# VEGETATION EVOLUTION OF GRASSLAND AFFECTED BY FLOODING

# EVOLUȚIA VEGETAȚIEI UNEI PAJIŞTI AFECTATE DE INUNDAȚII

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***Abstract:*** *The humidity excess represents one of the problems of many grassland from Banat, especially in spring, but sometimes in autumn too. In the area between Timiş and Bega rivers an important problem is represented by the temporary flooding of the grasslands with the water stagnation for a longer of shorter period. This fact determinates changes in the composition of vegetation.*

***Rezumat:*** *Excesul de umiditate reprezintă una din problemele multor pajişti din Banat, în special primăvara, dar uneori şi toamna. In interfluviul Timiş-Bega o problemă este reprezentată de inundarea temporară a pajiştilor cu stagnarea apei pe o durată mai lungă sau mai scurtă. Acest fapt determină schimbări majore în compoziția floristică a covorului vegetal.*

***Key words*:** *grassland, vegetation evolution, flooding, fertilisation influence.*
***Cuvinte cheie***: *pajişte, evoluția vegetației, inundație, influența fertilizării.*

## INTRODUCTION

In Romania, only 6.6% from grassland surface is not affected by degradation processes. Erosion and landslides affect the biggest part of the grasslands (60%). Humidity excess and alkalinity affect every 10%, or less from the total grassland surface. There are 379 000 hectares with parental material on the surface, which are totally degraded grasslands (MOISUC & ĐUKIC, *2002*).

In Timiş County and neighbour counties the situation is similar; different is only the size of the surface affected by degradation processes, depending by the specific of the county's relief. In this way, in Caraş Severin County 81.1% from grasslands are affected by soil erosion, in Timiş 35.5% have humidity excess, in Hunedoara 21.1% from grasslands surface has parental material on the surface (MOISUC & ĐUKIC, *2002*).

Through the exploitation of these ecosystems by humans appear a biotope standardisation trend and a simplification of the floristic composition, being promoted some species considered more important. Exploitation mode affects also the trophic chains, especially specific primary consumers, which are eliminated in a very high proportion.

In the absence of mowing, human intervention, the hayfield is degrading being replaced by another phytocoenosis, in correspondence with the natural series of the succession.

## MATERIALS AND METHOD

This study is realised on grassland from Foieni (Timiş County) during 2006-2007.

The experience is set after the blocks method, and the surface of a plot is 20 m$^2$ (4m x 5m). The replicates number is five and the variants number is 10.

Fertilizers doses used are next:

1. control ($N_0P_0K_0$) – 0 g
2. $N_{100}P_0K_0$ - 588 g ammonium nitrate;
3. $N_{200}P_0K_0$ – 1176 g ammonium nitrate;
4. $N_{200}P_{50}K_0$ – 500 g NP + 882 g ammonium nitrate;
5. $N_{200}P_{50}K_{50}$ – 500g NPK + 882 g ammonium nitrate;
6. $N_{50+50}P_0K_0$ – 294 g ammonium nitrate + 294 g nitrogen applied fractioned;

7. $N_{100+100}P_0K_0$ - 588 g ammonium nitrate + 588 g nitrogen applied fractioned;

8. $N_{100+100}P_{50}K_0$ – (500g NP + 294 g ammonium nitrate) + 588 g ammonium nitrate;

9. $N_{100+100}P_{50}K_{50}$ – (500 g NPK +294 g ammonium nitrate) + 588 g ammonium nitrate;

10. $N_{100+50+50}P_{50}K_{50}$ - (500 g NPK +294 g ammonium nitrate) + 294 g ammonium nitrate + 294 g ammonium nitrate.

The research methods used in this work are:

- square meter method, which facilitate the determination of some vegetation indexes;
- Shannon-Weaver (biodiversity index) and Simpson (dominance index) diversity indexes calculus.

Shannon-Weaver diversity index (H) represents calculated entropy for a sample randomly extracted from a coenosis.

$$H' = -\sum_{i=1}^{S} fi \times \log_2 fi = -\sum_{i=1}^{S} \left( \frac{N_i}{N} \log_2 \frac{N_i}{N} \right)$$

where:

*fi* - among 0 and 1;

*Ni* - among 0 and *N;*

*Ni* – species number of individuals *i* in sample;

*N* - total number of individuals ( $\Sigma N_i = N$ ).

