects (Fig.1): A,B Podgorje; C-G Sezansko-Komenski kras (C Kazlje, D Stari boršt, E Gabrovica, F Dutovlje, G Štorje); M Slavnik; N-T Plešivica (N Lokavec, P-R Velika Plešivica, S-T Mala vrata).

Each plane was treated as an independent relevé. The BRAUN-BLANQUET scale was modified as suggested by van MAAREL (1979). The transects were subject to multivariate statistic package modified version of DCA (Detrended Correspondence Analysis), CANOCO program (ter BRAAK, 1988). The nomenclature of species in this work follows EHRENDORFER (1973).

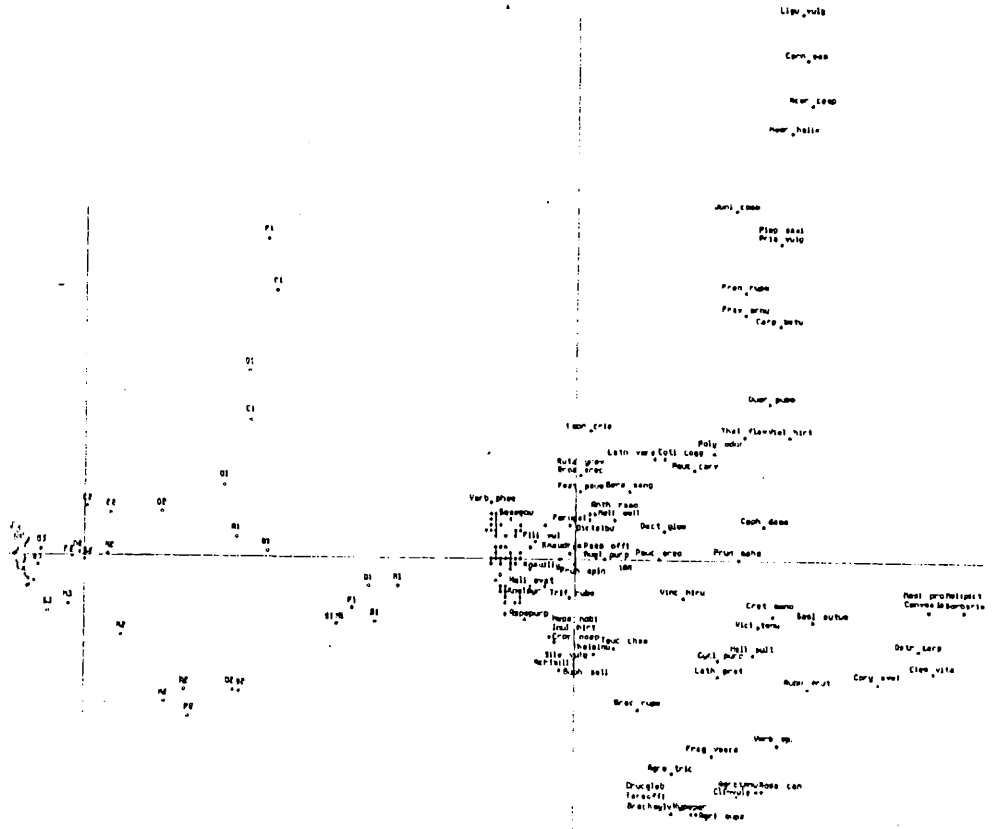


Fig.2.3. Results of DCA: relevés - left, species - right. Shown in the diagrams is the transition from meadow to forest - abscissa, whereas the ordinate reflects the division between the transects from higher above-sea-level (empty points) and those from the plateau (full points)

Results

The Karst plateau reveals a mosaic development of grass-shrubbery-forest vegetation. In last years the forest has been gaining ground quite rapidly. It expands from the existing sylvan surfaces or all a new from

so-called nucleus of reforestation. There first appear high-stalked plants, among them also shrubs that soon prevail over other species. Particularly aggressive in gaining new territories is the species *Cotinus coggygria*. Quite soon trees begin to mingle with shrubs. Finally there appear also forest herbs. A more frequently observed case is expansion of an already existent forest; such an instance was selected also for purpose of the present investigation to compare the dynamics at a lower altitude on the Karst plateau and at a greater elevation in Cicarija. The forest association chosen for transects was *OSTRYO-QUERCETUM PUBESCENS*, above all the subassociation *cornetosum maris*. In Cicarija the forest association is *SESLERIO-OSTRYETUM*.

On plateau as well as the upland the meadows, quite uniform, belong to the association *ARICI-CENTAUREETUM RUPESTRIS*. Though markedly few mediterranean-montane species differentiate between one height type and the other, the two types are easily distinguishable since the mesophilic species are relatively more frequent at higher levels and thermophilic on the plateau.

On the plateau the transition is more conjunctive. It is represented by vegetal species that might be classified to the fringe community of the alliance *GERANION SANGUINEI* Tx. in Th. Müll.61 (*Dictamnus albus*, *Cotinus coggygria*, *Lathyrus pannonicus* subsp. *versicolor*, *Anthericum ramosum*). The margins of Cicarija are of more mesophilic character. Considering the vegetal species thriving in those parts (*Hypericum perforatum*, *Agrimonia eupatoria*, *Achillea millefolium*, *Cruciata glabra*, *Taraxacum officinale*, *Crocus neapolitanus*, *Hepatica nobilis*) the margins could be classified into a more mesophilic, central European alliance *TRIFOLIUM MEDII* Th. Müll.61.

The forests into which the transects pass at greater elevations is rather uniform, consisting above all of association *SESLERIO-OSTRYETUM*, which is evident of such species as *Ostrya carpinifolia*, *Sesleria muhlenbergii* etc.. The plateau forest is not consistent, which is due to a fore-mentioned mosaic composition

on the Karst plateau. The inconsistency of the forest (Fig. 2.) might result from the fact that a surface of merely 2 m² of the forest ground is too small to obtain an optimal sample. The meadow sample is much more representative. The reason may be also locally deeper soil cover, that is fresher, less basophilic, as proved by presence of the species *Primula vulgaris*, *Carpinus betulus*.

Resulting from study of both transects, the plateau transect is more conjunctive. Vegetal species other than meadow species find their way into the meadow easily. Transitions are less pronounced, while they are much more obvious in Cicarija. In the meadows in Cicarija the non-forest vegetal species are confronted with less propitious conditions. The process of reforestation takes a faster course on the plateau than at higher above-sea levels, which logically follows from the fact that the ecologic circumstances at greater elevation are less propitious to vegetal life.

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