South-Moravian floodplain forest herb vegetation in the period 1978–1997

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ABSTRACT: The results document changes in the herb vegetation of a South-Moravian floodplain forest in the period of 1978–1997. It is shown that hydrological measures strongly changed the floodplain forest in the area of the Dyje river near Lednice na Moravě. The herb vegetation in the area of the confluence of the Morava and the Dyje rivers was conserved nearly unchanged after artificial floods.

Keywords: herb vegetation; floodplain forest; changes

A floodplain forest that is situated in the area of the confluence of the Morava and the Dyje rivers represents a small residue of the unique vegetation in Central Europe. Important monographs were devoted to its complex research. Monographs described the whole ecosystem in its natural habitat at different stages of development (PENKA et al. 1985) and after extensive hydrological measures were taken (PENKA et al. 1991). These measures were not identical in the whole area and the ecosystem was influenced in a different way. The herb layer is very sensitive to the main factor influencing the floodplain forest – water quantity – namely as a result of floods and of fluctuating groundwater level throughout the year. It is a long-time process. Observations and description of changes at some intervals provided a picture of the condition and development of these forest communities (VIEWEGH 1991a).

METHOD

For vegetation monitoring three transects were previously chosen (VAŠÍČEK 1985), taking up the most of the area of floodplain forest moisture gradient as reflected by herb vegetation – from "relatively" dry to considerably damp habitats with the exception of pool vegetation. They are as follows: a transect in the floodplain forest near Lednice na Moravě (L – plots L_1–L_8), influenced by the Dyje river, at an elevation between 160.8 m and 162.4 m a.s.l.; a transect near Moravská Nová Ves (M – plots M_1–M_6), influenced by the Morava river, at an elevation between 157.1 m and 157.7 m a.s.l. and a transect in the natural reserve Ranšpurk Virgin Forest (R – plots R_1–R_6) located in the area of the confluence of both rivers, at an elevation between 151.1 m and 152.2 m a.s.l.

Another transect was added to the above-mentioned ones in 1991 situated in the proximity of the confluence of the Dyje and the Morava rivers (called Soutok; S – plots S_1–S_5) (FRYŠTENSKÝ 1994) in the former "iron curtain" zone where the entry was forbidden; therefore the forest stands were not influenced by any anthropic interventions for a long time. The elevation was not measured, but this transect has the lowest elevation (about 150 m a.s.l.).

Biomass data were collected on 16 quadrats of the size 0.5 × 0.5 m on each plot of each transect in 1978 and 1983 (i.e. plot L_1 – 16 quadrats, L_2 – 16 quadrats, etc.). Collection of this quantitative data was discontinued due to laboriousness after 1983. To maintain the data continuity it was necessary to find a different method to use the former data and to monitor the transects more easily after some periods. One possibility was found – the frequency of species occurrence on each plot of each transect (FRYŠTENSKÝ 1994). So 16 quadrats of the size 0.5 × 0.5 m were randomly located on each plot. The species presence was determined on each quadrat and the frequency of occurrence was computed.

This data was collected in 1978, 1983, 1988 and 1997 on the transects at Lednice na Moravě (plots L_1–L_8), Moravská Nová Ves (plots M_1–M_6) and Ranšpurk Virgin Forest (plots R_1–R_6). Plots S_1–S_5 were investigated in 1991, 1992 and 1997. Data were ordinated by DCA method (detrended by segments) included in CANOCO program (TER BRAAK 1988). Division of all plots (in the floodplain area) was made by TWINSPAN program (HILL 1979).

