

WILLOW GRAVEL BANK THICKETS (*SALICION ELEAGNI-DAPHNOIDES* (MOOR 1958) GRASS 1993) IN FRIULI VENEZIA GIULIA (NE ITALY)

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Izveček

Analizirali smo grmišča vrb, strojevca in rakitovca na rečnih prodiščih v Furlaniji Julijski krajini. Rečni sistem je v regiji dobro ohranjen in s svojo hidrodinamiko vpliva na velike površine, zato so združbe zveze *Salicion eleagni-daphnoides* (Moor 1958) Grass 1993 dobro zastopane in razširjene. Ugotovili smo tri asociacije *Salici incanae-Hippophaetum* Br.-Bl. in Volk 1939, *Salici-Myricarietum* Moor 1958 and *Salicetum incano-purpureae* Sillinger 1933. Zadnja je zelo heterogena, zato smo jo členili v subasociacije, višinske forme in faze.

Abstract

Willows, tamarisk and sea buckthorn thickets along gravel banks of rivers in Friuli Venezia Giulia are analysed. The river system of this region is still well conserved and hydrodynamics governs large surfaces; for this reason, coenoses of the alliance *Salicion eleagni-daphnoides* (Moor 1958) Grass 1993 are well represented and spread. Three associations have been detected: *Salici incanae-Hippophaetum* Br.-Bl. in Volk 1939, *Salici-Myricarietum* Moor 1958 and *Salicetum incano-purpureae* Sillinger 1933. The latter shows high internal variability which has been arranged in sub-associations, altitudinal forms, and phases.

Key words: Willow thickets, river systems, Friuli Venezia Giulia (NE Italy)

Ključne besede: vrbišča, porečja, Furlanija Julijska krajina (SV Italija)

1. INTRODUCTION

Woods and thickets along river gravel and sand banks strictly depend on hydrodynamics and, due to human regimentation of waters, are nowadays in regression. These very instable but cyclic systems are characterized by herbaceous and woody pioneer vegetation, which is in risk of vanishing. For this reason in some Austrian regions, the entire alliance *Salicion incanae* is included in the red list of habitats (Wittmann & Strobl 1990; Grabherr & Polatschek 1986).

In Friuli Venezia Giulia the herbaceous vegetation of gravel and sand banks has already been analysed by Poldini & Martini (1990, 1993). These authors detected three different associations that colonise these habitats: fitocoenon with *Petasites*

paradoxus, in the upper part of river courses (stretched), *Leontodo berinii-Chondriletum* T. Wraber 1965 (montane) and *Epilobio-Scrophularietum caninae* W. Koch et Br.-Bl. in Br.-Bl. 1949 (lower part of river courses). A revision of thickets and woods of the *Salicetea purpureae* Moor 1958 class is still missing but there are partial analyses such as a study for Tagliamento (Lippert et al. 1995) and one for Natisone-Nadiža (Šilc & Čušin 2000). In this paper, published and unpublished relevés from Friuli Venezia Giulia have been considered and analyzed in order to better understand this type of vegetation (alliance *Salicion eleagni-daphnoidis* (Moor 1958) Grass 1993).

While *Myricaria* and *Hippophae* stands can easily be referred to known coenoses for the Alps, *Salix incana* thickets show very high variability which can be arranged at different ranks.

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We do not deepen the problem of the interpretation of the class *Salicetea purpureae*. Some authors do not accept it; they consider it as an order inside the class *Quercu-Fagetea* Br.-Bl. et Vlieg. in Vlieg. 1938, or propose the new class *Salici purpureae-Populetea nigrae* (Rivas-Martinez & Cantò ex Rivas-Martinez et al.) Rivas-Martinez et al. 2001 which includes both *Salicetalia purpureae* Moor 1958 and *Populetales albae* Br.-Bl. 1931 (Rivas-Martinez et al. 2001) Based on floristic and syndinamic considerations, we maintain the class *Salicetea purpureae* as an independent syntaxon.

2. THE RIVERS SYSTEM OF FRIULI VENEZIA GIULIA

Friuli Venezia Giulia can be ecologically divided in a mountain area (Alpine and Pre-alpine) and in an alluvial plain which ends in the sedimentary coast. Major alpine rivers (Degano, Tagliamento, Fella, Isonzo-Soèa) form relatively integer systems where catenal and serial relationships are still well defined. Hydrodynamics is the major factor in conditioning the movements of alluvial materials and their stabilization and therefore the formation, persistence and degradation of herbaceous and shrubby coenoses along the river course. Several studies (Lippert et al. 1995, Ward et al. 1999; Kollmann et al. 1999; Gurnell et al. 2000) testify to this near-natural situation and to its great ecological value. Besides these alpine rivers, some torrents (Meduna and Cellina) flow from the Carnic Pre-Alps and form large alluvial deposits (gravels). These false-plain areas still conserve very interesting pioneer herbaceous coenoses ("magredi") with high biogeographical value (Chiapella Feoli & Poldini 1993).

The granulometric differentiation between high (gravels) and low plain (sand and clay) has contributed to the formation of two different ecological systems. Between them there is a spring belt where the watershed emerges and gives place to a system of spring rivers with short courses: along these rivers there are no formations of *Salicion eleagni-daphnoidis*, but only *Salicion cinereae* Müll. et Görs 1958 bushes and *Salicion albae* Soó em. Moor 1958 woods.

2.1 Data and methods

Published (Lippert et al. 1995, Šilc & Čušin 2000) and unpublished relevés has been collected

according to Braun-Blanquet (1964) method and analysed. Cover values are not subdivided by layers, because this kind of coenoses is always bi-stratified. Only one notable differentiation can be detected between montane and hill-plain form; in the first one shrubs are smaller, due to the primitive conditions and frequent disturbance, while in the hill-plain forms willows are usually taller (small trees). This difference is not significant to the statistical elaboration of relevés.

Five relevés for each of the typologies have been drawn from Lippert's and Šilc's papers. All relevés have been implemented in a vegetation database (Gallizia Vuerich et al. 1998) and the extracted tables have been numerically processed using SYN-TAX package (Podani 1993). Using cluster analyses, dendrograms based on average and complete links have been built. Analytic and synthetic tables have been compiled.

Floristic nomenclature follows Poldini (1991).

Willow brushes show high internal variability due to the concurrent influence of different factors. We tried to schematise it using three different categories: sub-associations, altitudinal forms (Matuszkiewicz & Matuszkiewicz 1981) and phases. A transversal sub-division can be detected; it determines the formation of sub-associations, the discriminative factor, in the case of willow brushes, being the degree of soil humidity. The subdivision into altitudinal forms follows the direction source-mouth of the river course. A temporal division (phase) relates to in situ modifications that depend on exogenous factors which, in these habitats, are represented by the hydrodynamic cycles (flooding and re-deposits of alluvial materials) (Kollmann et al. 1999, Gurnell et al. 2000). These phases differ from the temporal stages of vegetation series which are instead conditioned by autogenous factors and by the co-evolution of soil and vegetation.

3. RESULTS

Class *Salicetea purpureae* Moor 1958

Characteristic species: *Salix purpurea*, *Populus nigra*, *Salix alba*, *Salix triandra*

River banks brushes and woods

Order *Salicetalia purpureae* Moor 1958

Characteristic species: see class

Alliance *Salicion eleagni-daphnoidis* (Moor 1958)
Grass 1993

Characteristic species: *Salix eleagnos*, *Salix daphnoides*, *Hippophae rhamnoides* subsp. *fluviatilis*, *Myricaria germanica*

Differential species : *Petasites paradoxus*

Salix eleagnos brushes

3.1 *Salici incanae-Hippophaetum* Br.-Bl. in Volk 1939 (Tab. 1)

Willow and sea buckthorn brushes

Dominant species: *Hippophae rhamnoides* subsp. *fluviatilis*.

Differential species : *Euphorbia cyparissias*, *Melilotus alba*, *Achillea millefolium*, *Pinus sylvestris*.

Constant companions: *Achnatherum calamagrostis*, *Populus nigra*, *Petasites paradoxus*, *Ostrya carpinifolia*, *Sanguisorba minor*.

