

Biomonitoring of alluvial willow forests

JUHÁSZ MAGDOLNA¹ & DÉNES ANDREA²

¹Somogy County Museum Natural History Department, H-7401 Kaposvár, Fő u. 10., Hungary,
e-mail:juhasz@smmi.hu

²Janus Pannonius Museum Natural History Department, H-7623 Pécs, Szabadság u. 2., Hungary

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Abstract: Alluvial forests with *Salix alba* on floodplain of river Drava were studied in five consequent years. Year-to-year changes in coenological characteristics of the community were pointed out. These changes are unambiguously connected with changes of water supply of the growing place. Preservation of natural state of the community needs temporal surface flooding connected to the river floods.

Key words: biomonitoring, alluvial willow forests, coenological changes

Introduction

Biomonitoring of alluvial willow forests along river Drava is part of an environmental monitoring system, which follows up changes of some abiotical environmental factors and wildlife. Studies aiming to survey environmental changes caused by a Croatian hydro-power plant planned on river Drava have begun in 2000. Coordinated botanical monitoring studies of alluvial forest communities and of populations of chosen herbaceous plants have been performed (JUHÁSZ & DÉNES 2001, 2004). Here we summarize results of five-year study of willow forests.

Existence and characteristics of alluvial plant communities are strongly determined by water supply of their growing place and - in connection of this - by changes of water level of the river. Changes of height and duration of surface water coverage affects species composition of the community and coverage and physiological state of species. Goal of biomonitoring of willow forests is documentation of coenological and compositional state of the community and follow-up of degradational and regenerative processes and changes of growing place characteristics. Coenological indication is based first of all on evaluation of changes of species composition.

Willow forests studied are situated on the left bank of river Drava, in county Somogy, Hungary. River Drava meanders here strongly, its valley runs approximately from northwest to southeast. Larger part of the floodplain belongs to Croatia, the smaller Hungarian part is ca. 300 km². Drava enters Hungary at the mouth of river Mura; for twenty kilometers from here the floodplain is bordered by loess hills, further downwards for another fifty kilometers by aeolian sand areas.

Climate of this area is moderately warm, humid. Annual mean temperature is between 9,7°C and 9,9°C. Hottest summer days' average of many years is about 32,5°C, of coldest winter days is -17,0°C. Annual precipitation 800-840 mm, of which 450-490 mm falls in growing season. Most frequent wind direction is northern, second-frequent is southwestern. Floods of Drava comes in spring, early summer and autumn, low waters in late summer and winter.

There are quaternary deposits in the Drava valley with fluvial and floodplain sand, gravel and mud (MARKÓ-JUHÁSZ 1997). In this area Drava is not constrained in between dams, so it can change her bed even in our days. Surface of floodplain can be divided into low and high floodplain levels, oxbows and oxbow lakes. Elevation differences make only some meters. Groundwater can be reached anywhere between 0-4 meters, its quantity is reasonable, its level changes are in accordance with level changes of the river.

Materials and methods

Study areas were appointed inside the area effected by the planned power plant. Willow forest near Órtilos is upstreams of the planned plant, the other one near Vízvár is downstreams of it.

Permanent quadrats were assigned in typical parts of the given stand. (JUHÁSZ 1997, 2004, ORTMANN-NÉ AJKAI 2004). Near Órtilos, according to terrain characteristics, one 20x10 m and one 20x5 m study plot were assigned, whose data were drawn together in Figures. Study plot near Vízvár is 100x25 m, continuously. Inside permanent quadrats microquadrats of 1x1 m size, chosen by semi-random way, were surveyed; in the smaller Órtilos plot 30, in larger Vízvár plot 50 ones. Our aim was to represent all parts of the plots by the same chance. Surveys were made in the same part of the year in all study years, in June.

Willow forests were surveyed by estimation of coverage percentages, as usual in phytocoenology. Studied variables: coverage of herb species in all microquadrats and coverage of canopy and shrub layer in permanent quadrats.

Results

Studied willow forests of both plots belong to *Leucojo aestivi-Salicetum albae* community (BORHIDI & KEVEY 1996). Data of surveys were ordered into coenological tables and analysed in various ways. In the following changes of coenological spectra of communities and changes of distribution of species by relative water demand and social behaviour types (BORHIDI 1995) are presented. In Figs 1-6 left-hand bars show results based on coverage data (cst), right-hand bars show results based on presence-absence data (csr).

