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Ecological and phytosociological changes in the willow woods of Szigetköz, NW Hungary, in the past 60 years

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Abstract: This paper is a phytosociological summary of two floodplain communities from the Szigetköz area, the willow shrubs (*Salicetum triandrae-purpureae*) and willow woods (*Salicetum albae-fragilis*). Temporal changes in these communities are evaluated through the comparison of recent data with those obtained 30 and 60 years ago. Changes in ecological characteristics are revealed by biological indication, using W(ater) indicator values and nature conservation ranks of constituting species. The W-spectrum of willow shrubs indicates a bit more extreme and drier habitat than earlier. The nature conservation ranks show a marked, but not too drastic degradation. The willow woods of the Szigetköz indicate better conditions than indicated by data collected by Kárpáti in the 1950's from willow woods outside the Szigetköz. The reason for this finding is that the Szigetköz region is fairly close to the natural conditions, especially in the Moson-Danube branch, because of the huge meanders. If one compares the present situation with that of in 1937 recorded by Zólyomi, the changes in species composition and enrichment in weeds are clearly indicated by both the W-spectrum and the nature conservation rank spectrum in the form of marked drying and degradation.

Introduction

Ecological conditions have been monitored by the qualitative and quantitative description of indicator organisms in the Szigetköz area in the framework of a monitoring system set up in the second half of the 1980's. In this paper we present the description of willow shrubs (*Salicetum triandrae-purpureae*) and willow woods (*Salicetum albae-fragilis*) on the basis of field data collected in 1991. Our data are compared with earlier descriptions (Zólyomi 1937, Kárpáti 1957). In this way not only the present state is recorded, but changes in the past three decades can also be evaluated. Special attention is paid to changes that can be interpreted in terms of water requirement of species and nature conservation values.

Materials

Most of the stands we studied are situated in the vicinity of Ásványráró - Dunasziget - Dunakiliti-Nagybajcs. Some of our samples were taken near Magyaróvár (Moson Danube branch) (Table 1). Of course, these stands are not the same as those described earlier by Zólyomi and Kárpáti, since most of the habitats have changed. They entered a seral stage of floodplain succession, they were filled up or destroyed completely. Simultaneously, on shelf islands, sand benches and low floodplain terraces, new stands have developed. The present species composition reflects the state of the 'base flora' in the area. Thus, the material for the comparisons consists of former and present day stands of willow communities.

For willow shrubs (*Salicetum triandrae-purpureae*) we use our own data ("present state") and those of collected by Kárpáti ("former state"). For willow woods (*Salicetum albae-fragilis*) we use our own data as present state and those of collected by Zólyomi as former state. In addition to these, an interesting comparison was possible using Kárpáti's data from the stands near Esztergom and Szentendre Island. This procedure proved the usefulness of our method and the results allow us

Table 1. The localities of stands with dominant or characteristic species in brackets. !: nice, seminatural, primeval-like stand

Willow shrubs - Salicetum triandrae-purpurea

1. Ásványráró, Senki-sziget (*Salix triandra*)
2. Dunasziget, Hajós-oldal (*Salix alba*)
3. Kisbodak, Kavics-sziget (*Salix purpurea*) river station 1831
4. Hédervár, Mosoni Duna (*Salix triandra*)
5. Hédervár, Mosoni Duna (*Salix triandra*)
6. Ásványráró, Öreg Árva (*Salix purpurea*) river station 1915
7. Ásványráró, Bagaméri bend (*Salix triandra*) river station 1813
8. Ásványráró, Bagaméri branch, Nagyduna torok (*Salix alba*) river station 1810
9. Ásványráró, Zátonysziget at Bagaméri dam (*Salix purpurea*)
10. Ásványráró, Zátonysziget at Bagaméri dam (*Salix purpurea*)
11. Nagybajcs, Medvei bridge, eastern side (*Salix alba*) river station 1804-1805
12. Vének, Öntéssziget .(New). (*Salix alba*) river station 1799