Floristic composition: the association is dominated by *Hippophae rhamnoides* subsp. *fluviatilis*, which is always present with high cover values. Among woody species, *Populus nigra* and *Salix daphnoides* are the most frequent, but also *Ostrya carpinifolia*, *Pinus sylvestris* and *Alnus incana* are common and indicate a relatively stabilized and dry situation. Among grasses and herbs, grassland and meadow species (*Sanguisorba minor*, *Euphorbia cyparissias*, *Galium album*, *Dactylis glomerata*, *Sesleria albicans*, *Carlina vulgaris*, etc.) indicate a certain level of stabilization of gravels, while *Thlaspietea* species (*Petasites paradoxus*, *Gypsophila repens*, *Achnatherum calamagrostis* and *Hieracium piloselloides*) suggest a connection with the herbaceous gravel pioneer coenoses.

Syntaxonomy: *Populus nigra* and *Salix purpurea* represent the connection with the class, while *Salix eleagnos*, *Salix daphnoides* and *Hippophae rhamnoides* subsp. *fluviatilis* that with the alliance. Also the differential species *Petasites paradoxus* is very frequent. For some authors (Pott 1995, Seibert & Conrad 1992) this association is synonymous with *Hippophaeo-Berberidetum* Moor 1958 (*Beberidion* Br.-Bl. 1950, *Prunetalia* R. Tx. 1952, *Rhamno-Prunetea* Rivas Goday et Borja Carbonell 1961). We prefer to follow Grass (1993) and maintain its independence on the basis of the floristic composition which justifies its framing in the *Salicetea purpurea* class, despite its connection with *Ostryo-Carpinion* Horvat (1954) 1950 and *Erico-Pinetea* Horvat 1959.

Synecology: *Salici-Hippophaetum* is a relatively stable association which grows on partially stabilized gravel banks. In the region this coenosis is in serial connection with *Alnetum incanae* in the endalpic area

and with *Alno incanae-Pinetum sylvestris* Poldini 1984 in the mesalpic area. Where it grows in proximity of mountain slopes with hop-hornbeam woodlands or black pine forest, the participation of species related to these woods increases. Besides *Salici-Hippophaetum* and *Hippophae-Berberidetum*, sea buckthorn can also be found on steep slopes of the montane belt, where it does not form an independent association.

Synchronology: the association is present along all the Alps. In Friuli Venezia Giulia it can be found mainly along the river Tagliamento and some of its tributaries.

3.2 *Salici-Myricarietum* Moor 1958 (Tab. 2)

Willow-tamarisk brushes

Dominant species: *Myricaria germanica*

Differential species: *Tussilago farfara*, *Calamagrostis pseudophragmites*

Floristic composition: besides the dominant species *Myricaria germanica*, which determines the physiognomy and the structure, *Salix eleagnos* and *S. daphnoides* are the most frequent bushes while *S. purpurea* is only sporadic. Among grasses, *Calamagrostis pseudophragmites* is constant and can be considered as a differential species. It is the first species which colonizes river islands made of fine materials (Fitocoenon with *Calamagrostis pseudophragmites*). Also *Tussilago farfara* prefers fine substrata and differentiates this coenosis from the other of the *Salicion incanae* alliance.

Syntaxonomy: *Salix eleagnos*, *S. daphnoides*, *Myricaria germanica* and the differential *Petasites paradoxus* ensure the connection with the alliance, while *Salix purpurea* and *Populus nigra* provide that with the class.

Subtypes: this coenosis can be subdivided into two subtypes; the first one can be considered as the typical form, with very high cover values of *Myricaria* and few other species; the second one represents instead a more primitive stage and is characterized by lower cover values of *Myricaria* and higher participation of pioneer species such as *Petasites paradoxus*, *Hieracium piloselloides*, *Gypsophila repens*, etc. Four relevés have been collected near Sappada (Belluno, 1200 m. a.s.l.) in the upper part of the course of the river Piave. They present a low participation of termophilous elements such as *Populus nigra*, high cover values of *Alnus incana* and the presence of some *Molinio-Arrhenatheretea* species such as *Trifolium pratense* and *Centaurea nigrescens* subsp. *transalpina*. This group of relevés can be

considered as an inner alpine and young variant of the association.

Synecology: the association is the most pioneer within the *Salicion incanae* alliance. It colonizes stands of fine materials in the braided course of rivers, where the water flow often alters the position of sediments. However these continuous changes guarantee the survival of *Myricaria* populations which are able to move from one deposit to another but are not competitive in stabilized sediments. Because almost all water courses have been regulated, this dependency on high river dynamics makes the survival of these coenoses difficult and therefore this species is in danger of extinction. Interesting studies have been carried out to better understand the biology of this species and to define conservation strategies. *Myricaria* is an oligotrophic species which grows on soil with low phosphorous (1,5 mg/kg) and nitrogen (0,015 %) content (in Isar and Lech). Thanks to its reduced leaves and the well developed root system which can reach the watershed, it can survive to long periods of hydric stress. *Myricaria* bushes can live up to some decades and be completely covered by alluvial material. It is an anemochorous species which can colonize totally uncovered areas. Its seeds have high germination speed (about 90 % of the seeds sprout between 4 and 20 hours) but very short persistence so that this species cannot build a seed-bank (Bill et al. 1997, Müller 1995, Müller-Schneider 1964, Petutschinig 1994, Platcher 1996).

Synchorology: This association is present all over the Alps both in the alpine and prealpine areas. It reaches also the northern Apennines (Biondi et al. 1997) and the Balkan peninsula (Trinajstić 1992), but is, almost everywhere, regressing. In Friuli Venezia Giulia it grows along the rivers Degano and Tagliamento.

3.3 *Salicetum incano-purpureae* Sillinger 1933 (Tab. 3)

Dominant species: *Salix eleagnos*

Differential species: *Solanum dulcamara*

Floristic composition: the association is dominated by *Salix eleagnos* which always shows high cover values. Other bushes are: *Salix purpurea*, sporadic and with low cover values, *Hippophae rhamnoides* subsp. *fluviatilis* and *Populus nigra* which is concentrated only in one of the variants. Among grasses and herbs, *Petasites paradoxus*, *Rubus caesius* and *Brachypodium sylvaticum* are the most common.

Syntaxonomy: *Salix eleagnos*, *Hippophae rhamnoides* subsp. *fluviatilis* and the differential species *Petasites paradoxus* ensure the connection with the alliance, while *Salix purpurea* and *Populus nigra* that with the class.

Relevés of the avanalpic area are characterized by a high presence of thermophilous and adventitious species. They could be interpreted as a variant of the association *Saponario-Salicetum purpureae* Tchou (1947) 1948, which has been described for Provence. The original (Tchou 1948) and Piemonte (Montanari & Gentile 1979) relevés show, instead, a significant presence of thermophilous trees such as *Fraxinus oxycarpa*, *Alnus glutinosa*, *Populus alba* and *Ulmus minor* which are completely absent from the relevés from Friuli. These species indicate also a major level of soil evolution. For this reason the latter as well as the relevés from Marche (Baldini & Biondi 1993), should be attributed to a thermophilous variant of the association *Salicetum incano-purpureae*.

Subtypes: as anticipated in the method chapter, willow brushes are very heterogeneous. The association in Friuli Venezia Giulia can be divided into sub-associations, altitudinal forms and phases. The following scheme synthesizes this complex articulation:

- 1) Subass. *typicum*
- 2) Subass. *petasitetosum hybridi*
 - a) Montane form
 - b) Hill form
 - I) phase with *Ligustrum vulgare*
 - II) phase with *Acer pseudoplatanus*
 - c) Plain form
 - III) phase with *Salix purpurea*
 - IV) phase with *Populus nigra*

The new subassociation *petasitetosum hybridi* (lectotypus: tab. 1 ril. 9 in Šilc & Čušin 2000) subass. nova hoc loco is proposed. It corresponds to more mesophylous conditions. It is well represented along the river Natisone-Nadiža which flows among *Tilio-Acerion* and *Erythronio-Carpinion* forests. It is characterized by several mesophilous herbaceous species such as *Petasites hybridus*, *Knautia drymeia* subsp. *drymeia*, *Cirsium oleraceum*, *Aegopodium podagraria*, etc. So far it has been observed only in the hill belt.