When they use natural logarithms the appreciation scale is next:

0,1 ... 1 –very low diversity;

l ... 2,5 –low diversity;

2,5 ... 4 –average diversity;

4 ... 7 –high diversity;

~ 7 –very high diversity.

**RESULTS AND DISCUSSION**

Grassland from Foieni is situated on one of the surfaces that have suffered after flooding, this being covered with water during two months. This fact has determined the change of the initial vegetation, this being represented by species as are *Cynodon dactylon, Echinochloa crus-galli* şi *Conyza candensis*. An important participation in the vegetation carpet is noticed also for *Xanthium strumarium.*

Because of the fact that this vegetation community is disturbed by the water stagnation for a long time period makes it to be covered with a range of annual and biennial weeds.

The botanical composition of the grassland and of every fertilization variant for 2006 is presented in table 1.

The vegetation carpet of the control variant is formed from 9 species from that 5 being grasses, one *Juncaceae*, and 3 species from other botanical families.

In figure 1 is represented the situation of vegetation of technological groups of plants. As can be seen in this graph, only on four variants are found leguminous, this fact being due especially to the soil that is saturated with water that not allow the proper development of the root system of the leguminous, respectively the nodosities from them.

Also, there is shown the positive influence of the fertilization through the fact that grasses are favoured, these valorising favourably the chemical fertilizers. There starts to appear grasses species with increased forager value (e.g.: *Alopecurus pratensis*).

Another favourable aspect of the fertilization on this grassland consists in the fact that the effect is reflecting on biodiversity. Thus 7 experimental variants from those 10 present a number of species greater then the non-fertilised control variant.

*Table 1*

Botanical composition of the grassland from Foieni on experimental variants in 2006

| No. | Species | V1 | V2 | V3 | V4 | V5 | V6 | V7 | V8 | V9 | V10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *Cynodon dactylon* | 2 | 2 | 3 | 4 | 1 | 2 | + | + | 3 | 1 |
| 2 | *Agropyron repens* | 1 | 2 | 1 | + | + | + | + | + | + | |
| 3 | *Echinochloa crus-galli* | 2 | 1 | + | 1 | 2 | 1 | 2 | 3 | 1 | 2 |
| 4 | *Hordeum murinum* | + | | | | + | + | 1 | | 1 | + |
| 5 | *Phragmites australis* | + | | + | | | | | | + | |
| 6 | *Alopecurus pratensis* | | + | | + | | | | | + | |
| 7 | *Juncus effusus* | + | | | | | | | | | |
| 8 | *Juncus tenuis* | | + | + | | | + | | | | |
| 9 | *Conyza canadensis* | 1 | 1 | 2 | 1 | 2 | 1 | + | + | 1 | 2 |
| 10 | *Rumex crispus* | + | + | | | | | | + | | + |
| 11 | *Xanthium strumarium* | + | + | + | + | 1 | 1 | 2 | 2 | | 1 |
| 12 | *Cichorium intybus* | | | + | | | | | + | | + |
| 13 | *Portulaca oleracea* | | | + | + | | | | 1 | | + |
| 14 | *Polygonum persicaria* | | | + | | | | | | + | |
| 15 | *Poltentilla reptans* | | | | + | | + | | | | + |
| 16 | *Convolvulus arvensis* | | | | | + | 1 | 1 | + | | |
| 17 | *Ranunculus acris* | | | | | + | | | | + | + |
| 18 | *Taraxacum officinale* | | | | | + | | + | + | | |

The features of the vegetation from Foieni in 2007 are presented in table 2 on all 10 fertilisation variants.

The vegetation carpet of the control variant in 2007 is composed from 26 species, respectively 8 grasses, three legumes, and 13 species from other botanical families.

