DRY CALCAREOUS DOLOMITE OUTCROP AND GRASSLAND COMMUNITIES ON THE DAUGAVA RIVER BANK NEAR DZELMES

Solvita Jermacāne, Māris Laiviņš

Faculty og Geography and Earth sciences, University of Latvia, Raiņa bulv. 19, Rīga, LV-1586

Vegetation of the dolomite outcrop on the Daugava River bank was described according to the Braun-Blanquet method in order to reveal vegetation structure, ecology and dynamics of this unique habitat.
Two rare plant communities for Latvia were described: Saxifrago tridactylito-Poetum compressae and Medicagini-Avenetum pubescentis. The first one occurs there as a point locality outside main distribution area of the association which is the Central and Southern Europe.
Communities occur on well lit, warm habitat with nutrient poor, dry and basic soil. Soil depth determines the spatial distribution (position on the slope), structure (life form and ecological strategy spectra) and succession of plant communities.

Keywords: Dolomite, plant communities, Alysso-Sedion albi, Saxifrago tridactylito-Poetum compressae, Bromion, Medicagini-Avenetum.

INTRODUCTION

Dolomite outcrops occur rather frequently along the banks of the Daugava River (the largest river of Latvia). Fine earth of different thickness covers dolomites depending on slope inclination and on the degree of weathering of the dolomite. These calciphilous and thermophilous sites are characterised by basic, nutrient poor soils drying out often and rapidly.

One of such habitats unique for Latvia is located about 70 km from Riga on the right bank of the Daugava River near the village Dzelmes (54^o E longitude and 26^o N latitude) stretching for about 2 km. The width of the slope is 12 m in average with inclination 40^o-45^o (total area 2 ha). Soil depth is varying considerably: most part of the slope is covered with 6-10 cm deep fine earth, also completely exposed dolomites without soil are common, but on the gentlest part of the slope the depth of the soil is 50 cm and more. Vegetation is open and simply structured. Grassland communities dominate, but in some places also shrub vegetation has developed.

Tasks of the given study were to inventor vascular plant species and to describe structure and ecology of grassland communities.

MATERIAL AND METHODS

In 1998 (during May and the beginning of August) and in 1999 (July) flora of vascular plant species was investigated in all the area. Grassland plant communities were described (totally 37 relevés) according to the Braun -Blanquet approach (Braun-Blanquet 1964; Dierschke 1994). On the steepest part of the slope (with thin soil layer and rich in annual species), 14 relevés sized 1x1 m were described two times per year (1998) in late spring (May) and in summer (August). The rest (23 relevés sized 4-9 m^2) were described in July 1998 and 1999 on slope portion with thicker soil layer and denser vegetation. Vegetation tables (Table 1 and 2) contain summer coverage of species, but for spring ephemeral species (*Erophila verna*, *Veronica verna* etc.) spring coverage is given.

Classification methods (TWINSPAN) were used for vegetation analysis (Hill 1979). Spectrum of phytogeographical elements (species distribution area types) was calculated using initial data from Meusel et al. (1965, 1978) and Hulten, Fries (1986). Ellenberg values (Ellenberg et al. 1992) were calculated weighted by coverage.

Top soil samples were collected for grassland communities taking at random 5 samples per community. The following analyses were made: particle size analyses (particle settling), pH (1 M KCl), hydrolitic acidity (extractant 1 n $NaCH_3COO$), cation exchange capacity (extractant 0.1 n HCl), C-organic (by Tjurin, oxidation of organic matter by $K_2Cr_2O_7$) and total nitrogen by Kjeldahl.

Nomenclature for vascular plants: Gavrilova, Šulcs 1999, for mosses: Āboliņa 2001, for lichens: Piterāns 2001.

RESULTS

Vascular plant flora

In total 174 vascular plant species belonging to 123 genus and 43 families were recorded. The highest floristic diversity was observed in grassland communities, less one – in shrub communities on the gentler parts of the slope. Some species occur only on the foot of the slope in the narrow zone along the waterline, like *Eupatorium cannabinum*, *Aster salignus*, *Solanum dulcamara* etc. On the upper part of the slope some ruderal species (*Cirsium arvense*, *Convolvulus arvensis*, *Linaria vulgaris*, *Urtica dioica* as well as escaped plants, such as *Acer negundo*, *Amelanchier spicata*, *Physocarpus opulifolius*, *Populus longifolia* and *Saponaria officinalis*) form

patchy coenoses. All these species are a threat to rare and also to widespread native plant species and communities.

Four habitats with characteristic vegetation are present in the area:
A – Pioneer communities on dolomites with shallow soil;
B – xerothermophylous grassland communities on deeper soil;
C – partly developed shrub communities on the gentler part of the slope;
D – fragmentary groups of plants on stony riverside flood-plain.

List of vascular plant species
Vaskulāro augu sugu saraksts

(bold letters indicate the habitat where the species grow)
(treknie burti norāda biotopus, kuros suga sastopama)

Acer negundo L. – **C, D**
Acer platanoides L. – **D**
Achillea millefolium L. – **A, B, C**
Acinos arvensis (Lam.) Dandy – **A**, **B**
Agrimonia eupatoria L. – **B**
Agrostis gigantea Roth - **B**
Ajuga genevensis L. – **B**
Alnus glutinosa (L.) Gaertn. – **C, D**
Alnus incana (L.) Moench – **C**
Allium oleraceum L. – **B**
Allium vineale L. – **A, B**
Amelanchier spicata (Lam.) C. Koch – **C**
Anchusa officinalis L. – **B**
Anemone sylvestris L. – **A, B**
Angelica sylvestris L. – **D**
Anthemis tinctoria L. – **A, B**
Anthriscus sylvestris (L.) Hoffm. – **C, B**
Anthyllis vulneraria L. – **A, B**
Arenaria serpyllifolia L. – **A, B**
Arrhenatherum elatius (L.) J. et C. Presl – **B**
Artemisia campestris L. – **A, B**
Artemisia vulgaris L. – **B**
Aster salignus Willd. – **D**
Betula pendula Roth – **C**
Briza media L. – **A, B**
Bromopsis inermis (Leys.) Holub – **B, C**
Calamagrostis epigeios (L.) Roth – **B, C**
Campanula patula L. – **B**
Campanula rapunculoides L. – **B**
Campanula rotundifolia L. – **A, D**
Carex hartmanii Cajand. – **B**
Carex hirta L. – **B, C**
Carex leporina L. – **B**
Carex praecox Schreb. – **A, B**
Carex caryophyllea Latourr. – **B**
Carum carvi L. – **B**
Centaurea jacea L. – **B**
Centaurea scabiosa L. – **B**
Cerastium arvense L. – **A, B**
Cerastium holosteoides Fries – **A, B, C**
Cerastium semidecandrum L. – **A, B**
Cirsium arvense (L.) Scop. s. str. – **B**
Clinopodium vulgare L. – **B**
Convolvulus arvensis L. – **B**
Corylus avellana L. – **C**
Crataegus curvisepala Lindm. - **C**
Crepis tectorum L. – **A**
Cynoglossum officinale L. – **B**
Dactylis glomerata L. – **B, C**
Daucus carota L. – **A, B**
Dianthus deltoides L. – **B**
Echium vulgare L. - **A, B**
Elytrigia repens (L.) Newski – **B, C**
Equisetum arvense L. – **A, B**
Equisetum pratense Ehrh. – **C, B**
Erigeron canadensis L. – **A**
Erophila verna (L.) Bess. – **A**
Euonymus verrucosa Scop. – **C**
Eupatorium cannabinum L. – **D**
Euphorbia virgata Waldst. et Kit. – **B**
Festuca arundinacea Schreb. – **D**
Festuca rubra L. – **B**
Filipendula ulmaria (L.) Maxim. – **D**
Filipendula vulgaris Moench – **B**
Fragaria viridis Duch. – **A, B**
Fraxinus excelsior L. – **C**
Galium album Mill. – **A, B, C**
Galium boreale L. – **B**
Galium verum L. – **A, B**
Gentiana cruciata L. – **B**
Geranium pusillum L. – **A**
Geranium robertianum L. – **C, D**
Helictotrichon pratense (L.) Bess. – **B**
Helictotrichon pubescens (Huds.) Pilg. – **B**
Hepatica nobilis Mill. – **C**
Heracleum sibiricum L. – **B, C**