Following the river course from source to mouth, three different altitudinal forms can be detected. The montane form is represented by pauci-specific brushes with *Salix eleagnos*, *Petasites paradoxus* and very few other species. It grows along the stretched part of river courses and is dynamically

connected with the fitocenon with *Petasites paradoxus* and *Alnetum incanae*. The hill form is characterized by some mesothermic elements such as *Alnus incana*, *Calamagrostis varia* and *Galium laevigatum*. It can be found along the braided part of river courses and is dynamically connected with the herbaceous association *Leontodo-Chondriletum*. The plain form is present in the high plain and is characterized by high participation of termophilous and ruderal/adventitious species.

Inside the hill form two phases can be distinguished:

- phase with *Ligustrum vulgare* which develops in more xerophyllous habitats and is characterized by *Ligustrum vulgare*, *Galium album* and by the absence of mesophilous species.
- phase with *Acer pseudoplatanus* which represents a mature situation with mesophilous trees such as *Acer pseudoplatanus* and *Carpinus betulus*.

Also the plain form can be divided into two phases which correspond to different level of consolidation of alluvial deposits. The first phase (phase with *Salix purpurea*) is characterized by the high cover of *Salix purpurea*, *Robinia pseudoacacia* and some annual species of *Chenopodietae* such as *Polygonum persicaria* and *Chenopodium album*. The second phase (phase with *Populus nigra*) shows the highest cover values of the termophilous *Populus nigra* and the constant presence of *Amorpha fruticosa* and *Oenothera biennis*. It seems very close to the variant with *Amorpha fruticosa* of *Salicetum incano-purpureae*, reported by Biondi et al. (1999).

Relevé 1 represents a very poor stand of *Salix eleagnos* in the avanalpic area.

Synecology: the coenoses is present along gravel and sand river banks; it may be preceded by close and monospecific stands of *Salix eleagnos*. It grows on not entirely stabilized gravel.

Synchorology: the association is present along all the Alps, the Apennines and in Balkan peninsula (Trinajstić & Franjić 1994). In Friuli Venezia Giulia it can be found along all major rivers.

4. CONCLUSIONS

On the southern slopes of the eastern Alps, some river systems still have an high degree of naturalness thank to the absence, or a low level, of water regimentation. These systems include a complex of herbaceous and shrubby pioneer vegetation with an high conservation value. Willow, sea buckthorn and tamarisk thickets of Friuli Venezia Giulia and

the isoecic formation of the northern slopes of the Alps and Central Europe can be easily referred to an unique coenoses. However, they are well differentiated by a group of illyric and southern species such as *Ostrya carpinifolia*, *Fraxinus ornus*, *Peucedanum verticillare*, *Pinus nigra*, etc., which come from the neighbouring hop hornbeam-manna ash woodland, black pine forest and mapple-hornbeam forest of *Erythronio-Carpinion*.

5. LOCALITIES AND SPORADIC SPECIES

L = Lippert et al. (1995)

S = Šilc & Čušin (2000)

Salici incanae-Hippophaetum Br.-Bl. in Volk 1939

Localities: 1 But torrent near Cercivento (UD) (9443/4), 150 m², 80%, 24/07/1977; 2 Degano torrent near Ovaro (UD) (9543/1), 150 m², 75%, 10/08/1979; 3 Chiarzò torrent near Esemone di sopra (UD) (9543/3), 130 m², 75%, 14/08/1979; 4 Tagliamento river near Caneva (UD) (9543/1), 200 m², 75%, 27/06/1977; 5-6 But torrent near Zuglio (UD) (9544/1), 120, 120 m², 85, 80%, 18/08/1995; 7 Degano torrent near Val Pesarina (UD) (9543/3), 150 m², 80%, 18/08/1995; 8 But torrent near Imponzo (UD), 100 m², 70%, 18/07/1995; 9 Campo di Osoppo (UD) (9744/1), 200 m², 85%, 18/07/995; 10 Tagliamento river near Bordano (UD) (9644/1), 150 m², 70%, 08/07/1997; 11 Cavazzo (UD) (9644/1), 120 m², 75%, 18/07/1995; 12 Campo di Osoppo (UD) (9744/1), 170 m², 80%, 18/07/1995; 13 Tagliamento river near Cornino (UD) (9744/3) L; 14 Tagliamento river near Bolzano (PN) (0143/2) L; 15 Tagliamento river near Amaro (UD) (9644/2) L; 16 Tagliamento river near Cornino (UD) (9744/3) L; Tagliamento river near Cornino (UD) (9744/3) L.

Sporadic species: *Aegopodium podagraria* 3(r); *Agrostis gigantea* 12(1), 13(+); *Agrostis tenuis* 6(+); *Allium carinatum* 3(1); *Amelanchier ovalis* 15(+); *Amorpha fruticosa* 12(1), 14(+); *Astragalus glycyphyllos* 8(+); *Astragalus onobrychis* 14(+); *Brachypodium rupestre* 12(+); *Briza media* 8(+); *Bromus erectus* (aggr.) 9(+); *Campanula rapunculoides* 11(+); *Cardamine impatiens* 7(+); *Carduus crispus* 5(+); *Carduus defloratus* 11(+), 13(+); *Carex diandra* 7(4); *Carex flacca* 15(+), 16(+); *Carex mucronata* 17(+); *Centaurea bracteata* 10(+); *Centaurea jacea* 12(+), 14(+); *Centaurea scabiosa* 6(+), 12(+); *Chamaecytisus purpureus* 12(+), 15(1); *Cichorium intybus* 12(+);

Clinopodium vulgare 1(+); *Corylus avellana* 11(+), 17(+); *Crataegus monogyna* 12(+); *Crepis rheoadifolia* 9(+), 12(+); *Equisetum ramosissimum* 7(+); *Erica herbacea* (1); *Erigeron acris* 7(+); *Eupatorium cannabinum* 9(+); *Euphrasia stricta* 9(+); *Festuca norica* 16(3); *Filipendula ulmaria* 4(+); *Fragaria vesca* 1(1); *Frangula alnus* 15(1), 16(+); *Fraxinus excelsior* 8(+), 11(+); *Galeopsis speciosa* 7(+); *Geranium sanguineum* 15(2); *Globularia cordifolia* 16(1); *Globularia punctata* 16(+); *Helianthemum ovatum* 11(+), 14(1); *Helianthus tuberosus* 5(1), 7(+); *Hemerocallis lilio-asphodelus* 15(r); *Hieracium glaucum* 3(r); *Hieracium laevigatum* 8(+); *Hieracium pilosella* 10(+); *Hieracium sabaudum* 6(+), 6(+); *Hieracium stacticifolium* 7(+); *Hieracium sylvaticum* 1(2); *Ilex aquifolium* 17(r); *Impatiens glandulifera* 7(+); *Juncus inflexus* 2(+); *Knautia drymeia* subsp. *drymeia* 11(+); *Lathyrus sylvestris* 7(+); *Leontodon hispidus* 2(+); *Linaria alpina* 8(+); *Medicago lupulina* 6(+), 7(+); *Mentha arvensis* 2(+); *Mentha longifolia* 2(+), 7(+); *Oenothera biennis* 12(+); *Pastinaca sativa* 5(+); *Petasites hybridus* 2(2); *Peucedanum oreoselinum* 16(+); *Phalaris arundinacea* 5(+), 7(1); *Phleum pratense* 7(+); *Pimpinella major* 8(+); *Poa nemoralis* 1(+), 7(1); *Polygala vulgaris* 1(+); *Potentilla reptans* 7(+); *Quercus pubescens* 17(+); *Rhamnus saxatilis* 15(+); *Rhinanthus aristatus* 16(+), 17(+); *Robinia pseudacacia* 8(+), 15(+); *Rosa glauca* 15(+); *Rubus idaeus* 2(1); *Rubus ulmifolius* 9(+); *Rumex scutatus* 5(+); *Salvia glutinosa* 11(+); *Saponaria officinalis* 17(+); *Satureja montana* subsp. *variegata* 16(+); *Senecio inaequidens* 9(+); 11(+); *Seseli gouanii* 16(+); *Silene alba* 7(+); *Solidago gigantea* var. *serotina* 5(1), 11(+); *Tanacetum vulgare* 1(1), 6(+); *Taraxacum* sect. *Taraxacum* 8(+); *Thalictrum minus* 11(+); *Thesium linophyllum* 14(1); *Thymus longicaulis* 16(2), 17(1); *Thymus praecox* subsp. *polytrichus* 14(2); *Thymus pulegioides* 11(+), 13(+); *Tofieldia calyculata* 15(+); *Tortella tortuosa* 16(2), 17(2); *Trifolium pratense* 2(1), 12(+); *Trifolium repens* 2(+), 7(+); *Tussilago farfara* 1(2); *Verbascum thapsus* 12(+); *Viburnum opulus* 8(+); *Vicia tenuifolia* 11(+); *Vincetoxicum hirundinaria* 11(+), 12(+); *Viola hirta* 2(+).