Willow-poplar woods - Salicetum albae-fragilis

1. Hédervár, Mosoni Duna (*Calystegia, Galium odoratum*)
2. Ásványráró, Halrekesztő sziget (*Rorippa amphibia, Leucojum aestivum*)
3. Ásványráró, Szilfási channel, estuary (*Rubus caesius, Dactylis glomerata*)
4. Ásványráró, Senki-sziget (*Phalaris arundinacea*)
5. Ásványráró, Senki-sziget (*Phalaris arundinacea*)
6. Ásványráró, Kalap sziget (*Urtica dioica*) river station 1820
7. Kisbodak, Bodaki part (*Phalaris arundinacea, Aster tradescantii*) river station 1829.5
8. Dunasziget, Hajós side (*Urtica dioica, Leucojum aestivum, Ficaria*)
9. Lóvári erdő, Mosoni Duna (*Urtica dioica*)
10. Ásványráró, Ásványi branch, Árvai zárás (*Phalaris arundinacea*)
11. Ásványráró, Öreg Árva, (*Urtica dioica, Rubus caesius*) river station 1815
12. Ásványráró, Bagaméri bend (*Urtica dioica, Impatiens glandulifera*)
13. Vámosszabadi, Bagaméri branch, Nagy-Duna estuary (*Urtica dioica, Aster tradescantii*) river station 1810
14. Ásványráró, Bagaméri branch, Dani sziget (*Solidago gigantea*) !
15. Nagybajcs, Medvei bridge, eastern side (*Urtica dioica, Humulus*) river station 1804-1805 !
16. Nagybajcs, Medvei bridge, eastern side (*Urtica dioica, Humulus*) river station 1804-1805 !
17. Vének, Öntéssziget .(New). (*Urtica dioica, Agrostis stolonifera*) river station 1798-1799 !
18. Kisbodak, Kavics sziget (*Dactylis glomerata*) river station 1831
19. Vámosszabadi, Kormorános sziget (*Phalaris arundinacea, Phragmites*) river station 1811-1812
20. Dunasziget, Hajós side (*Urtica dioica, Leucojum aestivum*)
21. Ásványráró, Bagaméri bend (*Urtica dioica, Cirsium arvense*) river station 1813-1814 !
22. Vámosszabadi, Kormorános sziget (*Cornus sanguinea, Urtica dioica, Rubus caesius, Impatiens glandulifera*) river station 1811-1812 !
23. Vámosszabadi, Kormorános sziget (*Cornus sanguinea, Urtica dioica, Phragmites*) river station 1811-1812

to emphasize the phytosociological value of willow woods in the Szigetköz.

Methods

The phytosociological description followed the standard Braun-Blanquet - Soó method. In each stratum all vascular plants were listed and their dominance was characterized by A-D values. Synthetic tables were interpreted using the constant and dominant species. We also analyzed the information of the tables in terms of W indicator (Zólyomi and Précsényi 1964) and nature conservation categories (Simon 1984, 1988). For these characteristics diversity and evenness were calculated (Slack 1977) using the Shannon formula with natural logarithm.

Results

Willow shrubs

Willow shrubs are characteristically open, loose pioneer communities, quite susceptible to the invasion of aggressive, fast spreading ruderals. The stands are regularly flooded each year, in many cases for several months. In former stands (before the 1950's) the constant and dominant species of the shrub layer were *Salix purpurea, S. triandra* and *S. alba*. In the herb layer common species (constancy from V to III) were *Ranunculus repens, Rorippa sylvestris, Myosotis palustris, Poa trivialis, Phalaris arundinacea* (facies-forming species are underlined). The dominants were *Rubus caesius, Myosotis palustris, Rorippa austriaca, Polygonum lapathifolium, Poa trivialis.* The stands dominated by *Salix triandra* were quite similar, but they were treated as a separate community by Kárpáti. *Urtica dioica* and *Solidago giganeta* occurred exclusively in this community. The constant and dominant elements of recent stands are *Salix triandra, S purpurea, S. alba. Populus nigra* has similar constancy, but low dominance. *Agrostis stolonifera, Artemisia vulgaris, Aster tradescantii, Dactylis glomerata, Phragmites, Polygonum mite, Ranunculus repens, Rorippa sylvestris, Rumex sanguineum,* and *Solidago gigantea* are common in the herb layer. The dominants are *Agrostis stolonifera, Dactylis glomerata, Phalaris arundinacea*, and *Urtica dioica*.

The basic features of former and recent stands are not the same, yet quite similar. The occurrence of the adventive weeds *Aster tradescantii* and *Phragmites* is a marked difference. In the case of other species only the importance is different (Table 2).

Table 2. Synthetic phytosociological table of willow shrubs (*Salicetum triandrae-purpureaea* Soó 1927) in Szigetköz, 1991.

