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Biomonitoring of alder swamp forests

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JUHÁSZ, M. & DÉNES, A.: *Biomonitoring of alder swamp forests.*

Abstract: Studied stand of alder swamp forest (*Angelico sylvestri - Alnetum glutinosae*) is situated on alluvial plain of river Drava. Coenological survey of designated area has been made in every year. In this paper we analyze data of five consequent years (2000-2004). There are year-to-year changes in coenological characteristics of the community. Experienced changes are connected undoubtedly to changes of water supply of the growing place.

Keywords: floodplain, alluvial forests, river Drava.

Introduction

Studied stand of alder swamp forest is situated on the left-side alluvium of river Drava, in south-western part of Hungary, about five kilometers from present riverbed. In this section of the river there is no flood protection dam, but floods do not reach study area; although subsoil water moves in the gravel bottom of the wide valley in connection to the floods of Drava. Climate of study area is moderately warm, humid. Annual mean temperature is about 9.8°C. Annual precipitation, based on many years' average is 800-840 mm. Floods of Drava come in spring, early summer and autumn, low waters in late summer and winter.

Biomonitoring of alluvial alder swamp forest by river Drava is a part of an environmental monitoring system. Studies aiming to survey environmental changes caused by a Croatian hydro-power plant planned on river Drava have begun in 2000 (JUHÁSZ & DÉNES 2001, 2004, 2005, JUHÁSZ & LÓKI 2005). Coenological characteristics of partially flooded plant communities depend greatly on water supply of the growing place. Goal of study of the alder swamp forest are: documentation of coenological state of the community and monitoring of changes in growing place conditions through degeneration and regeneration processes.

Material amd methods

Previously to this study many field trips were made in Drava valley by the authors (JUHÁSZ 1997, 2004, MARKÓ & JUHÁSZ 1997). Detailed observation of this alder swamp

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stand - situated in Hungarian effect area of the planned Croatian hydroelectric power plant - and designating exact study area was made in 2000.

Permanent quadrat of 50x50m was designated in a typical plot of the stand. Inside it 50 micro-quadrats (1x1 m each), chosen by a pseudo-random way were surveyed. Goal of pseudo-random survey was to represent all parts of study area evenly. Field surveys were made at the same time of every year, in June, with estimation of percentage cover, as usual in phytocoenology. Variables studied: covering of herb layer species in all micro-quadrats and covering of shrub layer and canopy in the whole permanent quadrat.

Results

Alder swamp forest studied belongs to plant community *Angelico sylvestri - Alnetum glutinosae* (BORHIDI & KEVEY 1996). It is a ground-water influenced forest occurring in depressions of floodplains. During floods the growing place characterized by aerobic processes, because there are a lot of oxigen in the moving water; but time to time there is standing water which induces anaerobic processes to start. Alder swamp forests are two-faced, transitional between alder moors (*Carici elongatae - Alnetum*) and hardwood alluvial forests (*Carici brizoidis - Ulmetum*). Beechwood (*Fagetalia*) species are missing almost totally, so alder swamp forests are categorized coenotaxonomically into moor forests; but true moor species are also missing, even name-giving species of moor forests, *Carex elongata*. Herb layer between trees is more closed, characterised by high-growing sedges (*Carex acutiformis, C. riparia, C. gracilis, C. vesicaria*).

Our study site is situated near village Gyékényes. Characteristics of the growing site and the coenosis (Fig.1., Fig.2.) are as follows. Left-side floodplain of river Drava is very wide here, study site can be found on high floodplain level. Effects of floods are indirect, realized through rise of subsoil water level in the gravel bottom. Characteristic natural forest communities in the surroundings: hardwood alluvial forests, in deeper parts alder moors and alder swamp forests. In the designated study plot canopy is monodominated by alder (*Alnus glutinosa*) with a coverage of 65%. Shrub layer is sparse, its coverage is 20%, consist mostly of *Frangula alnus* and saplings of *Alnus glutinosa. Solanum dulcamara* creeps on tree trunks in some places. Between the trees soil is covered with water in most of the year. In the five study years, in June, when surveys were made, water depth changed between 0-80 cm. Eastern and southern part of the plot lies a bit deeper, here water coverage is longer. Coverage of herb layer change mosaically, in micro-quadrats surveyed it was between 0.1-90%. In herb layer *Carex acutiformis* occurs in masses. Moor-like species: *Hottonia palustris, Urtica kioviensis, Thelypteris palustris, Galium palustre*, with a significant frequency and abundance. Softwood species: *Leucojum aestivum, Galeopsis speciosa, Solanum dulcamara, Stachys palustris, Scrophularia nodosa*, with lesser frequency and abundance. Swamp species are also very significant, most common ones: *Sparganium erectum, Oenanthe aquatica*, less common ones: *Iris pseudacorus, Lysimachia vulgaris, Myosotis palustris, Rorippa amphibia, Alisma plantago-aquatica, Mentha aquatica, Symphytum officinale*. At high water level there are floating water plants, e.g.: *Lemna minor, Lemna trisulca, Hydrocharis morsus-ranae, Riccia fluitans*. Indifferent species are: *Ranunculus repens, Lycopus europaeus, Eupatorium cannabinum*, which occurs seldom in study plot.