Salici-Myricarietum Moor 1958

Localities: 1 Tagliamento river near Amaro (UD) (9644/2) L; 2 Degano river near Ovaro (UD) (9543/1), 100 m², 70%, 18/08/1995; 3 Tagliamento river near Amaro (UD) (9644/2) L; 4 Tagliamento river near Cornino (UD) (9744/3) L; 5-6-7 Tagliamento river near Amaro (UD) (9644/2) L; 8 Tagliamento river near Bordano (UD) (9644/4), 120 m², 75%, 11/06/1995; 9-10-11 Tagliamento river near Portis (UD) (9644/2), 100, 120, 100 m²,

80, 70, 75%, 08/07/1995; 12 Tagliamento river near Cornino (UD) (9744/3) L; 13 Tagliamento river near Amaro (UD) (9644/2) L; 14 Tagliamento river near Cornino (UD) (9744/3) L; 15 Tagliamento river near Amaro (UD) (9644/2) L; 16-17 Piave river near Cima Sappada (BL) (9442/1), 100, 100 m², 65, 60 %, 18/08/1995; 18 Degano torrent near Ovaro (UD) (9543/1), 100 m², 70%, 18/08/1995; 19 Piave river near Cima Sappada (BL) (9442/1), 100 m², 75%, 18/08/1995.

Sporadic species: *Acer pseudoplatanus* 6(+); *Achnatherum calamagrostis* 10(+), 11(+); *Aconitum paniculatum* 18(+); *Agropyron caninum* 19(+), 20(1); *Agropyron pungens* 14(+), 15(+); *Agropyron repens* 9(+), 20(2); *Agrostis canina* 19(+); *Anthriscus sylvestris* 20(+); *Arrhenatherum elatius* 20(1); *Aruncus dioicus* 19(+); *Betula pendula* 12(+); *Bidens tripartita* 15(+); *Blackstonia perfoliata* 10(+); *Brachypodium sylvaticum* 16(+); *Buphthalmum salicifolium* 11(+), 19(+); *Calamagrostis arundinacea* 21(1); *Calystegia sepium* 3(1); *Campanula cespitosa* 18(+); *Carduus carlinifolius* 18(+); *Carduus crispus* 21(+); *Carex caryophyllea* 11(+); *Carex flava* 12(1); *Centaurea jacea* 15(+); *Centaureum erythraea* 11(+); *Chaenarrhinum minus* 16(+); *Chaerophyllum hirsutum* 18(+); *Chondrilla chondrilloides* 13(+); *Cichorium intybus* 14(r); *Cirsium erisithales* 19(1), 21(+); *Deschampsia cespitosa* 4(+); 12(+); *Echium vulgare* 15(+); *Epipactis atrorubens* 18(+), 19(+); *Equisetum arvense* 3(1); *Equisetum palustre* 8(+); *Equisetum variegatum* 10(1), 12(+); *Erigeron annuus* subsp. *annuus* 9(+); *Erigeron annuus* subsp. *strigosus* 3(+); *Eupatorium cannabinum* 10(+), 12(+); *Euphorbia cyparissias* 9(+); *Euphrasia rostkoviana* 19(+); *Frangula alnus* 9(+); *Galeopsis angustifolia* 15(+); *Galeopsis speciosa* 21(+); *Galium levigatum* 19(+); *Geranium robertianum* 8(+); *Helianthemum grandiflorum* 18(+); *Helianthus tuberosus* 20(1); *Hieracium sylvaticum* 18(+), 20(+); *Hippocrepis comosa* 18(+); *Holoschoenus romanus* 12(+); *Impatiens noli-tangere* 21(+); *Impatiens parviflora* 8(+), 15(r); *Juncus alpino-articulatus* 10(+), 12(+); *Juncus bufonius* 8(+); *Juncus inflexus* 12(+); *Juncus subnodulosus* 11(+), 12(1); *Larix decidua* 18(1); *Laserpitium siler* 18(+); *Leontodon berinii* 14(+), 15(+); *Leucanthemum vulgare* (aggr.) 18(+), 19(1); *Ligustrum vulgare* 10(+); *Linum catharticum* 12(+); *Lycopus europaeus* 6(+), 8(+); *Melica nutans* 12(+); *Melilotus alba* 16(r); *Mentha aquatica* 8(+); *Myosotis scorpioides* 8(+); *Ostrya carpinifolia* 10(+), 11(+); *Parnassia palustris* 19(+), 21(+); *Petasites hybridus* 4(2); *Peucedanum verticillare* 10(+); *Picea abies* 18(1), 19(+); *Pimpinella major* 19(+); *Pinus nigra* 11(+); *Pinus sylvestris* 11(+); *Plantago lanceolata* 9(+), 16(+);

Plantago major subsp. *major* 9(+); *Plantago major* subsp. *intermedia* 14(+); *Plantago media* 20(+); *Pleurospermum austriacum* 18(+); *Poa annua* 8(+), 20(+); *Poa nemoralis* 20(1); *Poa trivialis* 8(+); *Polygonum lapathifolium* 8(+); *Polygonum persicaria* 6(+); *Polygonum viviparum* 18(+); *Potentilla reptans* 15(r); *Prunella vulgaris* 20(+); *Pyrola media* 18(1); *Ranunculus repens* 16(r); *Saxifraga aizoides* 19(+); *Scabiosa gramuntia* 9(+), 11(+); *Scabiosa lucida* 18(+); *Schoenus nigricans* 10(+); *Sesleria albicans* 19(+); *Silene pusilla* 19(+); *Silene vulgaris* subsp. *vulgaris* 19(+), 20(+); *Silene vulgaris* subsp. *glareosa* 16(+); *Solanum dulcamara* 15(r); *Solidago gigantea* var. *serotina* 7(+); *Sparganium emersum* subsp. *fluitans* 14(r); *Tanacetum vulgare* 7(+), 14(r); *Taraxacum* sect. *Taraxacum* 20(+); *Thesium alpinum* 18(+); *Thesium divaricatum* 11(+), 12(+); *Thymus pulegioides* 18(+).

Salicetum incano-purpureae Sillinger 1933

Localities: 1 Isonzo river near Peteano (GO) (0147/1), 200 m², 65%, 01/07/1979; 2 Tagliamento river near Passo of Mauria (UD) (9541/3) L; 3-4-5 Tagliamento river near Forni di Sopra (UD) (9541/4) L; 6 But torrent near Zuglio (UD) (9544/1), 170 m², 100 %, 25/08/1995; 7 But torrent near Cercivento (UD) (9343/4), 150 m², 90%, 24/07/1977; 8 Tagliamento river near Caneva (UD) (9543/4), 25/06/1977 ; 9 Tagliamento river near Amaro (UD) (9644/2) L; 10 Confluence between Cellina and Meduna torrents (PN) (9942/4), 200 m², 75%, 06/09/1979; 11 Tagliamento river near Peonis (UD) (9744/1), 150 m², 75%, 11/06/1995; 12 Natisone river near Nadizi (SLO) (9746/2) S; 13 Natisone river near Borjana (SLO) (9746/2) S; 14 Natisone river near Mokar (SLO) (9746/2) S; 15 Natisone river near Gabri at Podbela (SLO) (9746/4) S; 16 Natisone river near Loch of Pulfero (UD) (9846/2) S; 17 Natisone river near Brischis (UD) (9846/2) S; 18 Torrente Artugna (PN) (9941/1), 120 m², 70%, 03/07/1980; 19 Isonzo river near Farra d'Isonzo (GO) (0047/3), 200 m², 90%, 05/07/1979; 20 Isonzo river near Sagrado (GO) (0146/2), 180 m², 95%, 30/06/1979; 21-22 Isonzo river near Farra d'Isonzo (GO) (0047/3), 150, 200 m², 85, 85%, 06/07/1979; 23-24-25 Isonzo river near Sagrado (GO) (0146/2), 150, 200, 180 m², 80, 85, 85%, 27/06/1979, 30/06/1979 and 26/06/1979; 26-27 Isonzo river near Poggio III Armata (GO) (0147/1), 150, 200 m², 75, 80%, 26/06/1979 and 01/07/1979; 28-29 Tagliamento river between S. Vito and Cornino (UD) (9744/3), 180, 200 m², 90, 85%, 08/07/1995; 30 Isonzo river near Fogliano (GO) (0146/2), 200 m², 85%, 02/08/1979; 31