	Sample plots													
Species	1	2	3	4	5	6	7	8	9	10	11	12	AD	K
Shrub layer:														
Acer negundo	.	.	.	.	.	.	.	.	.	.	+	.	+	I
Populus deltoides	.	.	.	.	.	.	+	.	.	.	.	.	+	I
Populus nigra	.	.	.	.	.	.	+	.	+	+-1	+-1	+	+-1	III
Salix alba	.	4	+	.	.	+	2	4	.	.	+	3	+-4	III
Salix purpurea	.	+	3	.	.	4	.	.	2-3	2	.	.	+-4	III
Salix triandra	5	.	.	4	5	.	2	.	.	1-2	.	+	+-5	III
Salix viminalis	.	.	.	.	.	.	.	.	1	+	.	.	+-1	I
Herb layer:														
Acer negundo	+	+	.	.	.	.	.	.	.	.	.	.	+	I
Achillea millefolium	.	+	.	.	.	.	.	.	.	.	.	.	+	I
Agrostis stolonifera	.	.	.	.	.	+	.	+	+-1	1-2	2-3	.	+-3	III
Alopecurus pratensis	.	.	.	.	.	.	.	.	+	.	.	.	+	I
Angelica sylvestris	.	.	.	+	.	.	.	.	.	.	.	.	+	I
Anthemis sp.	.	.	.	.	.	.	.	.	.	+	.	.	+	I
Arctium nemorosum	.	+	.	.	.	.	.	.	.	.	.	.	+	I
Artemisia vulgaris	+	+	+	.	.	.	.	.	.	+	+	+	+	III
Aster tradescantii	.	+	+	.	.	+	+	+-1	1	+-1	+	+	+-1	IV
Ballota nigra	.	+	.	.	.	.	.	.	.	.	.	.	+	I
Barbarea vulgaris	+	+	.	.	.	.	.	.	.	.	.	.	+	I
Bidens tripartitus	.	.	.	.	.	.	.	.	.	+	.	.	+	I
Cala magrastis epigeios	.	.	.	.	.	.	.	.	.	.	+-1	.	+-1	I
Calystegia sepium	.	.	.	+	1	+	.	.	.	.	.	.	+-1	II
Carduus crispus	+	.	.	.	.	.	.	.	.	.	.	.	+	I
Carex sp.	.	.	.	.	.	.	.	.	+	.	.	.	+	I
Chamaenerion palustre	.	.	.	.	.	.	.	.	.	.	+	.	+	I
Chenopodium album	.	.	.	.	.	+	.	.	.	.	.	.	+	I
Chrysanthemum vulgare	+	.	.	.	.	.	.	.	.	.	+	.	+	I
Cirsium arvense	.	+	+	.	.	.	.	.	.	+	+	.	+	II
Dactylis glomerata	2-3	2-3	1	.	.	+	.	.	+	+-1	+	.	+-3	III
Deschampsia caespitosa	+	.	.	.	.	+	.	.	.	+	+	.	+	II
Erysimum cheiranthoides	.	+	.	.	.	.	.	.	.	.	.	.	+	I
Festuca gigantea	.	.	.	.	+	.	.	.	.	.	.	.	+	I
Festuca pratensis	+	.	.	.	.	.	.	.	.	.	.	.	+	I
Galium aparine	.	.	.	+	.	+	.	+	.	.	.	.	+	II
Glechoma hederacea	.	+	+	.	.	+	.	.	.	.	.	.	+	II
Humulus lupulus	.	.	.	+	+-1	.	.	.	.	.	.	.	+-1	I
Impatiens noli-tangere	.	.	.	.	+-1	.	.	.	.	.	.	.	+-1	I
Impatiens parviflora	.	.	.	+-1	+	.	.	.	.	.	.	.	+-1	I
Iris pseudacorus	.	.	.	+	.	.	.	.	.	.	.	.	+	I
Lamium purpureum	.	+	.	.	.	.	.	.	.	.	.	.	+	I
Lycopus europeus	+	.	.	.	.	.	.	.	.	.	.	.	+	I
Matricaria inodora	+	+	.	.	.	.	.	+	.	.	+	.	+	II
Mentha aquatica	+	.	.	.	.	.	.	.	.	.	.	.	+	I
Morus alba	.	.	.	.	.	.	+	.	.	.	.	.	+	I
Myosotis palustris	.	.	.	+	.	.	.	.	.	.	.	.	+	I
Myosoton aquatica	+	2	.	.	.	.	.	.	.	.	.	.	+-2	I
Pastinaca sativa	.	+	.	.	.	.	.	.	.	.	.	.	+	I
Phalaris arundinacea	2	+	2	.	.	2-3	1	+	1-2	+-1	2	4	+-4	V
Phragmites communis	+	.	.	+-1	2	+-1	.	.	.	.	+	+	+-2	III
Plantago media	+	+	.	.	.	.	.	.	.	.	.	.	+	I
Poa annua	+	+	.	.	.	.	.	.	.	.	.	.	+	I
Poa palustris	.	.	.	.	.	.	.	.	.	.	+-1	.	+-1	I
Poa trivialis	.	.	.	+	.	.	.	.	.	.	.	.	+	I
Polygonum aviculare	.	.	.	.	.	.	.	.	+	+	.	.	+	I
Polygonum lapathifolium	.	.	.	.	.	.	+	.	.	+	+	.	+	II
Polygonum mite	.	.	+	.	.	.	.	.	+	+-1	+	+	+-1	III
Potentilla reptans	.	.	.	.	.	.	.	.	.	+	.	.	+	I
Ranunculus bulbosus	+	.	.	.	.	.	.	.	.	.	.	.	+	I
Ranunculus repens	+	+	+	.	.	.	.	.	+	+	.	.	+	III
Rorippa amphibia	.	+	.	.	.	.	.	.	.	.	.	.	+	I
Rorippa barbaroides	.	.	.	.	.	.	+	.	+	+	.	+	+	II
Rorippa islandica	.	.	.	.	.	.	+-1	.	.	.	.	+	+-1	I
Rorippa sylvetris	.	+	+	.	.	.	+-1	.	+-1	1	+	.	+-1	III
Rubus caesius	.	.	.	1	+	.	.	.	.	+	.	.	+-1	II
Rumex acetosa	+	.	.	.	.	.	.	.	.	.	.	.	+	I
Rumex crispus	.	+	+	.	.	.	.	.	+	.	.	.	+	II
Rumex sanguineus	+	.	+	.	.	.	+	+	.	+	+	+-1	+-1	III
Scrophularia nodosa	+	.	.	.	.	.	.	.	.	.	.	.	+	I
Senecio fluviatilis	.	+	.	.	.	.	.	.	.	.	.	.	+	I
Solanum dulcamara	.	+	.	.	.	+	.	.	.	.	.	+	+	II
Solidago gigantea	+	+	+	.	.	.	.	.	+	.	+-1	+	+-1	III
Stellaria media	+	+	.	.	.	.	.	.	.	.	.	.	+	I
Stenactis strigosa	+	+	.	.	.	.	.	.	.	.	.	.	+	I
Symphytum officinale	.	.	.	.	.	.	.	.	+	.	.	.	+	I
Taraxacum officinale	.	+	+	.	.	.	.	.	+	+	.	.	+	II
Thalictrum flavum	.	.	.	.	.	.	.	.	.	+	.	.	+	I
Trifolium pratense	+	.	.	.	.	.	.	.	.	.	.	.	+	I
Urtica dioica	+	3	+	+	1	+	.	+	+	.	.	+	+-3	IV
Xanthium strumarium	.	.	.	.	.	.	.	.	.	.	+	.	+	I