After field survey data were arranged into coenological tabelles and analyzed by different methods. Changes of coenological character spectra of communities and changes of relative water demand and social behaviour types (BORHIDI 1995) are presented in the

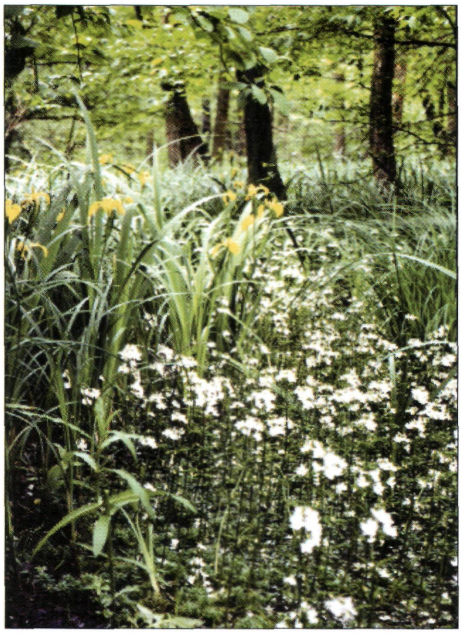

Fig. 1: The alder swamp forest study area in May (with *Iris pseudacorus* and *Hottonia palustris*)

Fig. 2: The alder swamp forest study area in June (with *Carex acutiformis*)

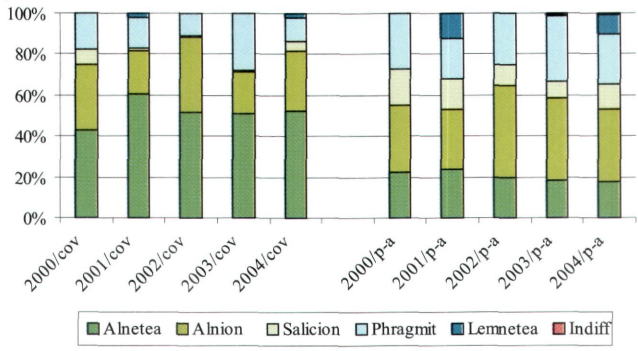

Fig. 3: Change in percentage distribution of species by coenological character in alder swamp forest (Alnetea*: Alnetea glutinosae;* Alnion*: Alnion glutinosae;* Salicion*: Salicion albae;* Phragmit*: Phragmitetalia incl. Magnocaricion;* Lemnetea*: Lemnetea;* Indiff*: Indifferent*)

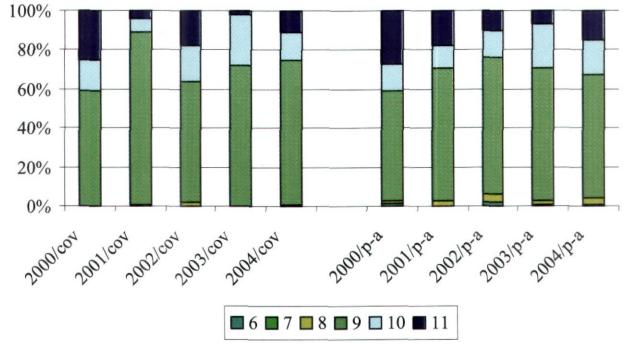

Fig. 4: Change in percentage distribution of species by relative water demand in alder swamp forest (6: plants of fresh soils; 7: plants of moist soils not drying out and well aerated; 8: plants of moist soils tolerating short floods; 9: plants of wet, not well aerated soils; 10: plants of frequently flooded soils; 11: water plants, with floating or partly emergent leaves)

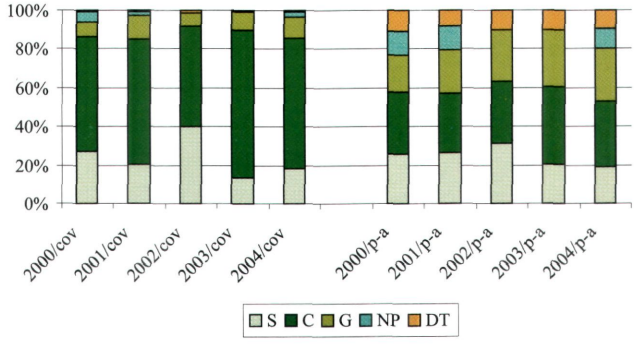

Fig. 5: Change in percentage distribution of species by social behaviour types in alder swamp forest (S: specialists; C: competitors; G: generalists; NP: natural pioneers; DT: disturbance tolerants)

Table 1: Change in percentage distribution of species by coenological character in alder swamp forest

cönotaxon	by covering					by presence-absence				
	2000	2001	2002	2003	2004	2000	2001	2002	2003	2004
Alnetea glutinosae	43.10	60.81	52.03	50.76	52.38	22.60	23.94	19.48	18.70	17.72
Alnion glutinosae	31.80	20.65	36.29	20.80	29.38	32.70	29.58	45.45	39.56	35.03
Salicion albae	7.40	8.82	1.07	0.60	4.39	17.60	17.37	9.96	8.70	12.66
Phragmitetalia	17.70	7.91	10.61	27.82	11.61	27.10	16.90	25.11	31.74	24.47
Lemnetea	0.00	1.81	0.00	0.01	2.23	0.00	12.21	0.00	0.43	9.70
Indifferent	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.87	0.42
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

following. In Figures 3-5. left-side columns represent data based on covering of species (cov), right-side columns represent data based on presence-absence of species (p-a).