Hieracium umbellatum L. – **B**
Humulus lupulus L. – **C, E**
Hypericum perforatum L. – **A, B**
Inula salicina L. – **B, D**
Jovibarba sobolifera (Sims) Opiz – **A, B**
Knautia arvensis (L.) Coult. - **A, B**
Lamium maculatum (L.) L. – **C**
Lathyrus pratensis L. – **B**
Linaria vulgaris Mill. – **A, B**
Lonicera xylosteum L. – **C**
Lotus corniculatus L. – **A, B**
Lythrum salicaria L. – **D**
Malus domestica Borkh. – **C, D**
Medicago falcata L. – **A, B**
Medicago lupulina L. – **B**
Melandrium album ((Mill.) Garcke – **B**
Melica nutans L. – **C**
Melilotus albus Medik. – **B**
Myosotis arvensis (L.) Hill – **A, B**
Myosotis stricta Link ex Roem. et Schult. – **A**
Oenothera biennis L. – **B**
Oenothera rubricaulis Klebahn – **B**
Ononis arvensis L. – **B**
Origanum vulgare L. – **B**
Padus avium Mill. – **C**
Peucedanum oreoselinum (L.) Moench – **B, C**
Phleum phleoides (L.) Karst. – **A, B**
Phleum pratense L. – **B**
Physocarpus opulifolius (L.) Maxim. – **C**
Pilosella officinarum F.W. Schultz et Sch. Bip. – **A, B**
Pimpinella saxifraga L. – **A, B**
Picea abies (L.) H. Karst. – **C**
Pinus sylvestris L. – **C**
Plantago lanceolata L. – **B**
Plantago media L. – **B**
Poa angustifolia L. – **A, B**
Poa compressa L. – **A, B**
Poa pratensis L. – **B**
Polygonum persicaria L. – **D**
Populus longifolia Fisch. – **C**
Populus tremula L. – **C**
Potentilla arenaria Borkh. – **A**
Potentilla argentea L. – **A, B**
Potentilla reptans L. –**B**
Primula veris L. – **B**
Pyrola rotundifolia L. – **C**
Quercus robur L. – **C**
Ranunculus acris L. – **B**
Ranunculus auricomus L. – **D, C**
Ranunculus polyanthemos L. – **B**
Rhamnus cathartica L. – **C**
Rosa canina L. – **B, C**
Rubus caesius L.- **B, C, D**
Rubus idaeus L. - **C**
Rumex acetosa L. – **A, B**
Rumex confertus Willd. – **D**
Rumex crispus L. – **B**
Rumex thyrsiflorus Fingerh. – **A, B**
Salix caprea L. – **C**
Salix cinerea L. – **C**
Salix fragilis L. – **C**
Salix starkeana Willd. – **C**
Salix purpurea L. – **C**
Saponaria officinalis L. – **B**
Saxifraga tridactylites L. – **A**
Scrophularia nodosa L. – **C, D**
Sedum acre L. – **A, B**
Sedum purpureum (L.) Schult. - **B**
Senecio jacobaea L. – **B**
Silene vulgaris (Moench) Garcke – **B**
Solanum dulcamara L. – **D**
Solidago virgaurea L. – **B**
Sorbus aucuparia L. – **C**
Stachys palustris L. – **D**
Tanacetum vulgare L. – **B**
Taraxacum officinale Web. – **B**
Thalictrum lucidum L. – **C, D**
Thymus pulegioides L. – **A, B**
Thymus serpyllum L. – **A, B**
Trifolium arvense L. – **A, B**
Trifolium medium L. – **B, C**
Trifolium montanum L. – **B**
Trifolium pratense L. – **B**
Trifolium repens L. – **A, B**
Tussilago farfara L. – **B**
Ulmus glabra Huds. – **C**
Urtica dioica L. – **B**
Valeriana officinalis L. – **C**
Verbascum nigrum L. – **B**
Veronica chamaedrys L. – **B, C**
Veronica longifolia L. – **D**
Veronica verna L. – **A**
Vicia angustifolia Reichard – **A**
Vicia cracca L. – **A, B, C**
Vicia sepium L. – **B, C**
Vincetoxicum hirundinaria Medik. – **A, B**
Viola arvensis Murr. – **A, B**
Viola collina Bess. – **C**
Viscaria vulgaris Bernh. – **A, B**

Rare and endangered species are present in the area.

1. *Ajuga genevensis* – small coenopopulation (about 15 individuals) is located on the upper part of the terrace slope in a small opening of schrub coenose.

2. *Allium vineale* – quite common in all the area although mainly in grassland communities on the steepest part of the slope.
3. *Gentiana cruciata* – a group of 5 individuals grows in the upper part of the terrace slope. The species is endangered by spreading of shrubs and vital stand of escaped plant *Saponaria officinalis*.
4. *Peucedanum oreoselinum* – several individuals (with lowered vitality) are found in shrub community.
5. *Saxifraga tridactylites* – rather common in the central part of the terrace slope with shallow soil and open vegetation.
6. *Vincetoxicum hirundinaria* – very common, especially in the steepest part of the slope where it is abundant.
7. *Anemone sylvestris* – common in all the area.

It is obviously that vascular plant flora is comparatively rich for such a small area (2 ha). It represents 19% of species number known in the part of the Daugava River valley laying in the boundaries of the Central Latvia geobotanical district (Фатаре 1987). It is worth to mention also rather high number of rare and endangered species in the area. *Ajuga genevensis* is a species found in Latvia only in the Daugava River valley. *Allium vineale* and *Saxifraga tridactylites* are found in western Latvia but in the eastern Latvia they grow only in the Daugava River valley. *Gentiana cruciata*, *Viola collina*, *Vincetoxicum hirundinaria* and *Allium oleraceum* are species restricted to river valleys in Latvia (Fatare 1992). Ornamental species *Jovibarba sobolifera* is also rather rare. Large and vital coenopopulation of this species is found on the slope.

Vegetation

The data set of 37 relevés was analysed with the computer program TWINSPAN and three plant communities with following syntaxonomy were distinguished:

Class: Koelerio-Corynephoretea Klika in Klika et Novák 1941
Order: Sedo-Scleranthetalia Br.-Bl. 1955
Alliance: Alysso alyssoidis-Sedion albi Oberd. et T.Müller in Müller 1961
Association: Saxifrago tridactylito-Poetum compressae (Kreh 1945) Géhu et Leriq 1957
variant with *Erophila verna*
variant with *Campanula rotundifolia*

Class: Festuco-Brometea Br.-Bl. et R.Tx. ex Klika et Hadač 1944
Order: Brometalia erecti Br.-Bl. 1936
Alliance: Bromion erecti Koch 1926
Association: Medicagini-Avenetum pubescentis De Leeuw in Br.-Bl. et Moor 1938

Saxifrago tridactylito-Poetum compressae communities occur only in places with very shallow soil. Characteristic feature is low and open herbage where mosses cover in average 35% (in places it can reach 70%) and herbs – 70%. 9 relevés encounter 64 vascular and 13 moss and lichen species (Table 1).