Isonzo river near Ruda (GO) (0146/3), 150 m², 90%, 18/07/1979; 32 Tagliamento river near Spilimbergo (PN) (9843/3) L; 33 Tagliamento river near Casarsa (PN) (9843/3) L; 34 Tagliamento river near Spilimbergo (PN) (9843/3) L; 35 Tagliamento river near Bolzano (PN) (0143/2) L; 36 Tagliamento river near Spilimbergo (PN) (9843/3) L.

Sporadic species: *Achillea roseo-alba* 29(+); *Achnatherum calamagrostis* 12(+), 13(+), 18(1); *Aethionema saxatile* 5(+); *Agropyron caninum* 17(+); *Alnus glutinosa* 19(+), 21(+), 31(1); *Amaranthus cruentus* 21(+); *Ambrosia artemisiifolia* 28(+), 29(+); *Anagallis arvensis* 19(+), 20(+); *Anemone nemorosa* 6(+); *Anthriscus sylvestris* 21(+), 27(+); *Aquilegia atrata* 13(+), 14(+); *Aquilegia einseleana* (r); *Arabis turrita* 13(+), 14(+); *Asarum europaeum* 12(r), 13(+), 16(+); *Asperula cynanchica* 35(+); *Asperula purpurea* 18(+); *Asperula taurina* 13(+); *Bidens tripartita* 20(+), 30(+), 31(+); *Biscutella levigata* 4(+); *Brassica napus* 19(+), 21(+); *Brassica oleracea* 20(+); *Bromus erectus* (aggr.) 36(+); *Calamagrostis arundinacea* 27(+), 31(1); *Campanula cespitosa* 2(+), 3(+), 4(+); *Campanula rapunculoides* 13(+); *Campanula rapunculus* 21(+); *Cardamine impatiens* 11(1); *Cardamine pratensis* (aggr.) 20(+), 30(+); *Cardaminopsis arenosa* 19(+), 20(+), 22(2); *Carduus carlinifolius* 36(r); *Carduus defloratus* 4(r), 18(+); *Carduus nutans* 18(+), 21(+); *Carex alba* 6(+), 12(+); *Carex brachystachys* 3(r); *Carex digitata* 6(+), 12(+); *Carex flava* s.l. 3(+); *Carex ornithopoda* 2(r), 5(+); *Carex pendula* 30(+); *Carex pilulifera* 33(+); *Centaurea jacea* 20(+), *Centaurea nemoralis* 33(+); *Centaurea nigrescens* subsp. *transalpina* 6(+); *Centaurea scabiosa* 18(+); *Centaureum erythraea* 32(+); *Centaureum pulchellum* 18(+); *Cerastium glomeratum* 1(+); *Chamaecytisus purpureus* 5(+); *Chelidonium majus* 21(+); *Chondrilla chondrilloides* 11(+); *Cichorium intybus* 10(+), 15(+); *Cirsium arvense* 9(+); *Cirsium vulgare* 8(+); 14(+); *Clematis recta* 31(+); *Coryza canadensis* 29(+); *Coronilla emerus* s.l. 18(+); *Crataegus monogyna* 10(+); *Crepis pulchra* 1(+); *Cyclamen purpurascens* 2(r), 12(r); *Daphne mezereum* 12(+); *Doronicum germanicum* 32(+), 34(1); *Dryas octopetala* 3(1), 4(1); *Epilobium dodonaei* 11(1), 34(+); *Equisetum arvense* 12(+); *Equisetum hyemale* 11(+); *Equisetum palustre* 31(+); *Equisetum ramosissimum* 28(+), 29(+); *Erica herbacea* 3(+); *Erigeron annuus* subsp. *strigosus* 10(+); *Euphorbia dulcis* 6(+); *Euphorbia triflora* subsp. *kernerii* 2(+); *Euphrasia salisburgensis* 3(r); *Fallopia convolvulus* 20(+); *Festuca arundinacea* 32(+); *Festuca pratensis* subsp. *pratensis* 22(+), 23(+), 24(+); *Filipendula ulmaria* 8(+); *Fragaria vesca* 8(+); *Fraxinus ornus* 6(+);

Galeopsis angustifolia 1(+), 20(+), 21(+); *Galeopsis ladanum* 11(+); *Galinsoga parviflora* 20(+), 21(+); *Galium aparine* 11(1); *Galium lucidum* 15(+); *Galium verum* 32(1); *Genista germanica* 5(+); *Genista radiata* 4(+); *Geum urbanum* 11(+); *Glechoma hederacea* 13(+), 14(+); *Gymnocarpium robertianum* 3(+); *Helianthemum nummularium* subsp. *nummularium* 5(r); *Helianthemum ovatum* 31(1), 32(+), 33(1); *Hieracium bifidum* 3(+); *Hieracium pilosella* 11(1), 28(+); *Hieracium piloselloides* 36(+); *Hieracium sabaudum* 6(+); *Hypericum montanum* 6(+); *Impatiens glandulifera* 16(+); *Impatiens noli-tangere* 26(+); 27(+); *Impatiens parviflora* 13(+), 14(+), 17(+); *Juncus alpino-articulatus* 29(+); *Juncus bufonius* 29(+); *Koeleria pyramidata* 34(+), 35(+), 36(+); *Laburnum alpinum* 12(+); *Lamiaeum flavidum* 12(+); *Lamium orvala* 6(+), 13(+), 22(+); *Lamium purpureum* 19(+); *Lapsana communis* 15(+); *Larix decidua* 2(r); *Laserpitium peucedanoides* 2(r); *Leontodon hispidus* 10(1); *Leucanthemum vulgare* (aggr.) 19(+), 21(+); *Linaria alpina* 5(+); *Linum catharticum* 5(r); *Linum tenuifolium* 33(+); *Lolium perenne* 19(+); *Lonicera xylosteum* 10(+); *Lunaria rediviva* 16(+); *Lycopus europaeus* 10(1), 31(+), 32(+); *Lysimachia vulgaris* 11(+), 32(+); *Lythrum salicaria* 21(+), 26(+), 29(+); *Medicago carstiensis* 18(1); *Medicago lupulina* 13(+), 19(+); *Mentha aquatica* 10(+), 23(r), 24(+); *Mercurialis annua* 12(+), 20(+), 24(+); *Moehringia ciliata* 3(r); *Morus alba* 31(+); *Mycelis muralis* 13(+); *Myosotis arvensis* 19(+); *Myosotis sylvatica* 18(+); *Myosoton aquaticum* 21(+); *Oenothera parviflora* 35(+); *Omphalodes verna* 12(+), 15(r); *Ostrya carpinifolia* 10(+), 18(2); *Panicum capillare* 20(+); *Papaver rhoeas* 21(+); *Parietaria officinalis* 21(+), 27(+), 31(+); *Parnassia palustris* 3(r); *Petasites albus* 12(r), 16(+), 17(+); *Petrorhagia saxifraga* 11(+); *Phleum pratense* 14(+); *Picea abies* 2(+), 4(+), 6(+); *Picris hieracioides* 10(+), 28(+), 29(+); *Pimpinella major* 7(+), 13(+), 14(+); *Pinus nigra* 4(r); *Pinus sylvestris* 3(+), 5(+), 8(+); *Plantago major* subsp. *major* 19(+); *Plantago media* 5(+); *Platanus hybrida* 21(+); *Poa annua* 19(+), 21(+); *Poa compressa* 19(+); *Poa nemoralis* 7(+), 30(+); *Polygala amara* 5(+); *Polygonum lapathifolium* 20(+), 27(+), 31(+); *Potentilla reptans* 11(+); *Primula vulgaris* 12(r); *Prunella grandiflora* 33(+); *Prunella vulgaris* 10(+), 16(+), 17(+); *Prunus avium* 16(+); *Pulmonaria officinalis* 16(r); *Quercus pubescens* 19(+); *Rubus ulmifolius* 18(1); *Rumex crispus* 22(2), 23(+), 24(r); *Rumex obtusifolius* 19(+), 20(+); *Salix appendiculata* 2(+), 3(+); *Salix glabra* 3(1), 4(r); *Salix nigricans* 5(+), 9(1); *Salix triandra* 29(1); *Sambucus ebulus* 21(+); *Satureja montana* subsp. *variegata* 35(+); *Saxifraga caesia* 3(r); *Scabiosa columbaria* s.l. 36(+); *Scabiosa*