Figure 3. shows changes of coenological character of species (Table 1). Proportion of species characteristic of this community (*Alnetea*) based on coverage is significant, in studied years about 50%. Besides them moor (*Alnion*) and swamp (*Phragmitetalia*) species determines the community in changing proportions. Presence-absence date present a wider spectrum. Based on species numbers softwood species (*Salicion*) are important in every year (9-18%). In years with higher water level proportion of floating water plants (*Lemnetea*) rises (between 0-12% in the five years).

Figure 4. shows changes of distribution of species of study area by relative water demand (Table 2). On 12-degree scale of relative water demand species occur between values 6-10. Community is determined mostly by plants of wet, not well aerated soils (WB:9). Besides them - in proportions changing according to water level changes - plants of frequently flooded soils (WB:10) and floating water plants (WB:11) are important. Plants with smaller water demand (WB: 6,7,8) are subordered, their proportion by coverage 1%, by presence-absence 4%.

Figure 5. shows distribution of species by social behaviour types in the study area (Table). In this respect community is determined by specialists, competitors and generalists in changing proportions. Naturalness of the community is indicated by high proportion of specialist species, which are very sensitive to environmental changes. Their

Table 2: Change in percentage distribution of species by relative water demand in alder swamp forest (6: plants of fresh soils; 7: plants of moist soils not drying out and well aerated; 8: plants of moist soils tolerating short floods; 9: plants of wet, not well aerated soils; 10: plants of frequently flooded soils; 11: water plants, with floating or partly emergent leaves)

WB	by covering					by presence-absence				
	2000	2001	2002	2003	2004	2000	2001	2002	2003	2004
6	0.20	0.00	0.02	0.00	0.01	1.50	0.00	1.74	0.00	0.42
7	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.43	0.00
8	0.10	0.67	1.74	0.18	0.35	1.50	2.82	4.35	2.61	3.80
9	58.60	88.24	62.02	72.19	74.37	56.30	67.60	70.00	67.39	62.87
10	16.20	7.31	18.32	25.71	14.68	13.60	12.21	13.48	23.05	17.72
11	24.90	3.78	17.90	1.91	10.59	27.10	17.37	10.43	6.52	15.19
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

proportion is between 13-40% by coverage and between 19-31% by presence-absence in the study years. Competitors have highest proportions (by coverage 52-76%, by presence-absence 30-40%). In some years natural pioneers have an important role too, 0-6% by coverage. Natural disturbance tolerants are very few (1% by coverage) but they are present floristically, and they presumably will gain space significantly if growing place becomes drier.

Table 3: Change in percentage distribution of species by social behaviour types in alder swamp forest

SBT	by covering					by presence-absence				
	2000	2001	2002	2003	2004	2000	2001	2002	2003	2004
Specialists	27.00	20.46	39.80	13.48	18.46	25.60	26.76	31.31	20.43	18.99
Competitors	59.10	64.90	52.20	76.31	66.95	32.10	30.04	32.17	40.01	33.76
Generalists	7.70	12.25	6.42	9.59	11.49	19.10	22.54	26.09	29.13	27.85
Natural pioneers	5.70	1.81	0.00	0.01	2.23	12.10	12.21	0.00	0.43	9.70
Disturbance tolerants	0.50	0.58	1.58	0.61	0.87	11.10	8.45	10.43	10.00	9.70
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Conclusions

Coenological studies of alder swamp 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.

The natural plant communities living on the floodplain need the floods and the high ground-water levels temporarily. Degradation processes make start and the habitats become weedy if these not occur systematically. Species composition and covering of species of the studied swamp forest are determined basically by: when the soil surface is covered by water, for how long and how high water level is. Preservation of natural state of the community needs floods of the river and temporal surface flooding of growing place connected to them.

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Égeres mocsárerdő monitoring vizsgálata

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A Dráva folyó árterületén lévő égeres mocsárerdő állomány cönológiai felmérését öt egymást követő évben végeztük el. 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 változásaival vannak szoros összefüggésben.

Az ártéren élő természetes növénytársulások igénylik a folyó áradásait és az azzal összefüggésben jelentkező, időszakosan magas talajvízállást, ennek elmaradása esetén gyomosodás, degradáció jelentkezik. A vizsgált mocsárerdő társulás fajösszetételét és a jelen lévő fajok borítását alapvetően meghatározza, hogy az évnek mely időszakában borítja víz a talajfelszínt, milyen hosszú ideig és mekkora a vízállás magassága. A folyó áradásai és a termőhely ezzel összefüggő időszakos felszíni vízborítása szükséges a vizsgált növénytársulás természetes állapotának megőrzéséhez.