

## CURRENT STATE AND CENOTAXONOMY OF GRASSLANDS IN THE REPUBLIC OF MOLDOVA

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### **Abstract**

*In the Republic of Moldova, grass-dominated vegetation is present on 348614.39 ha and there are two types of habitats in this area: calcicole and sodic. The most common are the calcicoles, which, in xeric conditions, characteristic of the plateaus and hills from the east and south of the country, represent the zonal vegetation of steppes of the class Festuca Brometea Br.-Bl. et Tx. 1943, extended from the Eurasian area, and the intra-zonal vegetation from river valleys includes communities of hygrophilic herbs of the class Cl. Phramiti-Magnocaricetea Klika 1941, as well as mezohygrophytes from the class Molinio-Arrhenathererea Tx. 1937. Herbs with sodic habitat are found in river valleys with mineralized groundwater and form communities of the class Puccinellio-Salicornietea Țopa 1939, Bolboschoenetetea maritimi Vicherec et R. Tuxen 1969 ex R. Tuxen et Holub 1971 and Crypsietetea aculeatae Vicherec 1973.*

**Keywords:** cenotaxonomy, calcicole habitat, sodic habitat.

### **INTRODUCTION**

Grasslands, or the ecosystems of herbaceous plants, from the Republic of Moldova, are traditionally an important source of forage. Currently, the area of grasslands from our country constitutes 348614.39 ha, 2213.9 ha of which are hayfields and 346,400.49 ha – pastures (according to the Land Cadastre, 2015), unlike January 1, 2000, when the pastures made up 373.9 thousand ha, including ameliorated ones – 53.4 thousand ha, hayfields – 2.5 thousand ha, swamps – 19.9 thousand ha, so, it has suffered a decline. The grasslands that are

presented in the Land Cadastre as pastures, hayfields and swamps are two types of multifunctional ecosystems: the first one – zonal grasslands with steppe grasses from xeric, calcicole habitat, spread from the Eurasian area and the second one – azonal grasslands from river valleys.

Currently, steppe and floodplain grasslands are highly degraded because of excessive and uncontrolled grazing. The area of native grasslands from river valleys constitutes 50 000 ha (POPIOT *et al.*, 1987) and xeric grasslands – 60 000 ha (TELEUȚĂ, 2000).

## MATERIAL AND METHOD

A phytocenotic research on the herbaceous vegetation from river valleys and from plateaus and hills was conducted during the years 1989-2014. 450 relevés from river valleys and over 200 – from higher ground were analyzed. Materials from the publications of different authors (ГЕЙДЕМАН, 1958; ПОЖАРИССКАЯ, 1956; КОСМОДАМИАНСКАЯ, 1967; КОНОНОВ, 1968; ШАБАНОВА, 2014; ПОСТОЛАКЕ, 1992, 1993; LAZU, 2014) were also used for the research. All the data obtained by us and found in the above-mentioned publications were processed, analyzed and presented according to the methods of the Central European phytosociological school (BRAUN-BLANQUET, 1963).

## RESULTS AND DISCUSSIONS

In the Republic of Moldova, communities of plants that live in sodic and calcicole habitats have been found, and their affinities for acidity, neutrality and alkalinity of edaphic environment and soil moisture, provided by groundwater

The distribution of herbs in the grasslands beside rivers is uneven and is determined not only by the duration of flooding and soil fertility, but also by the type of mineralization of phreatic (groundwater), surface and artesian water from that area. In the valleys of the rivers of the Republic of Moldova, there are areas with groundwater and surface water which contain high amounts of hydrocarbonates, sulphates, sodium chloride and potassium chloride, and are characterized by a high degree of mineralization (dry residue from 1 to 10 g/l) [ВЗНУЗДАЕВ, 1959; ДРУМЯ, 1978; СЛАСТИХИН, 1978; LOZAN, 2002; ГОРЯЧЕВА, ДУКА, 2004; OVERCENCO *et al.*, 2008].

and surface water, have been determined. On the basis of the presence of sodium-, carbonate-, nitrogen-loving and psammophilic plant species, the prodrome of grasslands in river valleys of Moldova has been elaborated (Fig. 1).