Table 1

Floristic composition
of the ass. Saxifrago tridactylito-Poetum compressae
Saxifrago tridactylito-Poetum compressae sabiedrību sugu sastāvs

	variant with *Erophila verna*										variant with *Campanula rotundifolia*									
Number of relevé Apraksta numurs	3	4	2	5	6	7	8	9	13	Constancy Konstantums	19	17	18	20	1	12	14	15	Constancy Konstantums	Constancy Konstantums
Size of relevé, m^2 Apraksta lielums, m^2	1	1	1	1	1	1	1	1	1		4	9	9	4	1	1	1	1		
Cover of herb layer,% Lakstaugu stāva segums, %	70	85	60	75	65	90	60	45	95		65	100	75	80	85	80	95	100		
Cover of moss layer, % Sūnu stāva segums, %	70	70	55	60	10	20	5	8	10		5	10	5	8	50	25	10	7		
Number of species Sugu skaits	22	26	31	31	28	28	25	26	34		17	32	22	25	26	22	26	23		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Ch. Ass. Saxifrago tridactylito- Poetum compressae																				
Saxifraga tridactylites	1	.	1	.	1	1	1	2	1	**V**	.	.	.	.	.	.	.	.	**.**	**III**
Poa compressa	.	2	2	2	.	.	+	1	.	**III**	2	2	.	1	1	.	.	.	**III**	**III**
Arenaria serpyllifolia	.	.	.	.	+	+	.	.	+	**II**	.	.	.	.	.	.	.	.	**.**	**I**
Differential species of the variants																				
Erophila verna	3	2	.	2	+	+	1	1	1	**V**	.	.	.	.	.	.	.	.	**.**	**III**
Campanula rotundifolia	.	.	.	.	.	.	.	.	.	**.**	+	+	1	1	2	.	.	.	**IV**	**II**
Ch. All. Alysso-Sedion albi, O. Sedo-Scleranthetalia																				
Jovibarba sobolifera	.	.	.	2	3	1	1	2	2	**IV**	2	1	2	2	2	.	+	.	**IV**	**IV**
Sedum acre	2	2	2	2	.	.	.	.	2	III	.	+	.	.	1	1	+	1	IV	III
Ch. Cl. Koelerio-Corynephoretea																				
Cerastium semidecandrum	1	2	1	1	1	2	1	1	.	**V**	.	.	.	.	.	+	.	+	**II**	**III**
Acinos arvensis	2	.	1	1	2	.	1	.	1	**IV**	1	+	.	1	1	.	.	.	**III**	**III**
Artemisia campestris	.	2	2	2	2	.	2	1	.	**IV**	2	.	2	1	1	.	.	.	**III**	**III**
Ceratodon purpureus	.	.	1	2	+	1	1	1	.	**IV**	2	.	.	.	.	.	.	.	**I**	**III**
Tortula ruralis	.	1	2	1	.	.	1	2	.	**III**	.	.	.	.	2	.	.	2	**II**	**III**

Table 1, continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Cerastium arvense	.	.	1	.	.	.	.	.	+	**II**	.	.	.	.	2	1	2	2	**III**	**II**
Thymus serpyllum	.	.	.	.	2	2	.	.	.	**II**	.	.	.	.	1	.	+	.	**II**	**II**
Myosotis stricta	+	.	1	.	.	1	.	.	.	**II**	.	.	.	.	.	2	.	.	**I**	**II**
Veronica verna	.	1	.	.	+	.	.	.	.	**II**	.	.	.	.	.	.	.	.	**.**	**I**
Brachytecium albicans	.	.	1	.	.	.	.	.	.	**I**	.	.	.	.	.	2	1	.	**II**	**I**
Pilosella officinarum	.	.	.	1	.	.	.	.	.	**I**	.	.	+	.	.	.	.	.	**I**	**I**
Potentilla argentea	.	.	.	.	.	.	.	.	1	**I**	.	.	.	.	.	.	.	.	**.**	**I**
Trifolium arvense	.	2	.	.	.	.	.	.	.	**I**	.	1	.	.	.	.	.	.	**I**	**I**
Anthyllis vulneraria	.	.	1	.	.	.	.	.	.	**I**	.	.	+	1	.	.	.	.	**II**	**I**
Ch. Cl. Festuco-Brometea																				
Galium verum	+	1	2	2	1	1	.	1	1	**V**	1	1	1	1	1	.	1	1	**V**	**V**
Thuidium abietinum	2	2	2	3	1	2	1	2	2	**V**	.	1	2	2	2	2	1	2	**V**	**V**
Phleum phleoides	1	2	1	1	.	1	.	1	2	**V**	.	2	.	2	.	.	2	1	**III**	**IV**
Pimpinella saxifraga	1	+	1	1	1	1	.	1	2	**V**	.	2	2	1	1	1	.	.	**IV**	**IV**
Medicago falcata	.	.	.	.	+	.	.	1	2	**II**	2	2	+	2	2	3	2	2	**V**	**IV**
Poa angustifolia	1	.	1	2	.	2	.	.	.	**III**	.	1	.	1	+	+	.	2	**IV**	**III**
Trifolium montanum	.	+	.	+	1	1	.	.	+	**III**	1	.	.	.	.	.	1	.	**II**	**III**
Fragaria viridis	.	.	.	.	.	2	.	1	2	**II**	2	+	1	1	.	2	2	2	**V**	**III**
Centaurea scabiosa	.	.	.	.	1	.	1	1	.	**II**	.	.	.	.	1	.	.	.	**.**	**II**
Carex caryophyllea	.	+	.	+	.	+	.	.	.	**II**	.	.	.	.	.	.	.	.	**.**	**I**
Filipendula vulgaris	.	.	.	.	.	1	2	.	.	**II**	.	.	.	.	.	+	.	.	**.**	**I**
Homalothecium lutescens	1	.	2	.	.	.	.	.	.	**II**	.	.	.	.	2	1	2	.	**II**	**II**
Ch. Cl. Molinio-Arrhenatheretea																				
Galium album	.	+	.	1	+	.	2	1	+	**IV**	.	1	.	.	1	2	1	2	**IV**	**IV**
Rumex acetosa	+	1	1	+	1	1	.	.	+	**IV**	.	.	.	.	+	.	.	.	**.**	**III**
Festuca rubra	+	2	.	.	.	.	.	1	2	**III**	.	2	1	1	1	2	2	2	**V**	**IV**
Knautia arvensis	.	.	+	1	.	.	.	.	1	**II**	.	1	+	1	1	.	.	1	**IV**	**III**
Achillea millefolium	.	1	.	.	.	.	1	.	.	**II**	.	.	.	.	+	.	1	.	**II**	**II**
Cerastium holosteoides	.	.	1	.	.	.	.	.	1	**II**	.	+	.	.	.	.	1	2	**II**	**II**
Dactylis glomerata	.	.	+	.	.	.	.	.	+	**II**	.	+	.	.	.	.	.	.	**.**	**I**
Phleum pratense	.	.	.	1	.	1	.	.	2	**II**	.	.	.	.	.	.	.	.	**.**	**I**
Vicia cracca	.	.	+	.	1	.	.	.	+	**II**	.	.	.	.	.	.	.	+	**.**	**II**
Helictotrichon pubescens	.	.	.	.	.	1	.	.	.	**I**	.	.	.	+	.	.	.	+	**II**	**I**
Other species																				
Anthemis tinctoria	2	.	1	2	1	2	1	1	+	**V**	+	.	.	2	+	1	2	1	**IV**	**V**
Vincetoxicum hirundinaria	2	2	1	2	2	2	2	2	.	**V**	2	2	2	2	2	1	+	.	**V**	**V**
Cladonia chlorophaea	2	2	1	2	+	2	.	.	.	**IV**	.	2	+	1	+	1	.	.	**IV**	**IV**
Hypericum perforatum	.	2	.	2	1	2	2	1	.	**IV**	+	1	1	2	.	.	1	.	**IV**	**IV**
Potentilla arenaria	1	1	1	.	.	.	1	1	1	**IV**	3	2	1	.	2	.	2	+	**IV**	**IV**
Thymus pulegioides	2	2	2	2	.	.	2	1	1	**IV**	1	2	1	2	.	.	.	1	**IV**	**IV**
Carex praecox	2	2	.	+	.	1	.	.	.	**III**	.	2	1	1	.	.	.	2	**III**	**III**
Galium boreale	.	.	.	.	.	2	+	1	1	**III**	.	1	2	1	.	.	.	.	**II**	**III**
Encalypta vulgaris	2	3	2	1	+	+	+	.	.	**III**	.	.	.	.	+	.	.	.	**I**	**III**
Barbula sp.	1	1	+	1	.	.	.	.	.	**III**	.	.	.	.	.	.	.	.	**.**	**II**
Allium vineale	.	.	.	.	.	2	1	.	1	**II**	.	2	.	1	.	1	2	2	**IV**	**III**
Campanula rapunculoides	.	.	.	.	2	.	.	.	1	**II**	+	+	+	.	1	+	1	.	**IV**	**III**
Myosotis arvensis	.	.	.	.	.	.	1	1	+	**II**	.	.	.	.	.	.	+	2	**II**	**II**
Viola arvensis	.	.	.	.	.	+	.	.	+	**II**	.	+	.	.	.	+	.	.	**II**	**II**