Regarding the W indicator spectra we can conclude that the recent W spectrum indicates a somewhat more extreme and a bit drier habitat than the former one. As Figure 1 shows some drought tolerant species occur and the importance of species that indicate wet habitats has decreased.

The nature conservation rank spectra show a slight degradation. The importance of species indicating natural state has slightly decreased, whereas disturbance tolerators have increased considerably. At the same time the importance of weeds has nearly halved. On the whole the proportion of species indicating degradation has increased from 47% to 55%, whereas that of indicating naturalness has decreased from 53% to 45% (Figure 2).

We note here a striking phenomenon observed in the study area. On young islands the river bank weed community is characterized by the presence of tomato (*Lycopersicon esculentum*). The possible reason for this is the release of waste waters from canning factories in Vienna or in Bős (Gabčikovo, Slovakia) into the Danube.

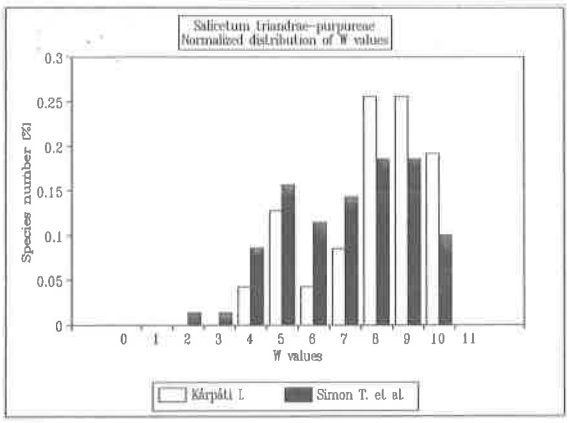

Figure 1.

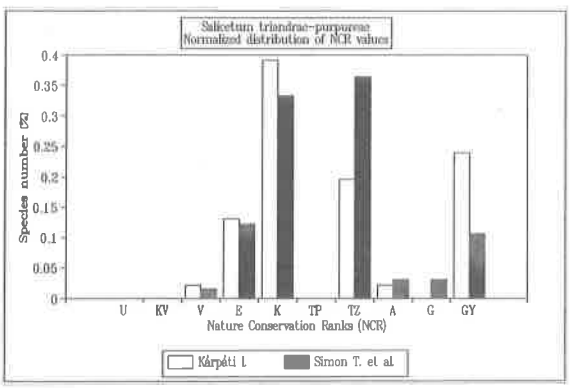

Figure 2.