More important growing place and coenological characteristics of the study plot near Órtilos are as follows. Here the left-side floodplain of Drava is very narrow, from the river (state border) to the loess hillfoots only 100-1100 m. Whole area is low floodplain, whose caharacteristic natural vegetation are willow forests. On appointed study plots canopy cover is between 25-70%. Most important dominant tree is *Salix alba*, beside it *Alnus glutinosa* and *Alnus incana* can be found. *Humulus lupulus* is a lian climbing up to canopy. Shrub layer is thin, its coverage is max.10%, consists of *Cornus sanguinea*

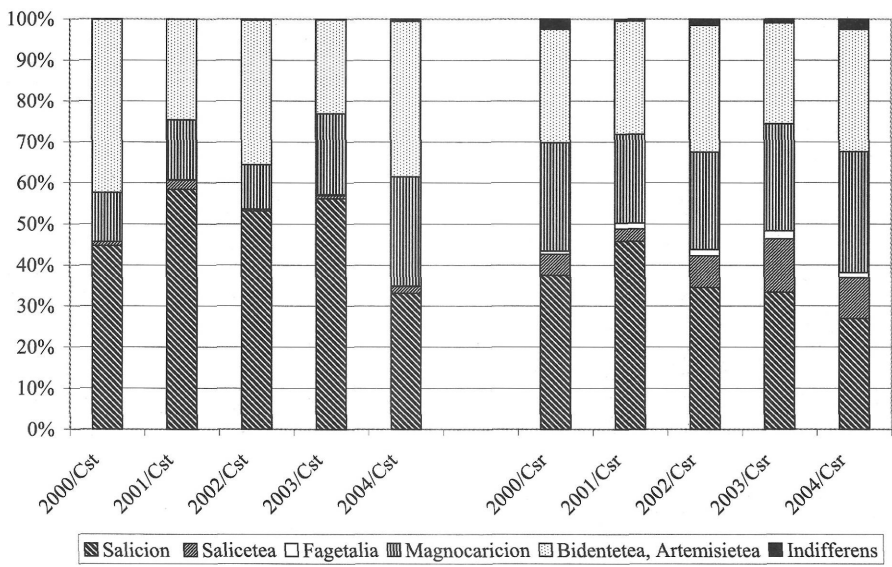


Fig. 1.: Percentage distribution of species by coenological character in willow forest study area at Órtilos

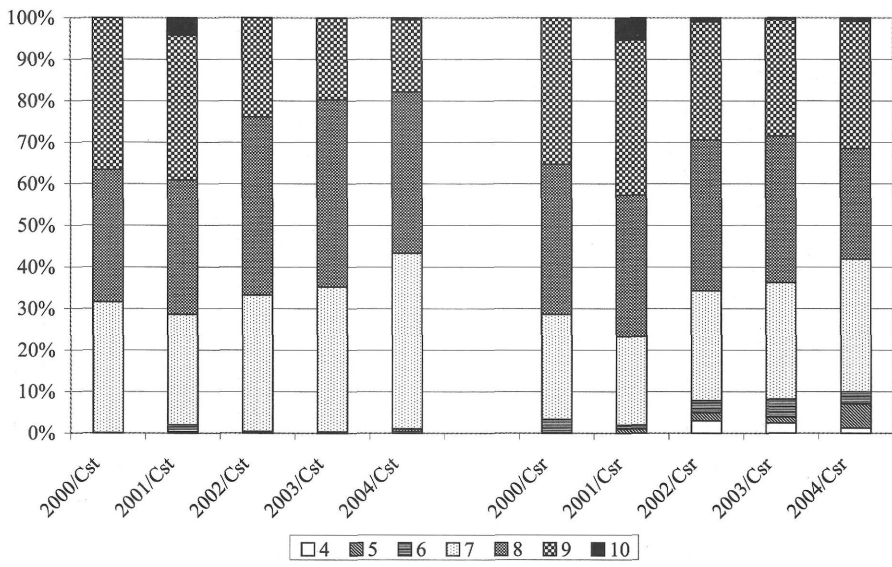


Fig. 2.: Change in percentage distribution of species by relative water demand in willow forest study area at Órtilos