gramuntia 33(+), 35(+); *Sedum sexangulare* 10(+), 11(1); *Sedum spurium* 6(+); *Senecio erraticus* 11(+), 21(+), 30(+); *Senecio nemorensis* subsp. *fuchsii* 13(+); *Sesleria albicans* 4(+), 5(+); *Setaria viridis* 1(+), 20(+); *Silene pusilla* 3(+); *Silene vulgaris* subsp. *glareosa* 3(+); *Solidago virgaurea* 7(+); *Sonchus arvensis* 19(+); *Sonchus asper* subsp. *asper* 19(+), 20(+); *Sonchus oleraceus* 11(+); *Sorghum halepense* 29(+); *Stachys sylvatica* 7(+), 13(+), 14(+); *Stellaria nemorum* subsp. *nemorum* 24(+); *Symphytum officinale* 31(+); *Tamus communis* 6(+); *Tanacetum vulgare* 28(+), 33(+); *Taraxacum* sect. *Erythrosperma* 15(+); *Thalictrum aquilegifolium* 9(r); *Thymus longicaulis* 36(1); *Thymus praecox* subsp. *polytrichus* 5(+); *Thymus pulegioides* 34(1); *Tilia cordata* 13(+); *Tofieldia calyculata* 2(r); *Trifolium montanum* 12(+); *Trifolium pratense* 19(+), 20(+); *Trisetum argenteum* 4(+); *Valeriana montana* 2(r); *Valeriana wallrothii* 6(+), 7(+), 10(+); *Verbascum phlomoides* 18(+); *Veronica agrestis* 19(+); *Veronica anagallis-aquatica* 19(+); *Veronica chamaedrys* 21(+); *Veronica persica* 20(+); *Veronica urticifolia* 12(+), 13(+); *Viburnum lantana* 10(1); *Vicia cracca* (aggr.) 6(+), 7(+), 19(+); *Vicia tenuifolia* 28(+), 29(+); *Vinca minor* 12(+); *Vincetoxicum hirundinaria* 13(+), 18(+); *Viola reichenbachiana* 6(+); *Vitis vinifera* 23(2), 31(+); *Xanthium italicum* 29(1); *Xanthium strumarium* 34(+), 36(+).

5. SUMMARY

Vrbova grmišča na prodiščih (*Salicion eleagnidaphnoidis* (Moor 1958) Grass 1993) v Furlaniji Julijski krajini (SV Italija)

V Furlaniji Julijski krajini je zeliščna vegetacija prodišč dobro poznana, medtem ko sestoji, ki jih uvrščamo v zvezo *Salicion eleagno-daphnoidis* (Moor 1958) Grass 1993 še niso dovolj raziskani.

Vegetacijo smo raziskovali po standardni srednjeevropski metodi. V reviziji smo uporabili neobjavljeni in objavljeni material. Sestoji smo členili po Matuszkiewicz & Matuszkiewicz (1981), uporabili pa smo tudi časovno členitev (faze), saj na ta rastišča vplivajo zunanji dejavniki, ki jih predstavljajo hidrodinamski cikli.

Salici incanae-Hippophaetum Br.-Bl. in Volk 1939

V sestojih dominira vrsta *Hippophae rhamnoides* subsp. *fluvialis*. V sestojih so pogoste travniške vrste, ki nakazujejo določeno stopnjo stabilizacije prodišč, medtem ko vrste razreda *Thlaspietea* nakazujejo povezavo s pionirsko zeliščno vegetacijo prodišč.

Asociacija je razširjena v Alpah, v Furlaniji

Juljski krajini jo najdemo predvsem ob reki Tilment (Tagliamento) in nekaterih njenih pritokih.

Salici-Myricarietum Moor 1958

Dominantna vrsta je *Myricaria germanica*, poleg nje pa sestojajo gradita tudi *Salix eleagnos* in *S. daphnoides*. Asociacijo členimo v dve obliki. V tipični obliki je malo vrst, strojevec pa ima veliko pokrovnost. Druga oblika je bolj inicialna z večjim številom pionirskih vrst. Sestoji, ki jih uvrščamo v to asociacijo uspevajo na najbolj inicialnih rastiščih znotraj zveze *Salicion eleagno-daphnoidis*.

Razširjena je v Alpah, pa tudi v severnih Apeninih in na Balkanskem polotoku. V Furlaniji Juljski krajini jo najdemo ob rekah Degano in Tilment (Tagliamento).

Salicetum incano-purpureae Sillinger 1933

Dominantna vrsta je *Salix eleagnos*, med zelišči so najbolj pogoste vrste: *Petasites paradoxus*, *Rubus caesius* in *Brachypodium sylvaticum*. Sestoji so zelo heterogeni zato smo jih členili v številne subasociacije, višinske forme in faze, ki so prikazane na shemi.

- 1) subass. *typicum*
- 2) subass. *petasitetosum hybridi*
 - a) montanska forma
 - b) gričevnata forma
 - I) faza z vrsto *Ligustrum vulgare*
 - I) faza z vrsto *Acer pseudoplatanus*
 - c) nižinska forma
 - III) faza z vrsto *Salix purpurea*
 - IV) faza z vrsto *Populus nigra*

Asociacija je razširjena v celotnih Alpah, Apeninih in na Balkanu. V Furlaniji Juljski krajini jo najdemo ob vseh večjih rekah.

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Tab. 1 *Salici incanae-Hippophaetum* Br.-Bl. in Volk 1939