Willow woods

Willow woods are the fast-growing softwood gallery groves of the low floodplain (*Salicetum albae-fragilis*). They are closed, forest-like communities, usually flooded by several meters of water during inundation. The characteristic structure with two canopy layers and dense, several meters high herb layer and veil-like liane cover of trees and shrubs develop quite fast after the retreat of water. Their stands used to give a nearly continuous cover on the islands of the Szigetköz-Danube labyrinth until the 1920's. It was Zólyomi (1937), who first described this community. *Salix alba* and *Salix fragilis* consociations were the most common, but stands with *Alnus glutinosa, A. incana, Populus nigra* and *P. alba* also occurred. The common species of the shrub layer were *Cornus sanguinea, Corylus avellana, Sambucus nigra.* The field layer was characterized by *Carex acutiformis, Impatiens noli-tangere, Agrostis stolonifera, Urtica dioica, Galium aparine,* sometimes by *Aegopodium podagraria, Convallaria majalis* and *Circaea lutetiana.*

Constant, subconstant (V-IV) species: *Salix alba, S. fragilis, Alnus incana, Cornus sanguinea, Rubus caesius, Glechoma hederacea, Galium aparine.* Common (III) species: *Populus nigra, Alnus glutinosa, Padus avium, Humulus lupulus, Agrostis stolonifera, Brachypodium sylvaticum, Urtica dioica, Ficaria verna, Angelica sylvestris, Symphytum officinale, Solidago gigantea.* Characteristic species (partly in common with hardwood gallery forests - *Populetalia*): *Alnus incana, Ulmus laevis, Padus avium, Vitis sylvestris, Leucojum aestivum, Cardamine pratensis ssp. dentata, C. impatiens, Pimpinella major, Carduus crispus, Senecio fluviatilis.* Additional mesophytic deciduous forest plants: *Clematis vitalba, Scilla vindobonensis, Paris quadrifolia, Galanthus nivalis, Stachys sylvatica, Galeopsis speciosa.*

There are fewer softwood groves near the upper Danube East of Vének. Those stands (Táti-sziget, Körtvélyesi-sziget, Nyáras-sziget, Szentendrei-sziget) were described by Kárpáti (1957). They were similar to the stands in the Szigetköz regarding the main types (*Rubus caesius, Urtica dioica, Agrostis stolonifera, Glechoma hederacea, Solidago gigantea*), but contained less species and more weeds. Several natural species e.g. *Alnus incana, Circaea lutetiana, Pimpinella major, Vitis sylvestris* were missing.

In the Szigetköz willow woods have preserved the former vegetation quite well by now (1991). About one-third of the stands we studied have semi-natural structure. In the canopy layer *Salix alba* is the most dominant with *S. fragilis, Populus nigra, P. alba, Ulmus laevis* as codominants. *Alnus incana* has become rare. The common species (constancy V-III) in the field layer are *Rubus caesius, Phalaris arundinacea, Solanum dulcamara, Phragmites, Humulus lupulus, Urtica dioica, Solidago gigantea, Galium aparine, Aster tradescantii, Impatiens glandulifera*. Some montane rarities, like *Galium odoratum, Circaea lute-tiana, Carex sylvatica, Senecio fluviatilis, Cardamine amara, Veronica beccabunga* are also present. Dominant species are: *Populus alba, P. nigra, Salix alba, Rubus caesius, Dactylis glomerata, Phalaris arundinacea, Calystegia sepium, Urtica dioica, Aster tradescantii* (Table 3).

By assessing the W-spectra of past and today's stands we can state that all of them indicate typical wet, floodplain circumstances. Former stands indicate more even water levels (W-range = 4-10, dominant categories = 5-8; cf. Figure 3). The present situation indicates a more extreme water regime (W-range = 1-10, dominant categories = 5-9).

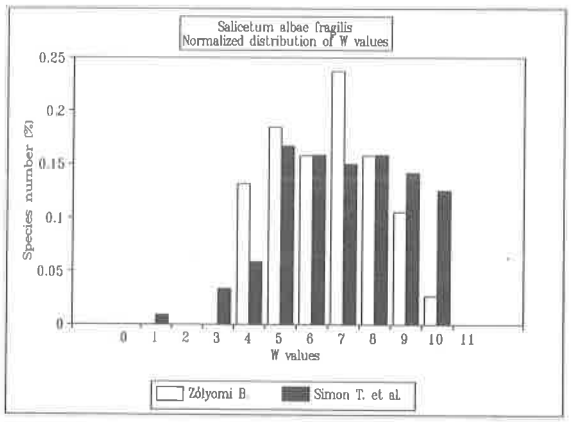

Figure 3.