Table 1, continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Carex hirta	.	+	.	+	.	+	.	.	.	**II**	.	.	.	.	.	.	.	.	**.**	**I**
Echium vulgare	.	.	.	1	.	.	+	.	.	**II**	.	.	.	.	.	.	.	.	**.**	**I**
Vicia angustifolia	.	.	+	.	1	.	.	.	.	**II**	.	.	.	.	.	.	.	.	**.**	**I**
Viscaria vulgaris	.	.	.	2	.	.	2	1	.	**II**	.	.	.	.	.	.	.	.	**.**	**I**
Calamagrostis epigeios	.	.	.	.	.	.	.	.	1	**I**	.	.	.	.	.	1	1	1	**II**	**II**
Ranunculus polyanthemos	.	.	.	.	.	.	.	.	1	**I**	.	.	+	.	.	.	2	.	**II**	**I**
Rumex thyrsiflorus	.	.	.	.	.	.	.	.	.	**.**	.	1	.	+	.	.	.	.	**II**	**I**

Sporadic species (Retas sugas): *Anemone sylvestris* 1 (14), 2 (2), *Bromopsis inermis* 1 (17), *Bryoerythrophyllum recurvirostre* + (7), *Bryum caespiticium* 2 (8), *Campylium chrysophyllum* + (1), *Centaurea jacea* + (18), *Erigeron canadensis* + (2), *Eupatorium cannabinum* + (13), *Euphorbia virgata* 1 (17), *Mannia fragrans* + (3), *Medicago lupulina* 1 (9), *Ononis arvensis* 2 (6), *Origanum vulgare* 1 (12), *Rhabdoweisia fugax* 1 (13*), Sedum purpureum* 2 (5), *Senecio jacobea* + (4), *Trifolium repens* + (19)

Vegetation physiognomy changes rapidly during vegetation season. Many spring ephemeral species (*Saxifraga tridactylites, Erophila verna, Veronica verna, Myosotis stricta* etc.) form spring aspect and in summer are not visible. Summer aspect is dominated by *Jovibarba sobolifera*, *Vincetoxicum hirundinaria* and *Anthemis tinctoria*. There is a number of character species of the Class Festuco-Brometea, too. They include *Phleum phleoides*, *Pimpinella saxifraga*, *Medicago falcata*, *Poa angustifolia*, *Trifolium montanum* etc. and also mosses *Thuidium abietinum* and *Homalothecium lutescens*.

On the basis of floristical differences two variants were distinguished. Variant with *Campanula rotundifolia* develops on almost bare dolomites. Variant with *Erophila verna* occurs where the fine earth layer covers dolomites providing better moisture and nutritional conditions. *Erophila verna*, *Saxifraga tridactylites*, *Arenaria serpyllifolia* and *Cerastium semidecandrum* are recorded only in the variant with *Erophila verna*. Characteristic species of the variant with *Campanula rotundifolia* are *Medicago falcata* and *Potentilla reptans* rooting in the dolomite fissures and dominating with their prostratous habitus the vegetation. *Campanula rapunculoides* and *Fragaria viridis* are also abundant.

Medicagini-Avenetum pubescentis communities were found on the upper part of the slope where soil is rather well developed. In total 84 vascular plant and 5 moss and lichen species were recorded (Table 2).

Medicago falcata, *Carex praecox* and *Festuca rubra* are dominant plant species. Vegetation is mosaic because of the cessation of mowing for several years. Litter accumulation has resulted in the patchy dominance of expansive grasses, like *Calamagrostis epigeios* and *Elytrigia repens*, but in places also *Bromopsis inermis* and *Saponaria officinalis* are abundant.

Table 2

Floristic composition
of the ass. Medicagini-Avenetum pubescentis
Medicagini-Avenetum pubescentis sabiedrību sugu sastāvs