RESULTS AND DISCUSSION

LEDNICE NA MORAVĚ TRANSECT

The result of ordination on the transect in the floodplain forest near Lednice na Moravě is documented in Fig. 1. X1-axis represents plot localization through a mois-

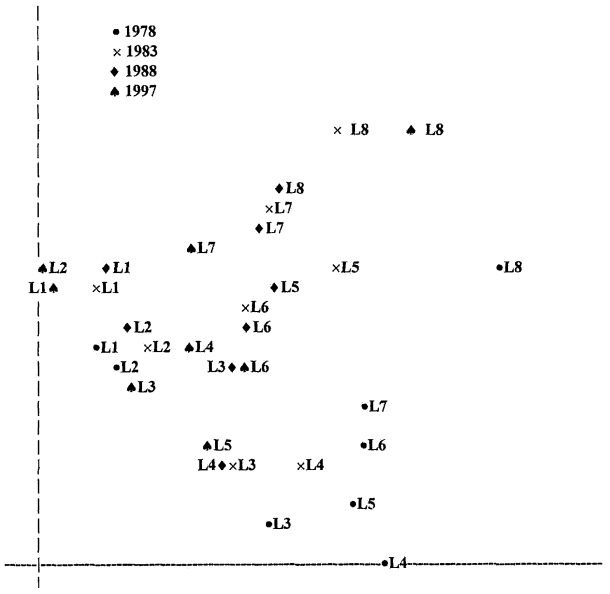

Fig. 1. Ordination of the plots on Lednice na Moravě transect

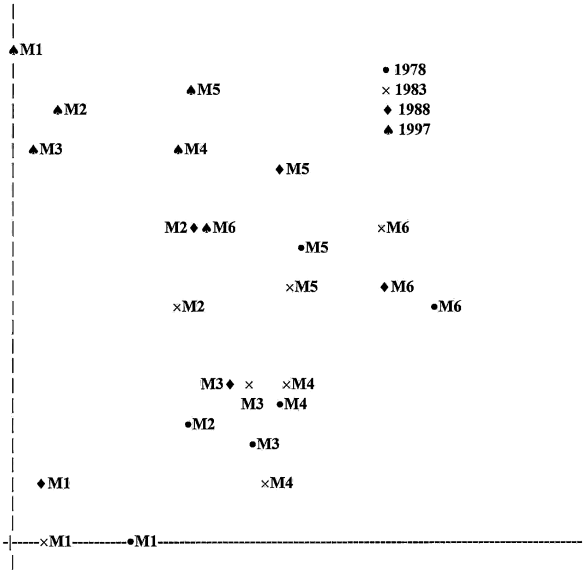

Fig. 2. Ordination of the plots on Moravská Nová Ves transect

ture gradient (left side – "drier", right side – wet). X2-axis shows the gradient of light conditions. As it can be seen, both determined gradients are not so explicit and the mutual plot position on gradients was influenced by other environmental factors in the years of observation: in the first place nitrogen soil conditions and probably some soil structural changes as well. Actually, the last flood occurred in this area in 1976.

We can see (Fig. 1) how the primary plots, arranged through the moisture gradient in 1978, gradually changed. A trend to dry localities is perspicuous. Plots 1, 2 and particularly plot 3 are influenced by the conditions of a specific sand configuration called "hrúd". All plots are on stagnosols. The groundwater level was measured just about 10 cm below the soil surface in 1978 (PRAX 1985). Plots 4–8 considerably narrowed their moisture amplitude and the original large differences in vegetation tended to disappear. Site light conditions changed too. Tree and shrub natural regeneration resulted in a strong overshadowing of the herb layer. This floodplain forest is a commercial stand and even considerably superannuated (it is about 140–160 years old), so it is cut down on some plots. Only one plot (No. 8) of the transect was cut down for the time being, some others lie very closely to the new stand margins.

MORAVSKÁ NOVÁ VES TRANSECT

The results of ordination on the transect in the floodplain forest near Moravská Nová Ves can be seen in Fig. 2. X1 and X2 axes determine the same gradients as in the transect above. The primary moisture gradient, from plot M_1 to plot M_6 – from "drier" to damp, has changed too, even the fact that in the vegetation season 1976 (a year before the last data collection) the area was flooded for about 20 days by 100 years flood. It is shown that a single although very substantial flood does not influence the long-time trend of vegetation drying caused by the decreasing groundwater level after the measures in the Morava river bed were taken. Like in Lednice transect, this floodplain forest is a commercial stand and the clear-cut area admittedly has not affected the transect plots until now, but it is very close from both sides. As Fig. 2 shows, the plots are considerably shifted to the light gradient in comparison with previous years.