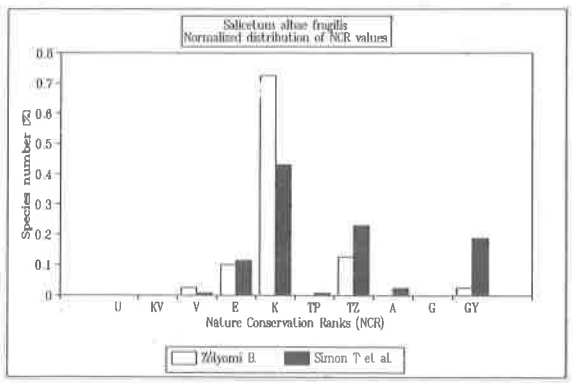

Figure 4.

The comparison of the two spectra shows that both the dry and the wet ends of the spectrum increased in importance, which indicates the more extreme water regime of the area. In the mid-range (5-8) no considerable change occurred (only the importance of group W7 decreased slightly).

If we compare the recent stands in the Szigetköz with those of described by Kárpáti (1957) outside the Szigetköz, we find that the W-spectrum of the Szigetköz stands indicates wetter habitats (Figure 5). The only decrease in species number occurs in categories 9-10, as a result of narrower floodplains of the upper Danube with longer inundation.

As Figure 4 shows the nature conservation rank spectra of the Szigetköz stands indicate a marked degradation (e.g. an increase in the number of weeds) since 1937. The proportion of species indicating natural state decreased from 84.5% to 57%, whereas the proportion of species indicating disturbance increased from 15.5% to 43%.

In Figure 6 we compare our stands with those of Kárpáti (1957). The willow woods outside Szigetköz were in a worse condition at that time (48% natural species) than they are in the Szigetköz now (57% natural species).

All these results, based on W indicator values and nature conservation ranks, confirm the semi-natural state of the softwood groves and the possibility of forest reconstruction in the protected areas of the Szigetköz. The most beautiful willow wood stands (e.g. Senki-sziget, Hajós-side, Öreg-Árva, Nagybajcs: east of Medvei bridge) could be

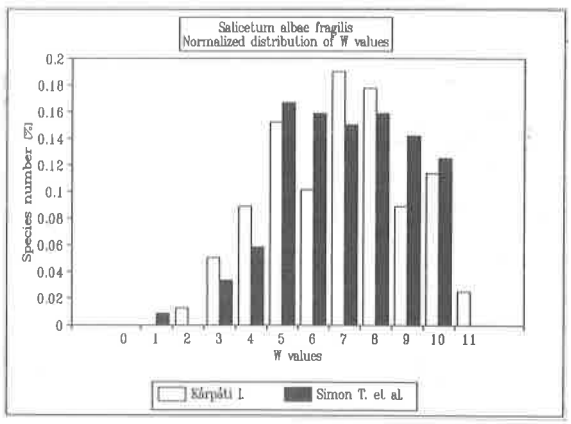

Figure 5.

Table 3. Synthetic phytosociological table of willow woods (*Salicetum albae-fragilis* Issler 1926) in Szigetköz, 1991