Number of relevé Apraksta numurs	10	11	21	22	25	27	29	28	35	24	26	30	23	31	32	33	34	36	37	16	**Constancy Konstantums**
Size of relevé, m^2 Apraksta lielums, m2	1	1	4	4	4	6	8	4	4	4	4	6	4	9	8	4	4	4	4	4	
Number of species Sugu skaits	15	33	31	16	16	22	23	25	28	27	20	22	21	26	17	21	23	16	14	11	
Cover of herb layer,% Lakstaugu stāva segums, %	85	80	90	98	70	98	98	98	95	98	98	98	98	98	98	95	98	98	98	95	
Cover of moss layer, % Sūnu stāva segums, %	0	15	15	8	0	0	0	0	0	1	0	0	1	5	0	0	0	5	5	0	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Ch. Ass. Medicagini-Avenetum																					
Medicago falcata	2	1	2	3	1	1	1	1	1	2	2	3	3	4	2	2	2	.	.	.	**V**
Helictotrichon pubescens	.	.	.	.	.	.	.	.	1	.	.	+	1	1	.	.	+	.	.	.	**II**
Ch. Cl. Festuco-Brometea																					
Galium verum	1	1	1	2	2	1	2	1	1	1	1	.	2	.	1	1	1	2	2	2	**V**
Fragaria viridis	1	1	1	.	1	2	+	2	2	1	2	.	1	.	1	2	.	.	.	2	**IV**
Pimpinella saxifraga	1	+	1	2	2	+	.	+	+	2	.	+	.	+	1	.	+	.	.	1	**IV**
Poa angustifolia	.	+	1	2	.	.	.	+	1	.	+	+	1	2	1	1	2	1	1	.	**IV**
Filipendula vulgaris	1	2	2	.	+	2	1	2	2	.	.	.	.	.	.	1	.	1	+	.	**III**
Phleum phleoides	.	.	+	.	.	1	.	1	+	+	+	1	1	.	+	1	+	.	.	.	**III**
Centaurea scabiosa	.	.	2	.	1	.	.	.	.	.	.	.	2	1	1	1	.	.	.	.	**II**
Trifolium montanum	.	1	1	.	.	2	+	1	+	.	.	.	.	.	.	.	.	.	.	.	**II**
Ch. Cl. Koelerio-Corynephoretea																					
Cerastium arvense	.	+	.	.	.	.	.	.	+	.	.	.	.	.	+	+	+	.	.	.	**II**
Acinos arvensis	.	1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	**I**
Artemisia campestris	.	.	.	.	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	**I**
Ch. Cl. Molinio-Arrhenatheretea																					
Festuca rubra	1	1	1	2	1	3	3	3	+	2	2	2	2	2	1	2	+	.	.	2	**V**
Vicia cracca	1	.	+	+	+	+	+	1	+	+	+	.	+	2	+	+	+	1	+	.	**V**
Achillea millefolium	.	2	.	.	+	+	+	.	.	+	1	2	1	2	.	.	.	.	.	.	**III**
Dactylis glomerata	.	1	+	.	.	.	+	+	+	+	.	+	.	.	.	+	+	.	.	.	**III**
Cerastium holosteoides	.	+	+	.	.	.	.	.	.	1	.	.	+	+	.	.	.	.	.	.	**II**
Phleum pratense	.	.	.	.	.	1	+	.	+	.	.	1	.	2	.	.	.	.	.	.	**II**
Veronica chamaedrys	.	1	.	+	.	.	.	.	+	.	.	+	.	+	.	.	.	.	.	.	**II**
Centaurea jacea	2	2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**I**
Lathyrus pratensis	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	**I**
Trifolium pratense	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.	.	.	.	.	.	**I**
Ch. O. Arrhenatheretalia																					
Knautia arvensis	.	2	+	.	1	+	+	.	1	1	+	+	1	.	1	.	+	.	.	+	**IV**
Galium album	1		.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	+	+	.	**II**
Ch. Cl. Trifolio-Geranietea																					
Origanum vulgare	.	2	2	2	2	+	1	+	+	.	.	.	.	.	.	.	.	.	.	.	**III**
Vincetoxicum hirundinaria	.	.	1	.	+	.	.	+	.	2	.	+	2	.	.	.	.	.	.	3	**II**
Campanula rapunculoides	3	2	+	+	2	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	**II**

Table 2, continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Agrimonia eupatoria	.	.	1	2	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	I
Anemone sylvestris	.	2	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Senecio jacobea	.	.	.	.	.	.	.	.	.	+	.	+	.	+	.	.	.	.	.	.	I
Other species																					
Calamagrostis epigeios	2	1	2	2	2	2	+	2	.	2	+	.	2	.	3	+	+	4	4	.	V
Allium vineale	.	+	1	1	.	+	.	+	.	1	1	.	2	.	1	+	+	.	.	+	IV
Ranunculus polyanthemos	2	1	.	.	.	+	+	1	+	+	+	.	.	+	+	.	.	1	+	.	IV
Elytrigia repens	.	.	.	.	.	1	3	.	2	2	3	2	2	1	.	1	3	.	.	.	III
Galium boreale	2	.	+	1	1	.	2	.	+	.	.	.	1	.	.	1	+	.	.	.	III
Thymus pulegioides	.	1	.	.	.	.	.	.	+	1	+	.	1	.	1	+	+	.	.	.	III
Bromopsis inermis	.	.	.	.	.	.	+	.	.	.	1	.	.	.	.	+	2	.	.	.	II
Carex praecox	.	.	.	.	.	.	.	.	4	1	.	.	.	.	3	3	3	3	3	.	II
Convolvulus arvensis	.	.	.	.	.	.	1	.	.	.	2	+	.	+	.	.	.	+	1	.	II
Equisetum arvense	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	2	+	+	+	.	II
Linaria vulgaris	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	.	2	+	.	II
Melandrium album	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	II
Myosotis arvensis	1	1	+	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	+	II
Rumex thyrsiflorus	.	.	+	.	.	.	.	.	+	+	.	+	1	+	.	.	+	.	.	.	II
Urtica dioica	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	+	.	II
Hypericum perforatum	.	+	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	I
Briza media	.	.	.	.	.	1	1	.	+	.	.	.	.	.	.	.	.	.	.	.	I
Agrostis gigantea	.	.	.	.	.	.	.	.	.	.	.	+	.	2	.	.	.	.	.	.	I
Anthemis tinctoria	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	I
Artemisia vulgaris	.	.	.	.	.	.	.	.	.	+	.	+	.	+	.	.	.	.	.	.	I
Campanula rotundifolia	.	1	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Carex hartmanii	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	I
Eupatorium cannabinum	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	I
Heracleum sibiricum	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	1	.	I
Hieracium umbellatum	.	.	1	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	I
Plagiomnium affine	.	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Potentilla reptans	.	.	.	.	.	.	.	.	.	+	.	.	1	.	.	.	.	.	.	.	I
Saponaria officinalis	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	+	.	.	.	I
Silene vulgaris	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	I

Sporadic species (Retas sugas): *Angelica sylvestris* + (28), *Arenaria serpyllifolia* + (28), *Arrhenatherum elatius* + (29), *Carex caryophyllea* + (35), *Carum carvi* + (11), *Cladonia chlorophaea* 2 (21), *Clinopodium vulgare* + (10), *Daucus carota* + (21), *Dianthus deltoides* + (21), *Echium vulgare* + (31), *Equisetum pratense* + (36), *Euphorbia virgata* 3 (16), *Homalothecium lutescens* 1 (11), *Humulus lupulus* + (29), *Medicago lupulina* + (11), *Ononis arvensis* + (11), *Peucedanum oreoselinum* 1 (28), *Plantago lanceolata* + (27), *Pyrola rotundifolia* 1 (11), *Rumex acetosa* + (27), *Rubus caesius* + (27), *Sedum acre* + (21), *Taraxacum officinale* + (31), *Thuidium abietinum* 2 (11), *Tortula ruralis* 1 (11), *Trifolium arvense* + (28), *Trifolium repens* + (31), *Verbascum nigrum* + (24), *Viola arvensis* + (28).

Species of the Class Festuco-Brometea (*Medicago falcata, Poa angustifolia, Filipendula vulgaris, Galium verum, Pimpinella saxifraga*) form the core of the community but also species of the Class Molinio-Arrhenatheretea (*Festuca rubra, Vicia cracca, Achillea millefolium, Knautia arvensis* etc.) are common. Process of overgrowing promotes spreading of the character species of the thermophilous fringe vegetation (Trifolio-Geranietea), such as *Origanum vulgare, Vincetoxicum hirundinaria* and *Anemone sylvestris*.

Synecology and syngeography of plant communities

Ecological conditions for plants are extreme in sense of supply with moisture and plant nutrients. Ellenberg values and soil chemical analyses show little difference between communities described (Table 3, Fig. 1 and 2).