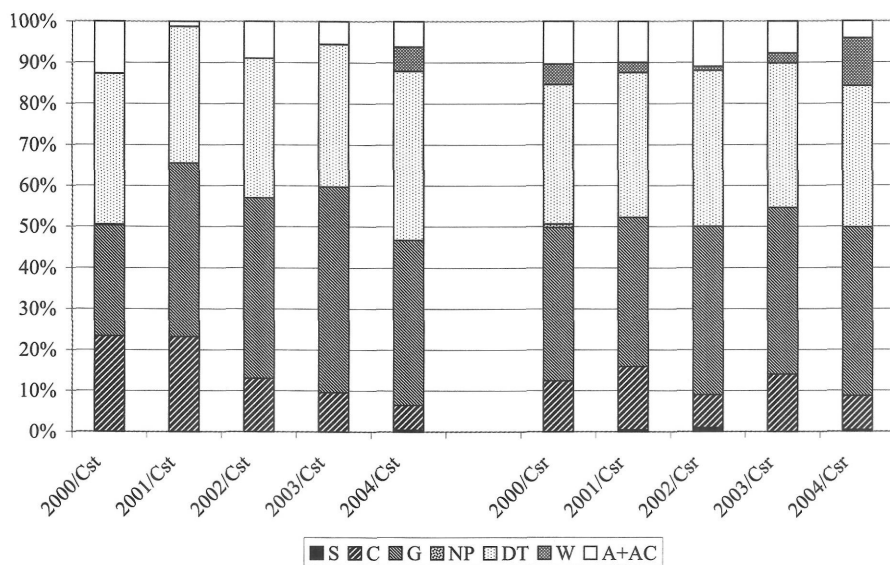


Fig. 3.: Change in percentage distribution of species by social behaviour types in willow forest study area at Órtilos

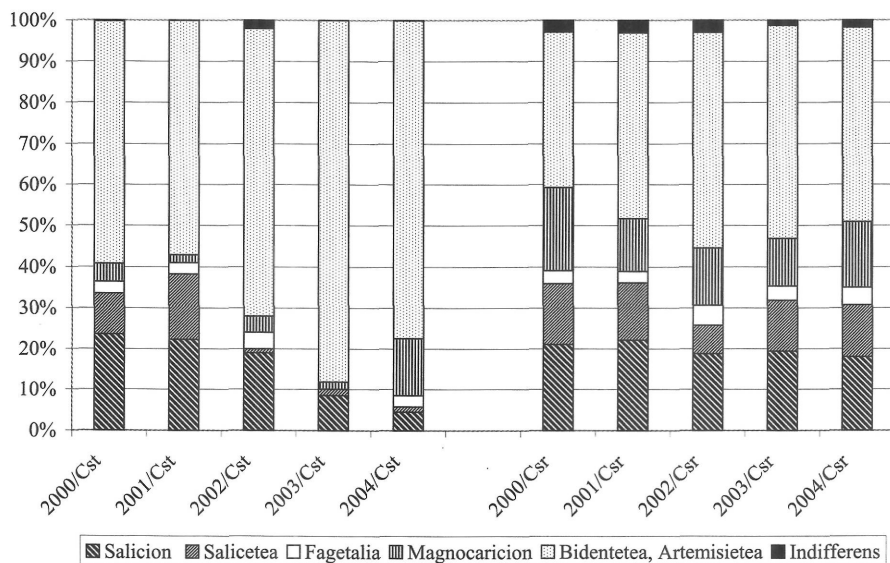


Fig. 4.: Percentage distribution of species by coenological character in willow forest study area at Vízvár

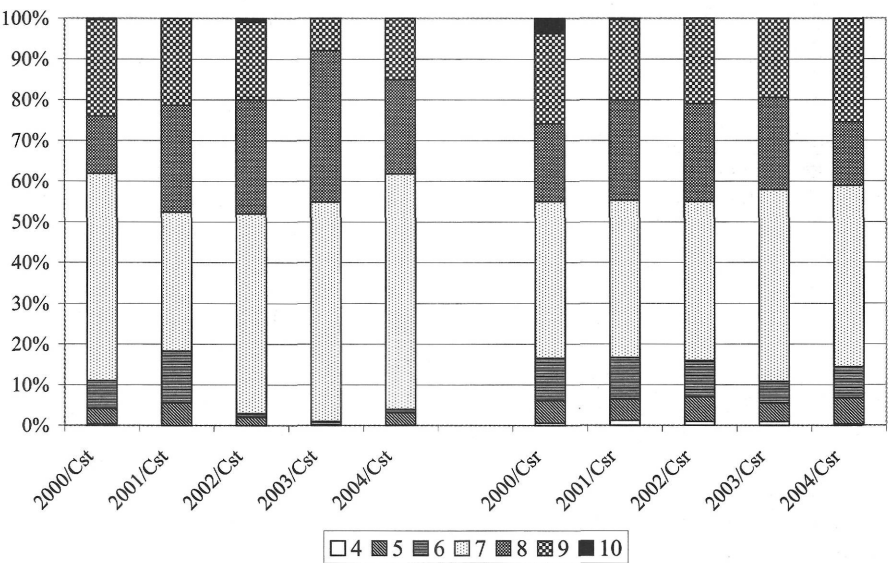


Fig. 5.: Change in percentage distribution of species by relative water demand in willow forest study area at Vízvár