Relevés progr. number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Fr.
Altitude (x10)	57	48	38	35	50	50	45	40	15	22	28	15	13	10	29	18	18	
Association species																		
<i>Hippophae rhamnoides/fluviatilis</i>	2	2	2	4	3	4	3	4	2	4	3	3	3	4	2	3	.	94
<i>Achnatherum calamagrostis</i> (d)	.	.	1	2	+	+	1	1	1	1	+	+	2	.	.	2	3	76
<i>Euphorbia cyparissias</i> (d)	+	.	+	.	+	1	.	+	+	+	+	1	+	1	.	+	1	76
<i>Melilotus alba</i> (d)	.	+	.	.	1	+	+	+	.	+	+	+	.	.	.	.	.	47
<i>Pinus sylvestris</i> (d loc.)	.	.	.	.	.	1	1	1	+	.	1	.	+	.	.	1	1	47
<i>Achillea millefolium</i>	.	.	+	.	+	+	+	1	.	.	+	.	.	.	.	.	.	35
Alliance species																		
<i>Salix eleagnos</i>	1	3	2	1	2	2	+	1	1	+	1	1	2	2	2	1	3	100
<i>Petasites paradoxus</i>	1	2	.	.	+	1	.	2	1	2	1	.	1	.	+	2	2	71
<i>Salix daphnoides</i>	.	1	.	+	1	1	.	+	1	.	+	.	.	.	+	.	1	53
Order and class species																		
<i>Salix purpurea</i>	4	2	3	1	2	1	1	1	+	+	.	+	.	.	.	1	2	76
<i>Populus nigra</i>	.	.	1	1	.	2	+	1	3	2	1	1	1	+	.	.	1	71
Companions																		
<i>Rubus caesius</i>	.	.	1	.	1	2	1	+	1	.	1	1	+	+	1	.	+	71
<i>Daucus carota</i>	+	+	1	+	+	+	.	1	+	+	.	.	.	+	.	.	+	65
<i>Sanguisorba minor</i>	+	.	+	+	.	1	.	1	.	+	+	.	+	1	.	1	.	59
<i>Galium album</i>	.	.	r	+	.	1	+	+	.	.	+	+	+	.	+	+	.	59
<i>Alnus incana</i>	1	1	1	1	.	.	2	.	.	+	+	.	.	.	2	.	1	53
<i>Ostrya carpinifolia</i>	.	.	.	.	.	.	.	+	+	+	+	+	1	.	1	1	1	53
<i>Artemisia vulgaris</i>	+	.	.	+	+	.	1	+	+	.	.	+	.	+	.	.	.	47
<i>Dactylis glomerata</i> s.l.	+	.	+	+	+	1	+	.	+	.	.	+	.	.	.	.	.	47
<i>Clematis vitalba</i>	.	.	+	.	.	.	.	+	+	+	.	+	+	.	.	.	+	41
<i>Peucedanum verticillare</i>	.	.	.	.	+	.	.	+	1	.	+	.	+	1	.	+	.	41
<i>Molinia arundinacea</i>	.	.	.	.	.	.	+	.	2	+	.	1	+	2	4	.	.	41
<i>Gypsophila repens</i>	.	.	.	.	.	.	.	.	+	+	.	1	1	2	.	1	1	41
<i>Calamagrostis varia</i>	1	.	1	.	+	+	1	+	.	+	.	.	.	.	.	.	.	41
<i>Hieracium piloselloides</i>	.	.	.	+	.	.	.	+	1	.	.	.	+	+	.	+	+	41
<i>Scabiosa gramuntia</i>	.	.	.	.	.	.	.	.	+	+	+	+	1	1	.	+	.	41
<i>Fraxinus ornus</i>	1	.	.	+	.	.	.	.	.	.	.	1	1	.	2	+	+	41
<i>Cornus sanguinea</i>	.	.	.	.	.	+	+	.	.	.	+	+	.	.	1	.	+	35
<i>Agrostis stolonifera</i>	.	.	1	.	+	1	1	.	1	.	1	.	.	.	.	.	.	35
<i>Erigeron annuus</i>	.	.	.	.	.	+	+	.	.	+	1	+	.	.	.	+	.	35
<i>Ligustrum vulgare</i>	.	.	.	.	.	+	.	+	.	.	+	1	+	.	1	.	.	35
<i>Bupthalmum salicifolium</i>	.	.	.	.	.	.	.	+	+	.	.	.	1	+	.	1	1	35
<i>Hypericum perforatum</i>	1	.	+	.	.	.	.	+	+	.	.	+	.	.	.	.	.	29
<i>Reseda lutea</i>	.	.	.	+	.	.	.	.	+	+	.	.	.	+	.	.	+	29
<i>Epilobium dodonaei</i>	.	.	.	.	+	+	+	1	.	.	.	.	.	.	.	.	+	29
<i>Agropyron pungens</i>	.	.	.	.	.	.	.	+	1	+	+	+	.	.	.	.	.	29

Relevés progr. number	57	1	48	2	38	3	35	4	50	5	50	6	45	7	40	8	15	9	22	10	28	11	15	12	13	13	10	14	29	15	18	16	18	17	Fr.	
<i>Vicia cracca</i> (aggr.)	.	.	+	.	+	.	.	.	+	.	+	29	
<i>Sesleria albicans</i>	1	.	+	.	+	.	2	1	.	29	
<i>Festuca arundinacea</i>	+	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	29
<i>Artemisia alba</i>	+	.	.	+	+	+	29	
<i>Melica nutans</i>	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	+	.	.	.	24
<i>Sedum sexangulare</i>	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	24
<i>Artemisia campestris</i>	1	1	.	.	2	1	.	.	.	24	
<i>Agropyron repens</i>	.	.	1	.	.	.	.	.	+	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	24
<i>Picris hieracioides</i>	+	.	.	.	+	+	+	24	
<i>Carlina vulgaris</i>	+	+	24	
<i>Diplotaxis tenuifolia</i>	+	+	+	18	
<i>Lotus corniculatus</i>	+	+	18	
<i>Plantago lanceolata</i>	18	
<i>Silene vulgaris/vulgaris</i>	+	+	18	
<i>Scrophularia canina</i>	+	18	
<i>Koeleria pyramidata</i>	+	+	1	.	.	.	.	.	.	18	
<i>Poa compressa</i>	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	
<i>Echium vulgare</i>	+	+	+	18	
<i>Centaurea nigrescens/vochinensis</i>	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	
<i>Matthiola carnica</i>	r	1	.	18
<i>Petrorhagia saxifraga</i>	+	.	+	18	
<i>Pinus nigra</i>	1	1	.	.	18
<i>Juniperus communis</i>	1	+	.	.	18	
<i>Valeriana wallrothii</i>	1	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18
<i>Carex digitata</i>	+	+	18
<i>Carex alba</i>	1	+	1	.	18	
<i>Linum tenuifolium</i>	18
<i>Solidago virgaurea</i>	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	
<i>Galium verum</i>	+	18	
<i>Coronilla emerus</i> s.l.	1	.	.	.	.	1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	
<i>Centaurea maculosa</i>	+	+	+	18	

Tab. 2 : *Salici-Myricarietum Moor 1958*

Progr. number	1	2	3	4	5	6	3	8	9	10	11	12	13	14	15	16	17	18	19	Fr.	
Altitude (x 10)	30	52	30	20	30	30	30	22	23	23	23	30	20	20	30	115	115	60	115		
Association species																					
<i>Myricaria germanica</i> (opt.)	3	3	4	3	3	2	3	2	1	1	2	+	1	+	.	2	3	2	4	95	
<i>Calamagrostis pseudophragmites</i> (d)	2	2	1	2	+	3	1	+	+	.	+	r	1	+	+	.	.	.	.	74
<i>Tussilago farfara</i> (d)	r	2	1	1	1	.	.	.	+	.	+	+	+	1	1	.	.	.	.	58
Alliance species																					
<i>Salix eleagnos</i>	3	3	1	2	1	.	1	1	+	1	+	2	4	4	2	3	3	2	+	95	
<i>Salix daphnoides</i> (opt.)	1	2	+	1	2	1	+	2	1	1	1	2	1	1	3	+	.	.	.	84	
<i>Hippophae rhamnoides/fluviatilis</i>	1	.	+	+	.	.	.	+	.	.	.	.	21	
<i>Petasites paradoxus</i> (d)	.	.	.	+	.	.	.	+	+	1	+	+	1	+	+	1	2	+	2	68	
Order and class species																					
<i>Populus nigra</i>	.	.	1	1	1	1	.	+	+	+	.	1	1	1	+	+	.	.	.	63	
<i>Salix purpurea</i>	1	2	1	1	.	.	.	.	.	+	.	.	.	.	.	2	1	+	1	47
<i>Salix alba</i>	.	.	.	1	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	11
Companions																					
<i>Alnus incana</i>	2	.	.	.	.	.	.	1	1	1	2	.	.	.	.	2	1	1	1	47
<i>Daucus carota</i>	.	+	+	+	+	+	.	.	+	.	37	
<i>Agrostis gigantea</i>	.	.	1	1	1	.	2	.	.	.	.	+	+	1	.	.	.	.	.	37
<i>Rubus caesius</i>	.	+	1	.	+	.	.	+	+	+	.	.	.	.	32	
<i>Artemisia vulgaris</i>	.	+	+	.	.	.	+	+	.	.	1	+	32	
<i>Agrostis stolonifera</i>	+	+	+	+	+	.	.	+	.	32	
<i>Molinia arundinacea</i>	2	1	+	2	.	+	.	.	.	.	.	.	26	
<i>Hieracium piloselloides</i>	.	+	1	1	.	+	.	.	.	+	.	.	26	
<i>Dactylis glomerata</i> s. lat.	+	+	+	+	21	
<i>Calamagrostis varia</i>	+	+	1	2	.	.	21	
<i>Lotus corniculatus</i>	.	+	1	.	+	+	21	
<i>Epilobium dodonaei</i>	+	+	+	21	
<i>Trifolium pratense</i>	+	+	+	+	21	
<i>Rhinanthus aristatus</i>	+	.	+	+	+	.	21	
<i>Centaurea nigrescens/vochinensis</i>	+	+	+	+	21	
<i>Sanguisorba minor</i>	+	+	+	.	16	
<i>Galium album</i>	+	.	.	+	.	.	+	16	
<i>Gypsophila repens</i>	+	1	.	.	.	.	+	.	.	.	.	16	
<i>Hypericum perforatum</i>	+	.	.	+	.	.	+	16	
<i>Diplotaxis tenuifolia</i>	+	+	1	.	.	.	.	16	
<i>Achillea millefolium</i>	+	1	1	.	16	
<i>Reseda lutea</i>	+	+	.	+	16	
<i>Scrophularia canina</i>	.	.	+	+	r	.	.	.	.	16	
<i>Angelica sylvestris</i>	1	1	.	+	16	
<i>Carex flacca</i>	+	+	+	.	.	16	
<i>Poa compressa</i>	1	.	+	+	.	.	.	.	.	.	.	.	.	16	
<i>Festuca arundinacea</i>	+	+	.	.	.	+	16	
<i>Artemisia alba</i>	+	+	+	16	
<i>Lythrum salicaria</i>	.	.	r	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	16
<i>Medicago lupulina</i>	+	.	.	1	+	.	16	
<i>Salix nigricans</i>	1	2	.	+	16	
<i>Leontodon hispidus</i> s. lat.	+	+	+	.	16	
<i>Salix appendiculata</i>	1	+	1	16	
<i>Prunella grandiflora</i>	r	1	1	.	.	16	
<i>Ranunculus acris</i>	+	+	+	.	16	
<i>Bidens frondosa</i>	+	+	+	16	