Table 3

Ecological and sociological parameters of plant communities
Augu sabiedrību ekoloģiskie un sociloģiskie parametri

Parameter Parametrs	Plant community Augu sabiedrība		
	Saxifrago-Poetum var. *Campanula rotundifolia*	Saxifrago-Poetum var. *Erophila verna*	Medicagini-Avenetum
Ellenberg values Ellenberga skaitļi			
Light Gaisma	7.2	7.5	7.1
Temperature Temperatūra	5.4	5.6	5.3
Continentality Kontinentalitāte	4.7	4.2	5.1
Moisture Mitrums	3.5	3.3	3.9
Acidity Augsnes reakcija	7.3	6.8	7.5
Nitrogen Slāpeklis	3.2	2.7	4.1
Life forms (species number in %) Dzīves formas (sugu skaits %)			
Chamaephytes Hamefīti	17.2	18.1	13.2
Geophytes Ģeofīti	5.7	5.4	13.1
Hemicryptophytes Hemikriptofīti	65.3	56.3	67.9
Therophytes Terofīti	11.6	20.0	6.0
Ecological strategy (species number in %) Ekoloģiskā stratēģija (sugu skaits %)			
Competitor Konkurenti	33.3	25.5	42.2
Competitive-ruderal Konkurenti-ruderāli	5.9	5.5	8.4
Stress-tolerant competitor Strestoleranti-konkurenti	15.7	18.2	14.5
CSR-strategist CSR stratēģija	33.3	30.9	27.7
Ruderal Ruderāli	5.9	9.1	3.6
Stress-tolerator Strestoleranti	2.0	1.8	2.4
Stress- tolerant ruderal Strestoleranti- ruderāli	3.9	9.1	1.2

Both variants of the ass. Saxifrago-Poetum occur in well lit and warm habitats poorly supplied with water and nitrogen, but with high pH. Slightly richer in nutrients and moisture is soil where Medicagini-Avenetum communities grow, also cation exchange capacity and soil pH is higher than that of the ass. Saxifrago-Poetum.

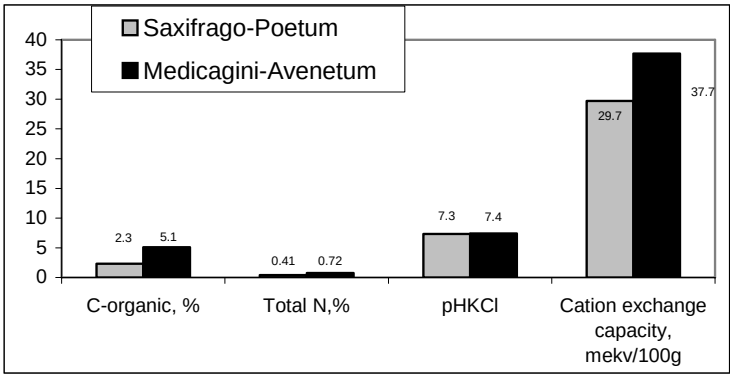

Fig. 1. Soil chemical properties
1.att. Augsnes ķīmiskās īpašības

Fine sand (> 0.005 mm) dominates (above 80%) in the top soil, percentage of silt is higher in deeper soil (the ass. Medicagini-Avenetum) and less in more shallow soil (the ass. Saxifrago-Poetum) (Fig. 2).

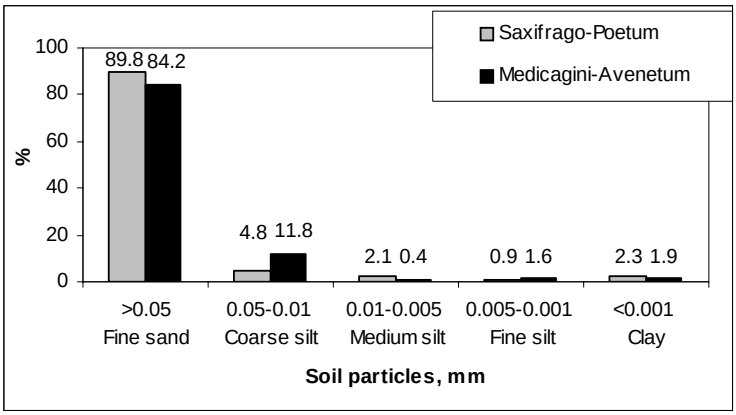

Fig.2. Soil texture
2.att. Augsnes mehāniskais sastāvs

Life form spectra of vascular plants (Table 3) is closely linked with the growing conditions. The ass. Saxifrago-Poetum (connected with more extreme conditions) contains more chamaephytes (mainly herbaceous –

Artemisia campestris, Jovibarba sobolifera, Sedum acre, Thymus pulegioides) and therophytes (*Myosotis stricta*, *Trifolium arvense*, *Viola arvensis*, *Cerastium semidecandrum*, *Saxifraga tridactylites*, *Veronica verna* etc.) and is richer in ruderals and stress-tolerators than the ass. Medicagini-Avenetum.

Phytogeographical spectrum (types of species distribution areas) show that more than a half of species have European-Asian temperate and submeridional distribution area. There is a difference in species sectoriality and oceanity groups between communities. The ass. Saxifrago-Poetum comprise more European and European-Asian Minor, and oceanic species, but the ass. Medicagini-Avenetum – more Eurasian and Circumpolar, and weakly oceanic ones (Fig.3-5).

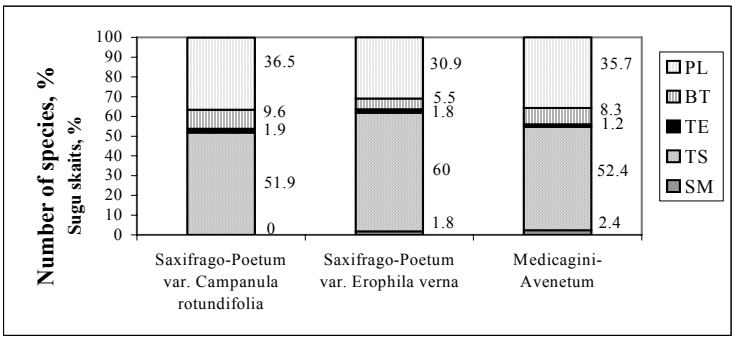

Fig. 3. Species zonality group spectra

3.att. Sugu zonalitātes grupu spektrs

PL –polizonal, BT –boreo-temperate, TE –temperate, TS –temperate-submeridional, SM –submeridional

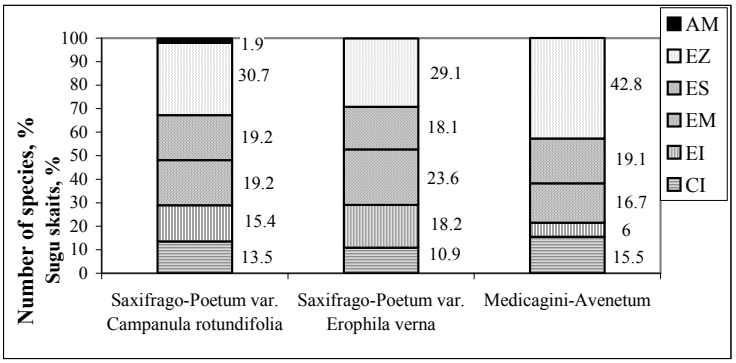

Fig.4. Species sectoriality group spectra

4.att. Sugu sektoritātes grupu spektrs

AM – American, EZ –Eurasian, ES - Eurosiberian, EM – European-Asian Minor, EI – European, CI – circumpolar

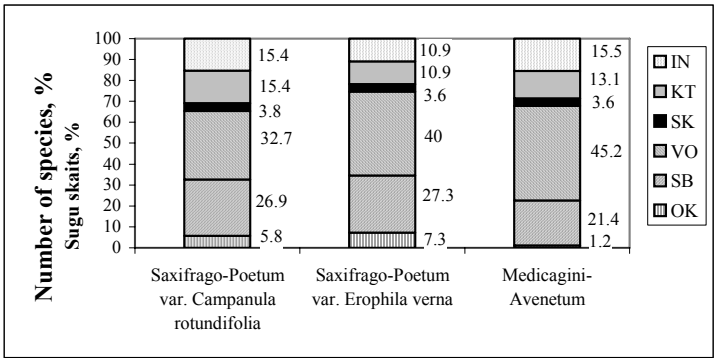

Fig. 5. Species continentality group spectra
5.att. Sugu kontinentalitātes grupu spektrs
IN – indiferent, KT –continental, SK – subcontinental, VO –weakly oceanic, SB – suboceanic, OK – oceanic

DISCUSSION

Degree of dolomite weathering and soil depth determines the spatial distribution and structure of plant communities, and also succession. In our investigations four stages of succession can be distinguished corresponding to the plant communities described (Fig. 6).