	Sampling plots																							
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AD	K
Canopy layer:																									
Acer negundo	.	.	.	.	.	.	.	+-1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	I.
Alnus incana	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	I.
Populus alba	.	.	.	.	.	.	.	+-1	.	.	.	.	.	.	.	.	.	.	.	4-5	.	.	.	+-5	I.
Populus canescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	.	.	.	.	.	.	.	.	+-1	I.
Populus nigra	.	.	.	.	.	.	.	.	.	1-2	3-4	.	.	.	.	+	1	.	.	.	4	.	.	+-4	I.
Prunus padus	.	.	.	.	.	.	.	.	+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	II.
Salix alba	2-3	2	2-3	2-3	4	4	2	2	3	4	2-3	2-3	.	4	2-3	4	3-4	3-4	4	1	+	2-3	3	1-4	V.
Salix cinerea	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Salix fragilis	.	2	.	.	.	.	2-3	.	1	.	.	1-2	.	.	.	.	.	.	.	.	.	.	.	+-3	I.
Salix purpurea	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	I.
Salix triandra	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	I.
Salix viminalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	I.
Ulmus laevis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	2	I.
Ulmus minor	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	I.
Shrub layer:																									
Acer negundo	.	.	.	.	.	.	.	+-1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+-1	I.
Acer pseudoplatanus	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Alnus glutinosa	+-1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	I.
Crataegus monogyna	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1-2	.	+	1-2	+-2	I.
Crataegus oxyacantha	.	.	.	.	.	.	.	+-1	+	.	.	.	.	.	.	.	.	.	.	+-1	.	.	.	+-1	I.
Cornus sanguinea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	.	1-2	1	+-2	I.
Fraxinus excelsior	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Fraxinus pennsylvanica	1-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1-2	I.
Salix alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	I.
Salix purpurea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	I.
Sambucus nigra	.	.	.	.	.	.	.	.	+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	I.
Ulmus procera	+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	I.
Herb layer:																									
Acer negundo	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	I.
Achillea millefolium	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Agrostis stolonifera	.	.	.	.	.	.	.	.	.	.	+	+	+-1	+	.	.	+-1	.	+	.	.	+	.	+-1	II.
Alliaria petiolata	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Angelica sylvestris	.	+-1	.	+-1	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	+-1	II.
Arctium nemorosum	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	I.
Arenaria serpyllifolia	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Artemisia absinthum	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Artemisia vulgaris	.	.	.	+-1	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+-1	I.
Asperula odorata	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	I.
Aster tradescantii	.	1	1	+-1	+	.	2-3	+-1	.	.	.	+	2	.	.	.	+-1	.	+-1	+	.	.	.	+-3	III.
Ballota nigra	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Barbarea vulgaris	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Bidens tripartitus	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	I.
Calystegia sepium	3	.	.	.	.	.	.	.	.	1	+	.	.	+	+-1	+	.	.	.	.	.	+	.	+-3	II.
Capsella bursa-pastoris	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Cardamine amara	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	I.
Cardamine impatiens	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Carduus crispus	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Carex elata	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Carex riparia	+	+	.	.	.	.	+	+-1	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+-1	II.
Carex sylvatica	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Carex sp.	+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	I.
Chaerophyllum bulbosum	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Chenopodium album	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	I.
Chrysanthemum vulgare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	I.
Circea lutetiana	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Cirsium arvense	1	.	.	+-1	.	.	.	+-1	.	.	+	.	.	.	.	.	.	+	.	.	2	.	.	+-2	II.
Clematis vitalba	.	.	.	+-1	.	.	.	.	+	.	+	.	.	.	.	+	.	.	.	.	.	.	.	+-1	I.
Dactylis glomerata	.	+	1-2	+	1	+	.	.	.	.	+	.	.	.	.	.	.	4	.	+	.	.	.	+-4	II.
Deschampsia caespitosa	.	+	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	+	+	.	.	.	.	+	II.
Equisetum arvense	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Festuca gigantea	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Ficaria verna	.	.	.	.	.	.	+	+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	I.
Fraxinus pennsylvanica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	I.
Galium aparine	+	1	1	1	.	+	+	.	.	1-2	1-2	+	+	.	1	1-2	+-1	.	.	+	+	+	+	+-2	V.
Galium palustre	.	.	.	.	.	.	+	+-1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+-1	I.
Geranium robertianum	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Glechoma hederacea	.	.	+-1	+-1	.	.	.	.	.	.	+	.	+	.	+	+	.	.	.	.	+	+	+	+-1	II.
Heracleum sphondylium	.	.	.	+-1	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	+-1	I.
Humulus lupulus	+-1	.	.	.	.	+	.	.	+	+	+-1	+	.	.	+	2	.	.	.	.	.	.	.	+-2	II.
Impatiens glandulifera	.	1	1	1	+	1-2	+-1	.	.	.	.	+	.	.	.	.	.	1	.	.	.	+	+	+-2	III.
Impatiens noli-tangere	1	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+-1	I.
Impatiens parviflora	+	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	+-1	.	.	.	+-1	I.
Iris pseudacorus	+	+-1	.	.	.	.	.	+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	I.
Lamium maculatum	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	I.
Leucojum aestivum	.	+-1	.	.	.	.	+	+-1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	I.
Lycopus europeus	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Lycopus intermedius	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Lysimachia nummularia	.	.	.	.	.	.	.	+-1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+-1	I.
Lysimachia vulgaris	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Lythrum salicaria	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Matricaria inodora	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Myosotis palustris	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	I.
Myosoton aquatica	.	+	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Parietaria officinale	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Pastinaca sativa	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Phalaris arundinacea	.	1	1	1	1	+	4	+-1	+	+-1	2-3	+	1	+	+	.	+	1	2	+	.	+	+	+-4	V.
Phragmites communis	+	+	+	.	.	.	+-1	+	+	+	+	.	.	+	.	.	.	+	+-1	.	.	+	+-1	+-1	III.
Pimpinella saxifraga	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Plantago major	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Plantago media	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Poa annua	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	I.
Poa palustris	.	.	.	.	.	.	+	+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	I.