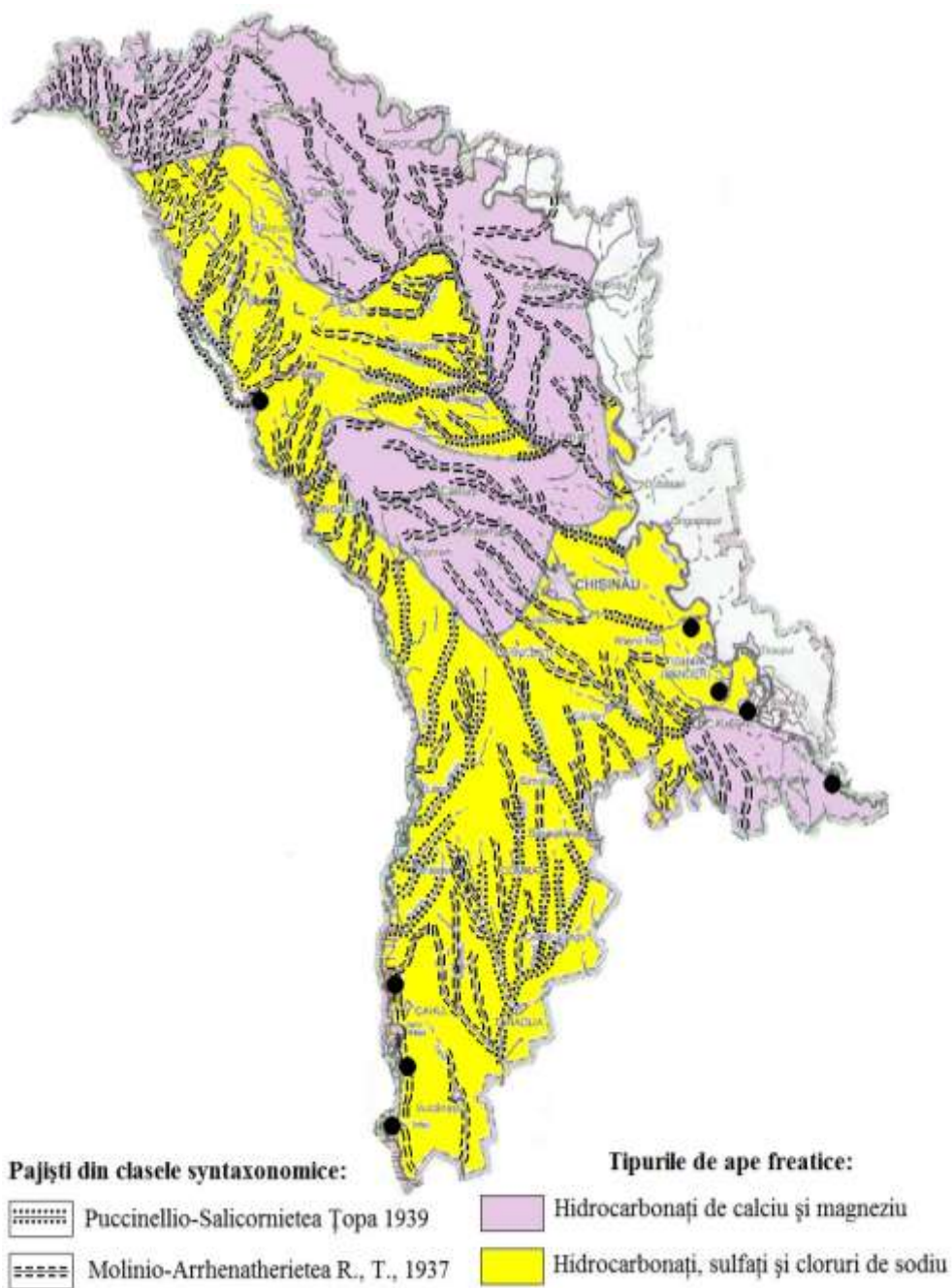


Fig. 1. The vegetation of floodplain grasslands from areas with different types of groundwater in the Republic of Moldova

By analyzing the associative characteristics of plant species and their distribution in the areas with specific types of groundwater and surface water, it has been elaborated the prodrome of potential vegetation in grasslands of

Vegetation of marshy grasslands with calcicole habitat (*Prata paludosa*)

Marshy grasslands with calcicole habitat in the Republic of Moldova cover about 19 900 ha and form large areas covered with reed, reedmace, sedge and smaller areas with scouring rush, chufa sedge, water mannagrass (along the shores

the Republic of Moldova, mentioned in previous publications (ГОРЯЧЕВА, ДУКА, 2004; OVERCENCO *et al.*, 2008; MIRON, 2009; LAZU *et al.*, 2012; LAZU, 2014; Fig. 1).

of freshwater lakes, estuaries), reed canary grass, simplestem bur-reed etc. They are little used, but serve as a refuge for various species of animals and rare plants, and help maintaining the level of groundwater and surface water necessary for human activity. The prodrome of the vegetation of marshy grasslands with calcicole habitat (LAZU, 2014).