Tab.3 *Salicetum incano-purpureae* Sillinger 1933

subass. alt. forms phases Progr. number Altitude (x 10)	typicum											petasitetosum hyb.						typicum										Fr.												
	montane					hill						Acer pseudoapl.						Salix purpurea					Populus nigra																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36				
Char. and diff. species of assoc.																																								
<i>Salix eleagnos</i> (opt., all.)	3	2	1	2	2	4	4	2	2	4	4	4	5	5	4	4	4	3	+	2	3	1	2	3	+	1	1	1	.	2	+	3	4	2	1	1	97			
<i>Solanum dulcamara</i> (d)	.	.	.	.	.	+	+	+	.	.	.	+	+	+	.	.	.	.	.	.	2	+	+	r	.	+	+	1	.	.	+	.	.	.	.	.	.	50	
Char. and diff. species of alliance																																								
<i>Salix daphnoides</i>	.	.	.	1	+	.	.	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17	
<i>Hippophae rhamnoides/fluviatilis</i>	.	.	.	.	.	.	.	2	4	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	14
<i>Myrica germanica</i>	.	.	.	r	r	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	
<i>Petasites paradoxus</i> (d)	.	r	1	1	2	.	.	.	.	4	1	.	+	1	+	3	1	1	1	.	+	+	+	+	r	+	.	.	.	.	.	.	.	.	.	.	58		
<i>Rubus caesius</i> (d)	.	.	.	+	1	.	.	.	3	1	3	3	3	2	.	2	3	2	+	1	1	3	2	1	1	64
<i>Brachypodium sylvaticum</i> (d)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	36	
Char. species of order and class																																								
<i>Salix purpurea</i>	+	.	r	+	.	2	2	1	.	.	.	.	+	.	.	2	3	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	69	
<i>Populus nigra</i>	+	.	.	.	.	.	.	2	2	.	1	.	.	.	.	.	.	.	.	.	+	.	.	1	+	1	.	+	+	3	+	3	2	3	1	2	2	+	58
<i>Salix alba</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14
Diff. species of sub-unities																																								
subass. petasitetosum hybridi																																								
<i>Petasites hybridus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	28
<i>Aegopodium podagraria</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	22
<i>Knautia drymeia/drymeia</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19
<i>Peucedanum verticillare</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	31
<i>Cirsium oleraceum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17
<i>Centaura nigrescens/vochinensis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14
<i>Eupatorium cannabinum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17
<i>Chaerophyllum hirsutum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14
Hill form																																								
<i>Alnus incana</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19
<i>Calamagrostis varia</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14
<i>Galium laevigatum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14
<i>Corylus avellana</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11
<i>Fraxinus excelsior</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11
Phase with <i>Ligustrum vulgare</i>																																								
<i>Ligustrum vulgare</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	22
<i>Galium album</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25
Species of mature phase																																								
<i>Comus sanguinea</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	39
<i>Clematis vitalba</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	42
<i>Frangula alnus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33
<i>Geranium robertianum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	28
Phase with <i>Acer pseudoplatanus</i>																																								
<i>Acer pseudoplatanus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17
<i>Carpinus betulus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14
Ruderal and adventitious species																																								
<i>Helianthus tuberosus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50
<i>Solidago gigantea v. serotina</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	39
<i>Daucus carota</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	39
<i>Artemisia vulgaris</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44
<i>Saponaria officinalis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33
<i>Deschampsia cespitosa</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33
<i>Melilotus alba</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25
<i>Erigeron annuus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33

subass. alt. forms phases Progr. number	typicum											petasitetosum hyb.								typicum																			
	montane					hill														plain																			
						Ligustrum vul.						Acer pseudoapl.								Salix purpurea								Populus nigra											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36			
Salix purpurea stage																																							
<i>Polygonum persicaria</i>	+	1	2	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	36	
<i>Chenopodium album</i>	+	+	+	.	r	+	+	.	.	.	.	.	.	.	.	.	.	.	22	
<i>Robinia pseudacacia</i>	2	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	25	
Populus nigra stage																																							
<i>Amorpha fruticosa</i>	25
<i>Oenothera biennis</i>	14
Companions																																							
<i>Urtica dioica</i>	31
<i>Euphorbia cyparissias</i>	28
<i>Taraxacum sect. Taraxacum</i>	28
<i>Diplotaxis tenuifolia</i>	+	25	
<i>Agrostis stolonifera</i>	25
<i>Plantago lanceolata</i>	25	
<i>Molinia arundinacea</i>	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	22
<i>Silene vulgaris/vulgaris</i>	22
<i>Barbarea vulgaris</i>	22
<i>Calamagrostis pseudophragmites</i>	19
<i>Hypericum perforatum</i>	19
<i>Angelica sylvestris</i>	19
<i>Phalastis arundinacea</i>	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19
<i>Scrophularia canina</i>	17
<i>Mentha longifolia</i>	17
<i>Calystegia sepium</i>	17
<i>Heracleum sphondylium</i>	17
<i>Bromus stennis</i>	+	17
<i>Sanguisorba minor</i>	14
<i>Dactylis glomerata s.l.</i>	14
<i>Agrostis gigantea</i>	14
<i>Agropyron pungens</i>	14
<i>Bupthalmum salicifolium</i>	14
<i>Melica nutans</i>	14
<i>Galium mollugo</i>	14
<i>Chaenarthium minor</i>	14
<i>Hedera helix</i>	14
<i>Stellaria media</i>	14
<i>Rorippa sylvestris</i>	14
<i>Gypsophila repens</i>	11
<i>Lotus corniculatus</i>	11
<i>Reseda lutea</i>	11
<i>Carex flacca</i>	11
<i>Brachypodium pinnatum aggr.</i>	11
<i>Achillea millefolium</i>	11
<i>Tussilago farfara</i>	11
<i>Echium vulgare</i>	11
<i>Ranunculus repens</i>	11
<i>Salvia glutinosa</i>	11
<i>Silena alba</i>	11
<i>Humulus lupulus</i>	11
<i>Centaurea nigrescens/vochinensis</i>	11
<i>Astragalus glycyphyllos</i>	11
<i>Festuca gigantea</i>	11
<i>Ranunculus lanuginosus</i>	11
<i>Acer campestre</i>	11
<i>Artemisia verlotorum</i>	11
<i>Molinia caerulea</i>	.	+	1	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11