RANŠPURK VIRGIN FOREST TRANSECT

The results of ordination are shown in Fig. 3. At a glance one can say that this site has not changed remarkably. X1-axis shows an increasing moisture gradient from left to right again and X2-axis documents the gradi-

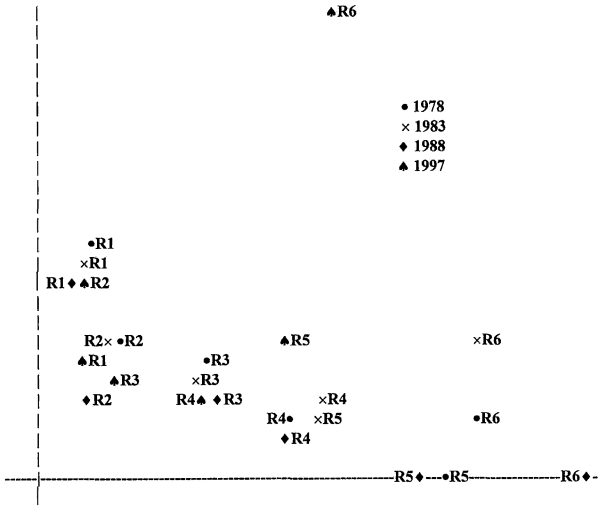

Fig. 3. Ordination of the plots on Ranšpurk Virgin Forest transect

ent of light conditions from bottom to top. Plots 1 and 2 are also influenced by the sandy soil ("hrúd"), which is drier and the tree layer is thinner. Plots 4–6 proved drying in 1997, namely with increasing gradient they were increasing as well. It is hard to say how this effect was caused, especially because this area has been flooded artificially every spring (PRAX – pers. commun.) since 1987 and there was an about 30-day flood in 1996. Plot 6 shows a sudden great light that could be a result of the fall of a big old tree.

SOUTOK TRANSECT

The moisture gradient is converse in comparison with the above mentioned figures (Figs. 1–4). The dampest plots are on the left and drier ones on the right of X1 axis. The gradient of light conditions is converse too, more shadow down and more light up of X2 axis.

The plots do not seem to have changed so much in the nineties of the last century. Their light conditions changed, however. Plots take less light, probably through a higher tree canopy. The moisture properties can hardly change close to the confluence due to yearly floods and because hydrological measures have been minimal there.

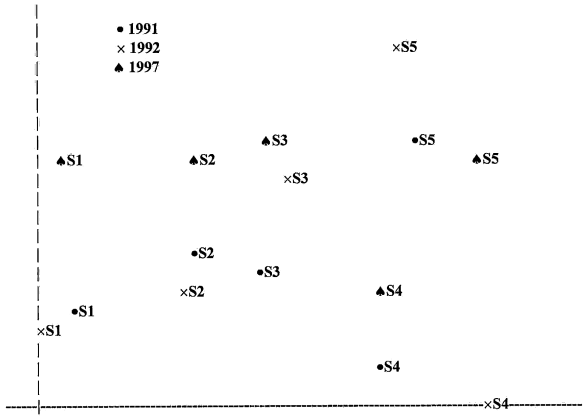

Fig. 4. Ordination of the plots on Soutok transect

COMPARISON OF PLOTS ON TRANSECTS

Fig. 5 shows a schematic moisture gradient of the floodplain forest according to typical herb species of the undergrowth (VIEWEGH 1991b). Plots are designated by their moisture gradients in their lower part. Attention should