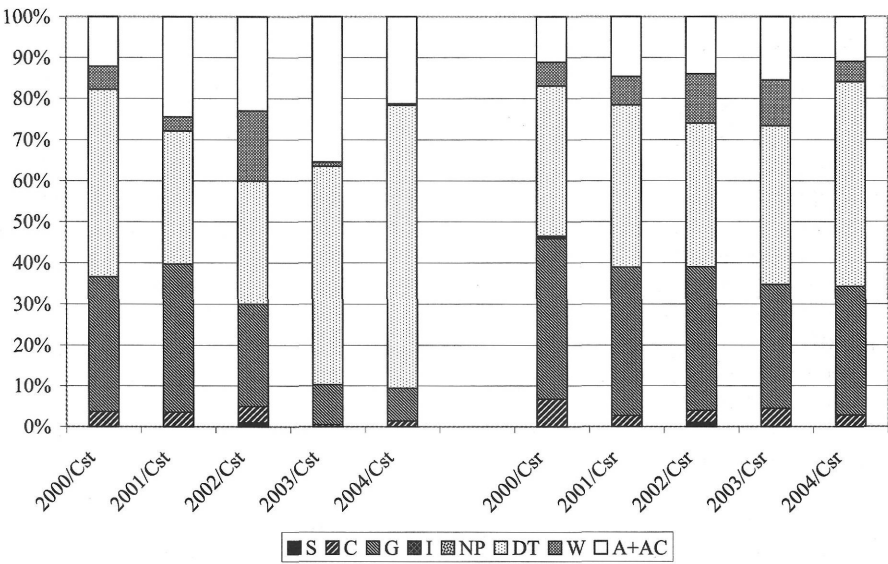


Fig. 6.: Change in percentage distribution of species by social behaviour types in willow forest study area at Vízvár

and *Viburnum opulus*. Coverage of herb layer changes with quantity and duration of surface water cover. *Phalaroides arundinacea* and *Succisella inflexa* are determinant local characteristic species of willow forests. Further characteristic species: *Carex gracilis*, *Equisetum hyemale*, *Galium palustre*, *Iris pseudacorus*. *Carex pseudocyperus*, *Carex vesicaria*, *Angelica sylvestris*, *Stachys palustris*, *Polygonum mite* also occur. In some places in the herb layer sometimes swamp and wet meadow species - most often *Lysimachia vulgaris* and *Symphytum officinale* - can reach significant coverage. Disturbance tolerant and weed species have significant coverage mostly in drier parts. Most important natural disturbance tolerant is *Rubus caesius*; *Urtica dioica* and *Galium aparine* are also common. Alien invasive species occurring here are *Impatiens glandulifera* and *Solidago gigantea*. Distribution of species by coenological characteristics in Órtilos plot are shown in Fig.1. It shows that this study plot is determined by changing proportions of local characteristic species of willow forests, swamp and wet meadow species and disturbance tolerant species. In case of long, high water cover swamp and wet meadow species gain space. In years with average water level changes the stand is determined by total coverage of local characteristic species of willow forests. In drier years proportion of natural disturbance tolerants grow. Results based on presence-absence data on the right-hand side of the figure show finer coenological composition of the community. Here even those coenological groups can be seen which take part in composition of the community with insignificant cover values. Coenological colouring species like this are species of mesophilous woodlands and indifferent species living in many different communities. Sometimes some species of mesophilous woodland are settle in the study plot; they come supposably from hornbeam-oak forests of the nearby loess hills. Fig.2. shows changes of distribution of species by relative water demand. On 12-degree scale of relative water demand species occur between values 4-10. Community is determined mostly by plants of moist soils and plants of wet, not well aerated soils; their proportions change according to water level changes. Extremities appearing in the study plots are plants of semidry habitats indicating extreme dryness, and water plants of frequently flooded soils indicating extrem wetness. Fig.3. shows distribution of species by social behaviour types in the Órtilos study area. In this respect community is determined by competitors, generalists and disturbance tolerants in changing proportions. In certain years weeds and invasive alien species appear with significant coverage.