Table 4. (Continued)

Species	Sampling plots 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AD	K
Poa trivialis	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Polygonum lapathifolium	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Polygonum minus	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Polygonum mite	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	+	.	.	.	.	+	I.
Populus alba	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	+-1	I.
Ranunculus bulbosus	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Ranunculus repens	.	+	+-1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+-1	II.
Rorippa amphibia	.	2	+-1	+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-2	I.
Rorippa armoracioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	I.
Roribba barbaroides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	+	I.
Rorippa islandica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	I.
Rorippa sylvestris	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	+	I.
Rubus caesius	3	+-1	1	.	+	+	+	.	+	+	2	+	+	+	+	+-1	.	.	+	+	1	2	+	+-3	V.
Rubus idaeus	.	.	.	+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	I.
Rumex crispus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	.	.	.	.	.	+-1	I.
Rumex obtusifolius	.	+	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Rumex sanguineus	.	.	+	.	+	.	+	.	+	.	+	+	+	+	.	.	.	.	+	.	.	.	.	+	II.
Scrophularia nodosa	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Scrophularia umbrosa	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Senecio fluviatilis	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	I.
Senecio paludosus	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Solanum dulcamara	.	.	+-1	+-1	.	.	.	+	.	+	+	+	+	+	.	.	.	+	+	.	+	+	.	+-1	III.
Solanum nigrum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	I.
Solidago gigantea	.	+-1	+-1	+-1	+	.	.	.	+	.	+	.	+	+-1	.	.	1	1	.	.	.	.	.	+-1	III.
Stachys palustris	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	I.
Stachys sylvatica	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Stellaria media	.	.	.	+-1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	I.
Stenactis strigosa	.	+-1	+-1	+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	.	.	.	.	.	+-1	I.
Symphytum inundatum	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Symphytum officinale	+	.	.	+-1	.	.	+	+-1	.	.	+	.	.	+	.	+	+	+-1	.	.	.	.	.	+-1	II.
Tanacetum vulgare	.	.	.	+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+-1	I.
Taraxacum officinale	.	.	+	+	+	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	+	II.
Tussilago farfara	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.
Urtica dioica	.	.	+	+-1	+	5	+	1	2-3	5	4	4	2-3	+	5	4	2-3	1	.	+-1	4	2-3	5	+-5	V.
Ulmus minor	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	2	I.
Veronica beccabunga	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	I.
Viburnum opulus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	I.
Xanthium ithalicum	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I.

the starting point of the reconstruction of these woods and of preserving compositional and habitat diversity. Their structure with multiple canopy layers, with veil-like "skirts" of the trees (*Clematis vitalba, Humulus lupulus, Solanum dulcamara, Calystegia sepium*) and with the dense, several meters high field layer proves the primeval character of the community.

Results of diversity and evenness analyses

The diversity and evenness values presented in the tables represent the distribution of species numbers among the classes. Here the classes are W indicator and nature conservation rank classes. Based on nature conservation values, Table 4 shows a slight increase in diversity and decrease of evenness in *Salicetum triandrae-purpurea.* There is a considerable increase of diversity and a slight decrease in evenness in *Salicetum albae-fragilis* between 1937 and 1991. The comparison of the 1937 and 1957 data shows a marked increase in both diversity and evenness, which is in good agreement with our conclusions on the phytosociological degradation of the area.

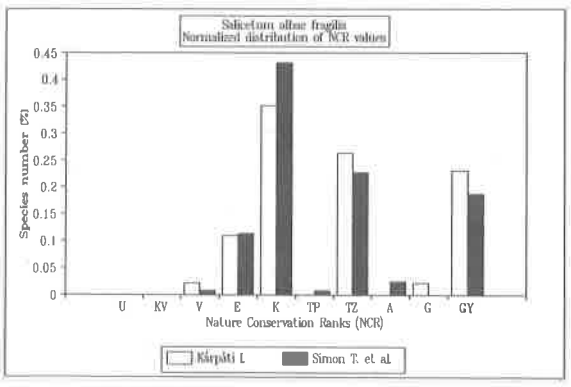

Figure 6.

Table 4. Diversity (D) and evenness (E) of nature conservation ranks (1937: Zólyomi - Szigetköz; 1957: Kárpáti - *Salicetum triandrae - purpurea* - Szigetköz, *Salicetum albae - fragilis* - Esztergom-Szentendrei-sziget; 1991: Simon et al.-Szigetköz)

Community	1937		1957		1991	
	D	E	D	E	D	E
Salicetum triandrae-purpurea	-	-	1.46	0.81	1.50	0.77
Salicetum albae-fragilis	0.91	0.56	1.46	0.91	1.42	0.73

Table 5. Diversity (D) and evenness (E) of W indicator values (1937: Zólyomi - Szigetköz; 1957: Kárpáti - *Salicetum triandrae - purpurea* - Szigetköz, *Salicetum albae - fragilis* - Esztergom-Szentendrei-sziget; 1991: Simon et al.-Szigetköz)

Community	1937		1957		1991	
	D	E	D	E	D	E
Salicetum triandrae-purpurea	-	-	1.75	0.90	2.0	0.92
Salicetum albae-fragilis	1.83	0.94	2.11	0.91	2.02	0.92

Table 5 shows that the diversity for W indicator categories increased in both associations. Evenness has not changed. All these facts support our statements about the more extreme ecological characteristics of the habitats

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