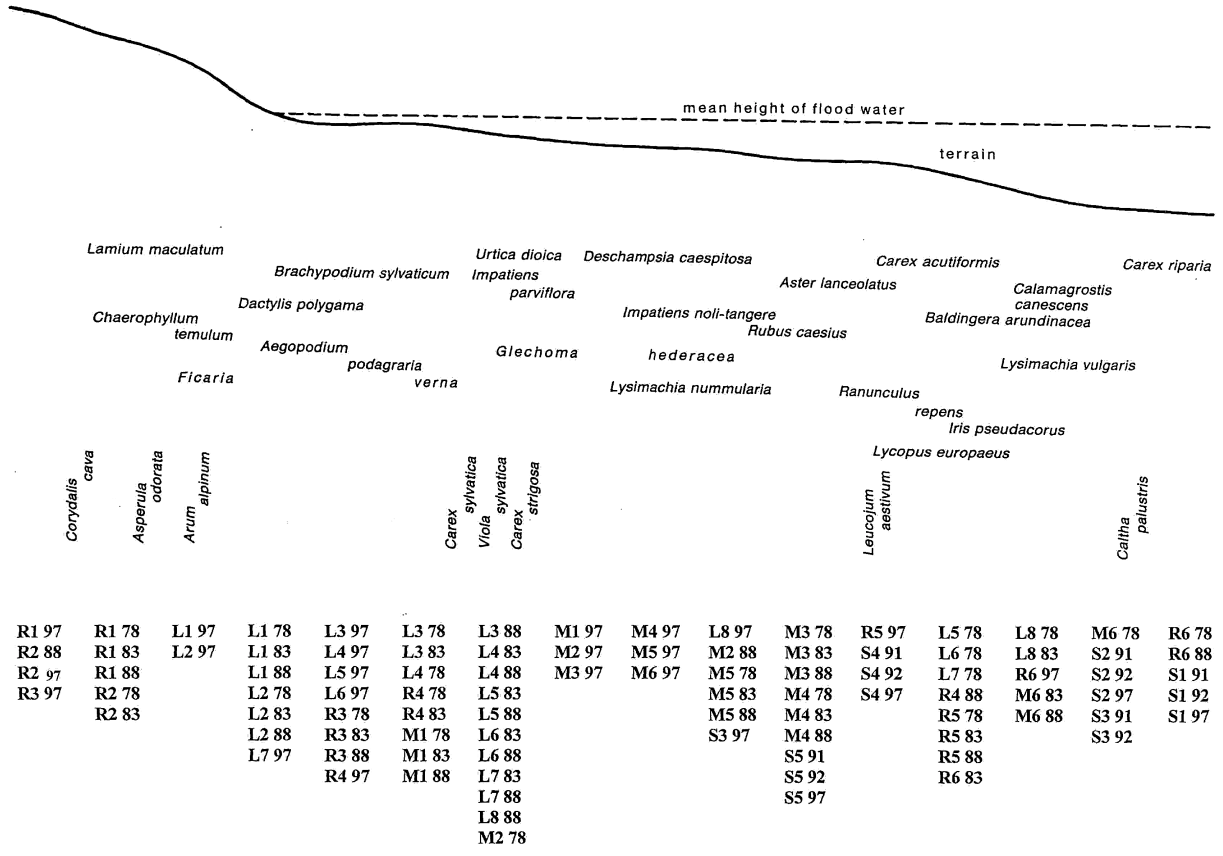

Fig. 5. Plot arrangement along a hypothetical moisture gradient of floodplain forest