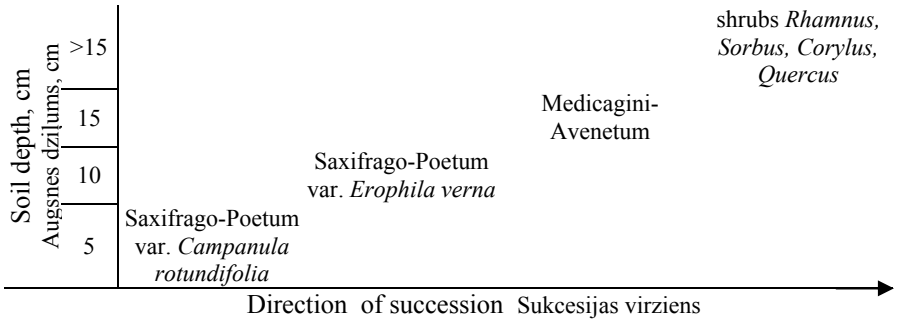

Fig. 6. Relation between soil depth and plant communities
6.att. Saistība starp augsnes dziļumu un augu sabiedrībām

Saxifrago-Poetum var. *Campanula rotundifolia* communities develop on dolomites where soil forming is suppressed by action of river. There is not yet soil or it is very shallow. Therefore species number is small and only some species, like *Medicago falcata, Potentilla reptans* etc. can reach high coverage. They root in dolomite fissures and cover ground with their

creeping or procumbent stems. In addition, *Medicago falcata* can obtain nitrogen with its root nodule bacteria; so the lack of nitrogen is not limiting for this plant. When soil getts slightly deeper, many therophytes appear. *Saxifraga tridactylites, Erophila verna, Cerastium semidecandrum* and *Acinos arvensis* are characteristic species for the community Saxifrago-Poetum var. *Erophila verna*.

Next stage (the ass. Medicagini-Avenetum) is characterised by the increase dominance of mesophilous species, such as *Festuca rubra, Achillea millefolium* and *Galium boreale*, as well as species of calcareous grasslands, like *Filipendula vulgaris*, *Poa angustifolia*, and *Centaurea scabiosa*. This stage can be maintained for a long time by mowing or grazing, but it is not the case for this area. Some features of the next stage of succession – shrub vegetation – are already apparent. Along the waterline, mostly *Salix* spp. and *Alnus incana* grow, but on the main portion of the slope frequent shrub species *Corylus avellana, Sorbus aucuparia, Rhamnus catharticai* occur.

We can not predict how rapid are vegetation changes. Ellenberg (1996) supposes that succession is very slow in such habitats because the shortage of nitrogen is important and it is accentuated by the frequent drying out of top soil. Therefore neither trees nor shrubs and large herbs can get established. On the other hand, overall eutrophication of environment promots substrate enrichment and such oligotrophic plant communities are replaced (Dierβen 1996; Ellenberg 1996; Pott 1995). In our opinion, the last process takes place in the area under investigation, too. Shrubs and expansive herbs (*Sobus aucuparia, Corylus avellana, Elytrigia repens, Dactylis glomerata, Anthriscus sylvestris, Rubus caesius*) as well as escaped species (*Populus longifolia, Amelanchier spicata, Acer negundo, Saponaria officinalis*) invade not only the gentlest part of the slope with rather deep soil but also the steep portion of the slope.

Plant communities described are rare in Latvia, especially communities of the Alliance Alysso-Sedion albi (O. Sedo-Scleranthetalia, Cl. Koelerio-Corynephoretea). The alliance includes xerothermophilous pioneer communities developing under extreme conditions – on rocks and sands with poorly developed dry, neutral to basic soils with low humus contents and where high amplitude of daily temperature in sunny days can be observed. Such communities are characteristic for Central and Southern Europe (Korneck 1975; Mucina et al. 1993) where the optimum area of alliance lies. Therefore communities of the alliance are very rare with impoverished species composition and found only fragmentary in Latvia. Many character species of the alliance (*Minuartia hybrida, Micropus erectus, Thlaspi perfoliatum* etc.) are absent and others (*Alyssum alyssoides, Hornungia petraea, Sideritis montana, Sedum sexangulare*) are very rare alien and

escaped plants in Latvian flora (Табака и др. 1988). Only *Saxifraga tridactylites* and *Jovibarba sobolifera* are native although rare species (reach their eastern and northern distribution boundary, respectively) in Latvia.

We assigned described communities on dolomites with very shallow soil to the Association Saxifrago-Poetum compressae. This association comprises pioneer vegetation mostly of antropogenic habitats – brick and stone walls, roofs etc. (Korneck 1975; Mucina et al. 1993; Schaminée et al. 1996). Rarely Saxifrago-Poetum communities occur also in natural habitats on calcareous rocks (Oberdorfer 1978; Pott 1995). Typically, Saxifrago-Poetum contain many ruderal species, like *Bromus spp., Conyza canadensis* etc. (Mucina et al. 1993; Oberdorfer 1978).

If compared with Saxifrago-Poetum in other regions, described community occur in natural habitat what is untypical for this association. Therefore it does not contain ruderal species, is more species rich and contains a number of Festuco-Brometea species. The last can be explained with its location close by Festuco-Brometea grassland (Medicagini-Avenetum). Syntaxonomically our communities are close to the Association Cerastietum pumili Oberd. et Th. Müller in Th. Müller 1961 (pioneer vegetation in natural habitats on calcareous rocks containing many Festuco-Brometea species (Oberdorfer 1978)), but character species of this association *Cerastium pumilum*, *C. brachypetalum, C. glutinosum* are absent (they do not occur in Latvia).

Distribution area of both mentioned associations is Central and Southern Europe and in Western Europe they reach the northern boundary of distribution (Schaminée et al. 1996). In Latvia, the investigated area could be considered as a point locality of Saxifrago-Poetum outside its main distribution area. Importantly that it supports also rare moss species *Mannia fragrans*. This is the only one locality for the species in Baltic countries (A.Āboliņa, pers.comm.), while the main distribution area is submeridional and meridional Europe and Asia.