#### I. Cl. Phragmiti – Magnocaricetea Klika 1941

1. Ord. Phragmitetalia W. Koch 1926
  1. All. *Phragmition communis* W. Koch 1926
    1. Ass. *Phragmitetum communis* (Gams 1927) Schmale 1939
    2. Ass. *Scirpeto-Phragmitetum* W. Koch 1926
2. Ord. Oenanthetalia aquaticae Hejny 1948
  2. All. *Oenanthion aquaticae* Hejny 1948
    3. Ass. *Butumetum umbellati* (Konczak 1968) Philipii 1973
  3. All. *Poion palustris* Sheliag, V. SI. et Sipailova 1985
    4. Ass. *Poetum palustris* Rezmeriță et Ratiu 1974
3. Ord. Nasturtio - Glycerietalia Pignatti 1953
  4. All. *Glycerio - Sparganion* Br.-Bl. et Sissingh ex Baer 1942
    5. Ass. *Glycerietum maximae* Heck 1931
    6. Ass. *Typhetum latifoliae* Soó 1927
    7. Ass. *Typhetum angustifoliae* Pignatii 1953
    8. Ass. *Acoretum calami* Egger 1993
    9. Ass. *Sparganio-Glycerietum fluitantis* Br.-Bl. 1925
    10. Ass. *Eleocharietum palustris* Sennicov 1919, Soó 1933
  5. All. *Phalaroidion arundinaceae* Kopecky 1961
    11. Ass. *Phalaroidetum arundinaceae* Libb. 1931
  12. Ass. *Calamagrostetum pseudophragmitis* Kopecky 1968

4. Ord. Magnocaricetalia Pignatti 1953
  6. All. *Magnocaricion elatae* W. Koch 1926
13. Ass. *Scirpetum sylvatici* Egger 1933
14. Ass. *Caricetum cespitosae* Steffen 1933
15. Ass. *Schoenoplectetum triqueter* Zonneveld 1955
16. Ass. *Caricetum acutiformis* Sauer 1937
17. Ass. *Caricetum ripariae* Soó 1928
18. Ass. *Caricetum vulpinae* Nowinski 1927, Soó 1927, 1969
19. Ass. *Caricetum vesicariae* Br.-Bl. et Denis 1928
20. Ass. *Caricetum otrubae* Burescu 1999; Dihorn (1969) 1970



Fig. 2. Phytocenosis of the association *Phragmitetum communis* (photo by MIRON)

Vegetation of mesophytic floodplain grasslands with calcicole habitat (*Prata Genuina*) Mesophytic and mesohygrophytic floodplain grasslands cover an area of 50 000 hectares and are mainly used for grazing and seldom – for making hay, though, in the past, traditionally, they were used only for hay (two harvests every summer).

The largest areas of mesophytic and mesohygrophytic grasslands are characterized by the predominance of bentgrass, meadow foxtail, Volga fescue, smooth meadow-grass, reed canary grass, oatgrass, perennial rye-grass, couch grass etc. Cenotaxonomic prodrome of the mesophytic and mesohygrophytic floodplain grasslands (LAZU, 2014).