be paid to the long-time plots, i.e. at Lednice (L), Ranšpurk (R) and Moravská Nová Ves (M), which have a continuing moisture gradient in the first year of observation, i.e. in 1978, from drier to very wet. Plots M_4 and M_5 are an exception because the site is influenced by the neophyte *Aster lanceolatus* Willd. The gradient of Ranšpurk Virgin Forest had a greater primary amplitude – plots R_1–R_6 – than the gradient of Moravská Nová Ves – plots M_1–M_6 at present. This fact is supported by elevation amplitudes – Ranšpurk Virgin Forest 1.6 m, Lednice na Moravě 1.5 m and Moravská Nová Ves 0.6 m. Looking at changes in the following years, no great changes were observed in 1983, i.e. within 5 years. Plots mostly remained without any changes, they became only a little bit drier in some cases – plots R_2 or R_6. It could be caused by an extremely dry vegetation season of that year (ANONYMOUS 1984; KAKOS 1984). Especially this situation provoked a discussion about the necessity of artificial flooding because hydrological measures were taken for such a situation, but only for the area of the confluence of both rivers (plots R and plots S) and not for the areas in the environs of Lednice na Moravě (forests along the Dyje river) and Moravská Nová Ves (forests along the Morava river). This fact was remarkably visible in the next monitoring in 1988 because artificial flooding started in 1986 and it could be carried out every year. It seems (Fig. 5) that the plots in Ranšpurk Virgin Forest (R) "came back" by moisture to the primary stage at the places influenced by floods (R_3–R_6). At places without floods, especially on the specific sandy "hrúd", drying continued (R_1 and R_2). Quite a different situation is shown in the floodplain forests near Lednice na Moravě (L) and Moravská Nová Ves (M), where drying of all plots continued (Fig. 5). So some vegetation unification started by drying on the plots near Lednice na Moravě, especially those not lying on sandy "hrúd" (L_4–L_8). This trend is visible in 1997, too.

As it is known, there was a hundred-year flood in the Morava river area in 1996. It was interesting to find out if this flood had any significant influence on these local communities. The influence was observed in the area near Moravská Nová Ves only, where the moisture gradient difference was nearly eliminated and M_1–M_6 plots did not differ from each other very much (Fig. 5). Since the terrain was not levelled, a hypothesis comes to one's mind that the flood in 1996 brought so much material to this transect that the small elevation amplitude was eliminated.

No artificial flood was carried out in the Ranšpurk Virgin Forest area in spring 1997 (PRAX – pers. commun.), some drying occurred there again (Fig. 5). It can be stated that the floodplain forest vegetation reacts more to regular yearly floods than to the random extreme one.

Plots S_1–S_6 continue to have a nearly stable moisture gradient (Fig. 5).

CONCLUSION

A nineteen-year period seems to be long enough for vegetation changes to occur, but not long enough to formulate strict trend hypotheses. It is really necessary to monitor this ecosystem as long as possible. Since two of the chosen transects are in production forests, there is a big danger of their destruction. As one can see, cut areas are very close to them.

Unfortunately, the primarily larger area of floodplain forest (but an insignificant fragment in comparison with the other types of Central European forests) was reduced by anthropic activities to an area of several square kilometers near the confluence of the Morava and the Dyje rivers. The other areas in the upper parts of the Morava and the Dyje down streams only, still called floodplain forests, change to lowland mesophyllous nutrient-rich oak forests, as can be seen namely near Lednice na Moravě.

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Bylinná vegetace jihomoravského lužního lesa za období 1978–1997

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ABSTRAKT: Výsledky dokládají změny bylinné vegetace jihomoravského lužního lesa za období 1978–1997. Je prokazatelné, že vodohospodářské úpravy silně změnily lužní les v oblasti řeky Dyje u Lednice na Moravě. Umělé povodňování zachovalo bylinnou vegetaci při soutoku Moravy a Dyje téměř nezměněnou.

Klíčová slova: bylinná vegetace; lužní lesy; změny

V letech 1978, 1983, 1988 a 1997 byla na třech transektech v lužním lese (Lednice na Moravě – plochy L_1–L_8; Moravská Nová Ves – plochy M_1–M_6; Prales Ranšpurk – plochy R_1–R_6), sestavených podle gradientu vlhkosti (VAŠÍČEK 1985), zjišťována frekvence výskytu bylinných druhů. K těmto transektům byl přidán v r. 1991 transekt v těsné blízkosti soutoku Moravy a Dyje (Soutok – plochy S_1–S_5). Na transektu u soutoku pak byly údaje zjišťovány v letech 1991, 1992 a 1997. Údaje o frekvenci se ukázaly postačující, nevyžadující přílišnou pracnost, a především poskytly kontinuitu celého pozorování (FRYŠTENSKÝ 1994). Zjištěné frekvence byly zpracovány metodou DCA, zahrnutou v programu CANOCO (TER BRAAK 1988) pro každý transekt odděleně. Celkové porovnání všech ploch na všech transektech se realizovalo programem TWINSPAN (HILL 1979).