The association Medicagini-Avenetum bears features of several classes (Festuco-Bormetea, Trifolio-Geranietea, Molinio-Arrhenatheretea and Koelerio-Corynephoretea). Traditionally, it has been classified under the Class Festuco-Brometea. Recent another classification was proposed by J.Schaminée and co-authors (Schaminée et al. 1996). They include association in the Class Koelerio-Corynephoretea, Order Trifolio-Festucetalia ovinae Moravec 1967, Alliance Sedo-Cerastion Sissingh et Tideman 1960 em. Weeda, Doing et Schaminée 1996 which contains grassland communities of river valleys on poor, sandy soils with high base saturation, and which is found in the Netherlands, Belgium, West and North Germany and Poland.

Habitat and vegetation structure of Medicagini-Avenetum of the Daugava River valley are very similar to communities described in the Netherlands (Schaminée et al. 1996). Vegetation is species rich and typical for river valleys (in Latvia, it is especially characteristic for Daugava River (Фатаре 1989)), and soil is loamy sand rich in bases, but with low nutrient contents in both cases.. As regarding dynamics, cessation of mowing and grazing leads the community to transform in vegetation of the class Trifolio-Geranietea (Geranion sanguinei) what is observed also in the Netherlands.

However, floristic composition posess some differences, for example, *Salvia pratensis, Thalictrum minus, Eryngium campestre* and *Ranunculus bulbosus* can not be found in our case. There are not also so many therophytes from the Class Koelerio-Corynephoretea, but a lot of Festuco-Brometea species (*Pimpinella saxifraga, Filipendula vulgaris, Fragaria viridis, Poa angustifolia*) have high constancy. Therefore we assigned the association to this class. However, with more data available, syntaxonomical position of this syntaxon in Latvia should be revised. As this association is found also in Lithuania (Balevičiene et al. 1998) we suppose its distribution area to be larger than it was considered earlier.

In our opinion it would be necessary to establish a protected nature area in order to maintain this biogeographically important habitat and to monitor the processes in vegetation and soil transformation. It could help also to reduce the influence of agricultural activities on this habitat (next to the slope on the terrace platform there is an arable land).

ACKNOWLEDGEMENTS

Authors are grateful to Dr. Austra Āboliņa and Dr. Baiba Bambe for their assistance in identification of bryophytes.

REFERENCES

Āboliņa A. 2001. Latvijas sūnu saraksts. *Latvijas Veģetācija* 3: 47-87

Balevičiene J., Kiziene B., Lazdauskaite Ž., Patalauskaite D., Rašomavičius V., Sinkevičiene Z., Tučiene A., Venckus Z. 1998. *Lietuvos Augalija* I. *Pievos*. Šviesa. Kaunas, Vilnius, 269 p.

Braun-Blanquet J. 1964. *Pflanzensoziologie*. Grundzüge der Vegetationskunde. Springer Verlag, Wien, New York, 865 S.

Dierschke H. 1994. *Pflanzensoziologie*. Verlag Eugen Ulmer, Stuttgart, 683 S.

Dierβen K. 1996. *Vegetation Nordeuropas*. Verlag Eugen Ulmer, Stuttgart, 838 S.

Ellenberg H. 1996. *Vegetation Mitteleuropas mit den Alpen*. Ulmer, Stuttgart, 1095 S.

Ellenberg H., Ruprecht D., Volkmar W., Willy W., Dirk P. 1992. *Zeigerwerte von Pflanzen in Mitteleuropa.* Verlag Erich Goltze KG, Göttingen, 258 S.

Fatare I. 1992. Latvijas floras komponentu izplatības analīze un tās nozīme augu sugu aizsardzības koncepcijas izstrādāšanā. *Vides aizsardzība Latvijā* 3. Rīga, 258 lpp.

Gavrilova Ģ., Šulcs V. 1999. *Latvijas vaskulāro augu flora*. *Taksonu saraksts*. Latvijas Akadēmiskā bibliotēka, Rīga, 136 lpp.

Hill M. O. 1979. *TWINSPAN. A FORTRAN Programm for Arranging Multivariate Data in an Ordered Two Way Table by Classification of the Individuals and Attributes*. Ecology and Systematics Cornell University Ithaca, New York, 47 p

Hulten E., Fries M. 1986. *Atlas of North European Vascular Plants. North of the Tropic of Cancer*. Koeltz Scientific Books, Federal Republic of Germany, Konigstein, vol. I, XVI+498pp, vol. II, XI+499-969 pp.

Korneck D. 1975. Beitrag zur Kenntnis mitteleuropaischer Felsgrus-Gesellschaften (Sedo-Scleranthetalia). *Mitteilungen der Floristich-soziologischen Arbeitsgemeinschaft.* Heft 18: 45-102

Laiviņš M., Jermacāne S. 1999. Neofītās laimiņu (*Sedum* L.) un dievkrēsliņu (*Euphorbia* L.) sabiedrības Latvijā. *Latvijas veģetācija* **2**: 7-28

Meusel H., Jäger E., Weinert E. 1965. *Vergleichende Chorologie der Zentraleuropäischen Flora.* Gustav Fischer Verlag, Jena, Bd.I, Text 583 S, Karten 258 S.

Meusel H., Jäger E., Rauschert S., Weinert E. 1978. *Vergleichende Chorologie der Zentraleuropäischen Flora.* Gustav Fischer Verlag, Jena, Bd.II Text 418 S. Karten, 259-421 S.

Oberdorfer E. 1978. Süddeutsche Pflanzengesellschaften. Teil II. *Pflanzensoziologie*, VEB Gustav Fischer Verlag, Jena, Bd.10, 355 s.

Piterāns A. 2001. Latvijas ķērpju konspekts. *Latvijas Veģetācija* 3: 5-46

Pott R. 1995. *Die Pflanzengesellschaften Deutschlands*. Ulmer. Stuttgart. 622 S.

Schaminée J.H.J., Stortelder A.H.F., Weeda E.J. 1996. De Vegetatie van Nederland. Deel 3. Plantengemeenschappen van graslanden, zomen en droge heiden. Opulus Press, Uppsala, 356 p.

Фатаре И. Я. 1987. Флора долины реки Даугава. В кн. *Флора и растителиность Латвийской ССР. Средне-Латвийский геоботанический район*. Зинатне, Рига, с.103-133

Фатаре И. 1989. *Флора долины реки Даугава*. Рига, Зинатне, 167 стр.
Табака Л., Гаврилова Г., Фатаре И. 1988. *Флора сосудистых растений Латвийской ССР*. Зинатне, Рига, 193 стр.

Sausas kalcifīlas dolomīta atsegumu un zālāju sabiedrības Daugavas krastā pie Dzelmēm

Solvita Jermacāne, Māris Laiviņš

Kopsavilkums

Atslēgas vārdi: Dolomīti, augu sabiedrības, Alysso-Sedion albi, Saxifrago tridactylito-Poetum compressae, Bromion, Medicagini-Avenetum.

Dolomītu atseguma veģetācija Daugavas krastā tika aprakstīta pēc Brauna-Blankē metodes, lai noskaidrotu šī unikālā biotopa augu sabiedrību struktūru, ekoloģiju un dinamiku.

Aprakstītas divas Latvijā retas augu sabiedrības: Saxifrago tridactylito-Poetum compressae un Medicagini-Avenetum pubescentis. Saxifrago tridactylito-Poetum compressae sabiedrība te sastopama kā punktveida atradne ārpus šīs asociācijas pamatareāla, kas ir Centrālā un Dienvideiropa.

Aprakstītajām sabiedrībām raksturīga silta, sausa augtene, kas ir bāziska un nabadzīga ar barības vielām. Augu sabiedrību telpisko izvietojumu (novietojums nogāzē) un struktūru (dzīves formas, ekoloģisko stratēģiju spektrs), kā arī sukcesiju nosaka augsnes dziļums.