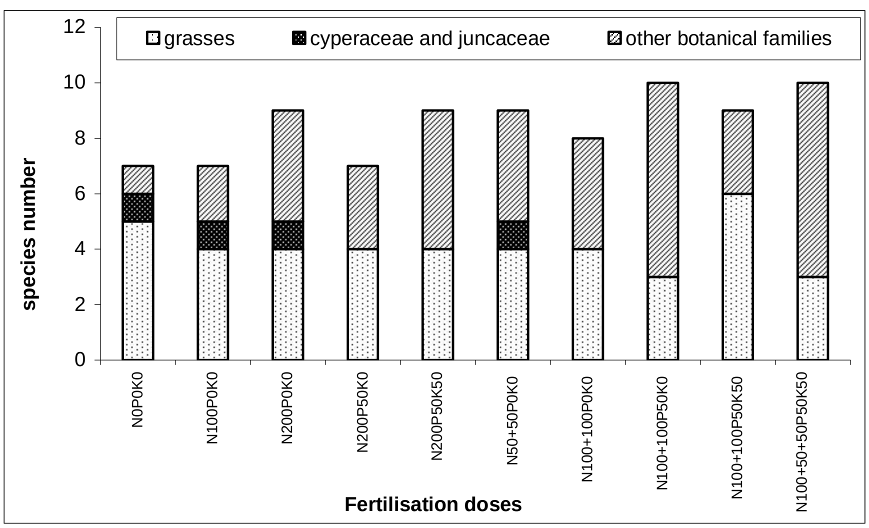


Figure 1 Botanical composition of the fertilisation variants from Foieni (2006)

Thus we notice a spectacular increase of the biodiversity. One of the reasons can be that after flooding the soil is enriched in nutrients from the set alluviums. Because of that in the next year after this kind of phenomenon takes place the increase of the soil fertility.

*Table 2*

Botanical composition of the grassland from Foieni on experimental variants in 2007

| No. | Species | V1 | V2 | V3 | V4 | V5 | V6 | V7 | V8 | V9 | V10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *Cynodon dactylon* | 3 | 3 | 2 | 3 | 1 | 1 | 2 | 2 | + | 1 |
| 2 | *Agropyron repens* | 2 | 2 | 2 | 1 | 3 | 2 | 3 | + | 1 | 2 |
| 3 | *Echinochloa crus-galli* | 1 | + | + | + | + | + | + | + | 1 | |
| 4 | *Hordeum murinum* | + | | + | | | | + | | | + |
| 5 | *Phragmites australis* | + | | 2 | + | + | | | 1 | 2 | + |
| 6 | *Alopecurus pratensis* | + | 1 | | 1 | + | 1 | | 2 | | + |
| 7 | *Lolium perenne* | + | + | | | 1 | + | | | 1 | 1 |
| 8 | *Poa pratensis* | + | + | | 1 | 1 | 2 | 1 | | 1 | 1 |
| 9 | *Festuca pseudovina* | | + | + | | | + | + | 1 | + | 1 |
| 10 | *Medicago lupulina* | + | + | | + | + | + | + | | + | + |
| 11 | *Trifolium repens* | + | + | + | | | + | | + | + | |
| 12 | *Lotus corniculatus* | + | + | + | + | + | + | + | | + | + |
| 13 | *Trifolium arvense* | | | + | + | | | + | | | |
| 14 | *Trifolim hybridum* | | | | + | | | | | | |
| 15 | *Juncus effusus* | + | + | | | | | | + | + | |
| 16 | *Juncus tenuis* | + | + | + | + | | + | + | | | |
| 17 | *Conyza canadensis* | | + | + | + | + | | + | + | + | + |
| 18 | *Achillea millefolium* | + | + | + | + | + | | + | + | + | + |
| 19 | *Rumex crispus* | + | | | + | | + | + | + | | |
| 20 | *Cichorium intybus* | + | | + | + | | | | | + | + |
| 21 | *Portulaca oleracea* | + | | | + | | + | | + | + | |
| 22 | *Polygonum persicaria* | + | | | | | | | | + | |
| 23 | *Poltentilla reptans* | + | + | | | + | + | | + | | + |
| 24 | *Xanthium strumarium* | + | | | + | + | + | | + | + | |
| 25 | *Convolvulus arvensis* | + | | + | + | + | + | + | | + | |
| 26 | *Ranunculus acris* | + | | + | | + | | | + | | + |
| 27 | *Taraxacum officinale* | + | | + | | | | + | + | + | + |
| 28 | *Eryngium campestre* | + | | | + | | + | | | | |
| 29 | *Xanthium spinosum* | + | | | | | | + | | + | |
| 30 | *Plantago lanceolata* | + | + | + | | + | + | + | + | + | + |
| 31 | *Carthamus lanatus* | | + | | | | | | + | | |
| 32 | *Leontodon autumnalis* | | + | | | | | | + | | + |
| 33 | *Taraxacum officinale* | | | + | + | | | + | + | | + |
| 34 | *Daucus carota* | | | + | + | | | + | | + | + |
| 35 | *Sonchus asper* | | | + | | | | | | + | |
| 36 | *Amaranthus retroflexux* | | | + | | | + | | | + | |
| 37 | *Chenopodium album* | | | + | | | + | | + | | |
| 38 | *Setaria viridis* | | | | + | | | | + | + | + |
| 39 | *Polygonum aviculare* | | | | | | + | | | + | + |