## II. CI. Molinio-Arrhenatheretea Tx. 1937

### 5. Ord. Molinietales W. Koch 1926

#### 7. All. *Calthion palustris* Tx. 1937

21. Ass. *Juncetum effusi* Soó (1931) 1949, Egger 1933

#### 8. All. *Filipendulo-Petasition* Br.-Bl. 1947

22. Ass. *Filipendulo-Geraniatum palustris* W. Koch 1926

23. Ass. *Petasitetum hybridi* (Dostal 1933) Soó 1940

#### 9. All. *Agrostion stoloniferae* Soó 1933

24. Ass. *Agrostetum tenuis* Sapeghin 1986
- 1967 25. Ass. *Agrostetum giganteae* n.n. M. Kosmodamianskaia;
26. Ass. *Agrostetum stoloniferae* Ujvaroşi 1941  
Subass. *ranunculetosum repentis* Soó  
1944  
Subass. *agrostetosum* Soó 1964  
Subass. *eleocharetosum* Soó 1964  
Subass. *caricetosum vulpinae* Soó  
1957  
Subass. *tussilagetosum farfara* n.n.
27. Ass. *Lythro-Calamagrostetum epigei* I.  
Pop 1968
28. Ass. *Lythro (salicariae)-Juncetum effusi-inflexi*  
Todor et al. 1967
29. Ass. *Cirsetum cani* Tx. 1951
30. Ass. *Calamagrostetum epigeios* Kosmodamianskaia M. M.,  
1967 n.n.
6. Ord. Deschampsietalia cespitosae Harvatic 1930
10. All. *Alopecurion pratensis* Soó 1938; Pass. 1964
31. Ass. *Alopecuretum pratensis* Regel 1925; Novinski 1928  
Subass. *poetosum pratensis* Soó 1957  
Subass. *caricetosum melanostachyae* Soó 1957  
Subass. *ranunculetosum acris* Juhasz Nagy apud Soó  
1957  
Subass. *puccinellietosum distantis* n.n.
32. Ass. *Festucetum pratensis* Soó (1938) 1955
33. Ass. *Poetum pratensis* Rav., Cazac. et Turenschi 1956  
Subass. *Poetosum sylvicola*
34. Ass. *Poetum sylvicolae* Buia, Paun, Safta, Pop 1959
35. Ass. *Poetum trivialis* Soó 1940
7. Ord. Arrhenatheretalia Pawl 1928
11. All. *Arrhenatherion elatioris* (Br.-Bl. 1925) W.  
Koch 1926
36. Ass. *Arrhenatheretum elatioris* (Br.-Bl. 1919 s. l.) Scherrer  
1925, Soó 1969  
Subass. *elytrigietosum repens* n.n.  
Subass. *Puccinellietosum gigantis*  
n.n.
37. Ass. *Medicagini (lupulinae) - Agropyretum repentis* Popescu,  
Sanda, Doltu  
1980

- 38. Ass. *Lolietum perennis* Safta 1943  
Subass. *Trifolietosum repentis*  
Subass. *potentillietosum anserinae*
- 39. Ass. *Elytrigietum intermedium* n.n.
- 40. Ass. *Agropyretum repentis* Gors 1966.



Fig. 3. Phytocenosis of the association  
*Calamagrostetum epigeios*



Fig. 4. Phytocenosis of the association  
*Poetosum pratensis*



Fig. 5. Phytocenosis of the association  
*Arrhenatherum elatios*



Fig. 6. Phytocenosis of the association  
*Agropyretum repentis*

Vegetation of xeric grasslands (steppes) with calcicole habitat

Xeric grasslands, or steppes, with an area of 300 000 hectares, are found in the southern region of the Republic of Moldova (Bugeac) and on the plateaus and hills in the central and northern regions of the country. The phytocenoses

dominated by beard grass constitute the largest areas; they often develop in overgrazed sectors of communities with needle grass or feather grass and Austrian wormwood. The vegetation of grasslands from the most southern areas of the country is dominated by wormwood (*Artemisia santonica*).

Cenotaxonomic outline of xeric grasslands (steppes; LAZU *et al.*, 2016).

I. Cl. *Festuco-Brometa* Br.-Bl. et. Tx. 1943

1. ord. *Festucetalia valesiaca* Br.-Bl. et. Tx. 1943

1. al. *Festucion valesiaca* Klika 1931

1. ass. *Botriochloetum (Andropogonetum) ischaemi* ( Krist. 1937 ) I. Pop 1977

2. ass. *Stipetum pulcherrimaerimae* Soó 1942

3. ass. *Stipetum lessingiana* Soó 1948

4. ass. *Stipetum stenophyllae* Mahn (1959) 1963

5. ass. *Stipetum pennatae* R. Jovanovici 1956

6. ass. *Stipetum (ucrainicae)-Agropyretum pectinati* Tyschenco 1996

7. ass. *Artemisietum austriaca* (Savul. 1927) Prodan 1939

2. al. *Achilleo setaceae-Poeton angustifoliae* Tkachenko, Mavchan et V. Sl 1987

8. ass. *Cynodonti-Poetum angustifoliae* (Rapaics) et Soó, 1957

3. al. *Chrysopogonion griles* n.n

9. ass. *Chrysopogonetum grilis* (Soó 1939), Borza 1962

10. ass. *Agropyretum (pectiniformae) cristati* (Prodan 1939), Dihoru 1970

2. ord. *Brometea riparia* n.n

4. al. *Bromition riparia* n.n

11. ass. *Bromopsidetum ripariae* n.n

II. Cl. *Puccinellio-Salicornietea* Topa 1939

3. ord. *Artemisio-Festucetalia pseudovinae* Soó 1968

5. al. *Artemision santonicae* Shelyag et V. Sol. 1987

2. ass. *Artemisietum santonicum* Soó 1947





Fig. 7. Xeric grassland with *Stipa lessingiana* (Bugeac nature reserve)