Výsledky ordinací ploch transektů ukazují obr. 1–4. Na všech osa X1 znázorňuje gradient vlhkosti s jejím nárůstem zleva doprava. Výjimkou je obr. 4, kde je sice osa X1 stále vlhkostní gradient, ale tentokrát s poklesem vlhkosti zleva doprava. Osa X2 představuje gradient světelných poměrů na plochách transektů nárůstem zdola nahoru pro transekty u Lednice na Moravě, Moravské Nové Vsi a v Pralese Ranšpurk (obr. 1–3). Na transektu Soutok je gradient opačný – světelné podmínky stanovišť zdola nahoru klesají (obr. 4). Lednický transekt vykazuje trvalé známky vysušování ploch a bylinná vegetace se na plochách L_3–L_8 stává téměř „uniformní“, bez výrazných znaků gradientu vlhkosti (obr. 1). Plochy L_1–L_3 jsou již od počátku ovlivňovány specifickými půdními poměry písečného „hrúdu“ (PRAX 1985). Transekt u Moravské Nové Vsi (obr. 2) s nejnižším rozpětím nadmořských výšek (VAŠÍČEK 1985) také po vodohospodářských úpravách značně setřel rozdíl ve vlhkostním gradientu stanovišť, což významně přispělo k většímu rozšíření zde se vyskytujícího (a často dominantního) neofytního druhu *Aster lanceolatus* Willd. Na transektu v Pralese Ranšpurk se po počátečním vysoušení stanovišť vše téměř vrátilo do původního stavu díky zavedení jarního umělého povodňování této oblasti (obr. 3). Částečné vysoušení stanoviště pokračuje na specifickém písečném „hrúdu“, kam povodňování nedosáhne. Vlhkostní gradient (a tedy i vlhkostní poměry) se téměř nemění v oblasti blízko soutoku Moravy a Dyje na transektu Soutok (obr. 4). Na všech transektech jsou ale vidět značné posuny v podmínkách světelnosti. Kromě Pralesu Ranšpurk jsou transekty v hospodářských lesích, které jsou v současnosti již přestárlé a postupně se těží. Ačkoliv těžba zasáhla transekt v Lednici na Moravě (plochu L_8) pouze částečně, značně se k transektům blíží a nezbývá jen doufat, že při příštím monitoringu v létě 2002 budou plochy ještě zachovány.

K porovnání vzájemných změn v celé oblasti lužních lesů (obr. 5) bylo použito stejného teoretického transektu, jaký uvádí VAŠÍČEK (1985) a hlavně VIEWEGH (1991b). Jednotlivé sloupce s označenými plochami na obr. 5 ukazují na značné posuny ve směru vysychání v oblasti Lednice na Moravě a Moravské Nové Vsi. Bylo zajímavé pozorovat, zda se nějakým způsobem projevila stoletá záplava na řece Moravě v r. 1996 (tedy na transektech u Moravské Nové Vsi, v Pralese Ranšpurk a u Soutoku). Jak je vidět, záplava se na vegetaci nijak dlouhodobě neprojevila, protože v oblasti Moravské Nové Vsi vegetace i v r. 1997 vykázala trend vysoušení. V Pralese Ranšpurk je v místech, kam dosahuje povodňování, situace víceméně stabilizovaná a u Soutoku se téměř nemění. Z toho vyplývá, že i tak velká a dlouhodobá záplava je pro celý lužní les po odstranění každoročních záplav náhodnou epizodou, která stav vegetace nemění, zatímco pravidelné každoroční záplavy udržují stav ekosystému lužního lesa v téměř původním stavu.

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