The situation of the species on technological groups for every experimental variant is represented graphically in figure 2. Thus can be noticed that all the fertilisation variants are containing legumes in comparison with the previous year when only 4 variant had this type of plants. This fact can be due on the decrease of the water level from soil that allowed the formation of the nodosities in plants and the fixation of the atmospherical nitrogen.

Also, can be noticed the positive influence of the chemical fertilisation because of the fact that there are favoured the grasses, as in the previous year, these valorising well the chemical fertilizers.

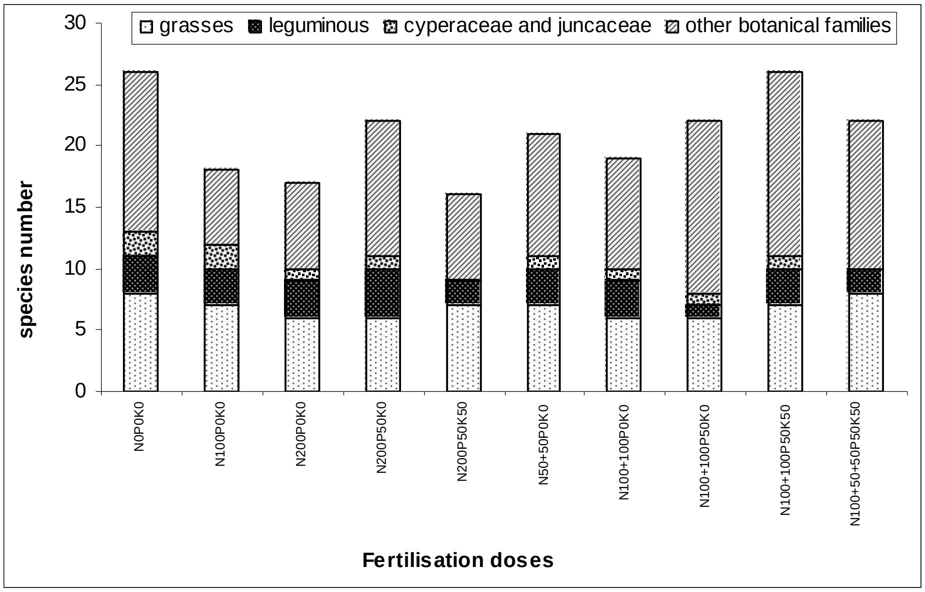


Figure 2 Botanical compsition of the fertilisation variants from Foieni (2007)

Comparing the species number from every fertilisation variant with the tester we have noticed that only V9 ($N_{100+100}P_{50}K_{50}$) has the same species number as the tester, and implicitly a lower biodiversity.

The biodiversity index (Shannon-Weaver) calculated for 2006 is 1.86 showing grassland with low diversity and in the second year (2007) the diversity index became 2.74, showing an average biodiversity of the vegetation carpet.

## CONCLUSIONS

Analysing the data obtained in this work we can conclude the following:

- in the case of the flooded grassland in the first year after are missing usually the leguminous because the soil saturated with water isn't allowing the formation of the nodosities on plant's roots, but the fertilisation is favouring the development of the grasses valuable from forager point of view;

- the fertilisation of the flooded grassland determinate the increase of the species number, mainly in the second year of fertiliser application;

- the increase of the biodiversity of the vegetation of the flooded grassland can be determined by the alluviums bring by flooding.

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