More important growing place and coenological characteristics of the study plot near Vízvár are as follows. Left-side flood area of Drava here is also relatively narrow. The river - trying to change her bed - steeply undermines the higher level of the neighbouring land. Floodplain is low, only 0-1000 m wide, its characteristic natural community is alluvial willow forests. In appointed study area canopy is formed exclusively by *Salix alba* with 65% coverage. Up the trees climb masses of *Humulus lupulus* and in some places *Hedera helix* too. Coverage of shrub layer is about 25%, its characteristic species is *Cornus sanguinea*; *Sambucus nigra* is also common. Coverage of herb layer shows small changes year by year, according to height and duration of surface water coverage. Amongst local characteristic species of willow forests *Phalaroides arundinacea* is most common, in some places *Carex gracilis* and *Caltha palustris* can also be found in masses. *Iris pseudacorus*, *Angelica sylvestris*, *Equisetum hyemale*, *Galium palustre*, *Carex vesicaria*, *Myosotis palustris*, *Polygonum mite*, *Succisella inflexa* also occur. Amongst local characteristic species of alluvial softwoods *Galeopsis speciosa* is relatively common, *Circaea lutetiana* and *Cucubalus baccifer* are more rare. Occurrence of swamp and wet meadow species is significant by their species number, more insignificant by their coverage. These species are: *Carex acutiformis*, *Carex elata*, *Lythrum salicaria*,

Lysimachia vulgaris, *Symphytum officinale*. In case of untouched natural conditions this growing place is more wet; rarer and lower floods - relative drying of habitat - is indicated by masses of disturbance tolerant and weed species. Most common disturbance tolerant species is *Rubus caesius*; in some places *Galium aparine*, *Urtica dioica*, *Glechoma hederacea* can be found in masses too. Amongst alien invasive species *Impatiens glandulifera* is very frequent, *Solidago gigantea* is rare. Distribution of species by coenological characteristics in Vízvár plot are shown in Fig.4. It shows that this study stand is determined mostly by two large species groups: local characteristic species of willow forests and disturbance tolerant species. In case of good water conditions proportion of local characteristic species of willow forests increases, in dryer years proportion of natural disturbance tolerant and invasive species rises. Results based on presence-absence data on the lefthand side of the figure show finer coenological composition of the community. According to their species number general species of gallery softwoods and swamp and wet meadow species are well represented too. Fig.5. shows changes of distribution of species in Vízvár plot by relative water demand. On 12-degree scale of relative water demand species occur also between values 4-10; but this stand is determined first of all by plants of moist soils. By surveys and analysing of diagrams we concluded that Vízvár plot is a little dryer than Órtilos plot. It is shown also by the diagram of distribution of species by social behaviour types (Fig.6). Natural communities of floodplains need floods, need temporary water cover; if it is left out, weeds and degradation follow. Relative dryness of Vízvár plot is indicated by significant proportions of natural disturbance tolerants, native weeds and alien invasive species. Generalists and competitors, indicating natural conditions are also present, so species pool is given for complete regeneration of the community in case of appropriate water conditions.

Conclusions

Coenological studies of alluvial willow forests along river Drava were accomplished in five consequent years. Year-to-year changes in coenological characteristics of the community were pointed out. Analysis of data and field observations unambiguously prove that experienced changes are connected closely with changes of water supply of the growing place. Preservation of natural state of the community needs floods of the river temporal surface flooding of alluvial habitats connected to them.

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Ártéri fűzligetek monitoring vizsgálata

JUHÁSZ MAGDOLNA és DÉNES ANDREA

A Dráva folyó mellett található ártéri ligeterdők monitoring felmérése egy környezeti monitoring rendszer része. A vizsgálatok a Dráva folyón tervezett horvátországi vízerőmű Magyarországot érintő környezeti hatásainak vizsgálata céljából indultak 2000-ben. Az ártéri fűzligetek cönológiai vizsgálatára a tervezett vízerőmű hatáskörzetében két mintaterületet jelöltünk ki. Az Őrtilos község határában lévő állomány a tervezett vízerőmű fölött, a Vízvár község közelében lévő állomány a tervezett vízerőmű alatt található.

Jelen tanulmányban a fűzligetek öt éven át végzett cönológiai felmérésének eredményeit foglaltuk össze. Elemeztük a társulás cönológiai karakter spektrumának változásait, valamint a fajok relatív vízigény és szociális magatartástípusok szerinti megoszlásának változásait. Megállapítottuk, hogy a növénytársulás cönológiai jellemzői tekintetében évről-évre elmozdulások vannak. A felmérések adatainak elemzése a terepi megfigyelésekkel összhangban egyértelműen azt mutatja, hogy a tapasztalt eltérések a termőhely vízellátottságának változásával vannak szoros összefüggésben.