Fig. 8. Volga fescue (*Festuca valesiaca* Schleich. ex Gaudin) – dominant species in the steppes of R.Moldova



Fig. 9. Needle grass (*Stipa capillata* L.) – common species in the steppes of R. Moldova



Fig. 10. *Koeleria cristata* (L.) Pers. – codominant species in xeric grasslands with needle grass and Volga fescue

### Vegetation of grasslands with sodic habitat

The grasslands with sodic habitat are met along river banks in the southern and central regions of the Republic of Moldova, where saline groundwater is found in the upper layer of soil (0-50 cm). They cover large areas in the valleys of the rivers Răut, Ciuluc, Cogâlnic, Ialpuș etc. The vegetation of these grasslands is dominated by weeping alkaligrass

(*Puccinellia distans*), iris (*Iris halophila*), black needle rush (*Juncus gerardii*), European slough-grass (*Beckmannia eruciformis*), sea clubrush (*Bolboschoenus maritimus*), sedge (*Carex melanostachia*) and softstem bulrush (*Scirpus tabernaemontani*).

The prodrome of the vegetation of saline grasslands (*Prata salina*) (LAZU, 2014).

#### I. Cl. *Puccinellio-Salicornietea* Țopa 1939

##### 1. Ord. *Salicornietalia* Br.-Bl. (1928) 1933

##### 1. All. *Thero-Salicornion* Br.-Bl. (1930) 1933 em. Pign. 1953

##### 1. Ass. *Salicornietum europaeae* Wendelbg. 1953

##### 2. Ass. *Puccinellio-Salicornietum* Popescu et al. 1987

##### 3. Ass. *Obionetum verruciferae* (Keller 1923) Țopa 1933;

#### Prodan 1939

##### 2. Ord. *Puccinellietalia* Soó 1940

##### 2. All. *Puccinellion limosae* (Klika 1937) Wendelbg. 1943, 1950

##### 4. Ass. *Puccinellietum limosae* (Rapaics 1927) Soó 1930

##### Subass. *Asteretosum tripoli* Pop 1968

##### 5. Ass. *Puccinellietum distans* Soó 1939 Knapp 1948

##### 6. Ass. *Puccinellietum giganteae* V. SI. et Sheleag 1984

##### 7. Ass. *Iridetum halophilae* (Prodan 1939) I. Șerbanescu 1965

##### 8. Ass. *Leuzeetum salinae* (Borza 1934/ Răvăruț 1958

##### 9. Ass. *Lepidio (crassifolio)-Puccinellietum limosae* (Rapaics 1927) Soó 1957

##### 3. Ord. *Scorzonero-Juncetalia gerardii* Wicherek 1973

##### 3. All. *Juncion gerardii* Wendelbg. 1943, 1950

##### 10. Ass. *Juncetum gerardii* (Warming 1906) Nordh. 1923;

#### Wenzl 1934

#### II. Cl. *Crypsietea aculeatae* Vicherek 1973

##### 4. Ord. *Crypsietalia aculeatae* Vicherek 1973

##### 4. All. *Crypsio-Spergularion* Slavnic 1948

##### 11. Ass. *Crypsietum aculeatae* (Bojko 1932) Țopa 1939

##### 12. Ass. *Spergularietum salinae* Tx. at Volk 1937

##### 5. All. *Beckmannion eruciformis* Soó 1933

##### 13. Ass. *Agrostio-Beckmannietum* (Rapaics 1916) Soó 1933

14. Ass. *Alopecuro (arundinacei)-beckmannietum* Kosmodamianskaia 1967 n.n.  
 15. Ass. *Cariceto (melanostachi)-beckmannietum* n.n.  
 16. Ass. *Alopecuretum ventricosi* Turenschi 1966
- III. Cl. *Bolboschoenetea maritimi* Vicherek et R.Tuxen 1969 ex R.Tuxen et Holub 1971
5. Ord. *Bolboschoenetalia maritimi* Hejny 1967  
 6. All. *Bolboschoenion maritimi* Soó 1947  
 17. Ass. *Bolboschoenetum maritimi* (Warming 1906) Tx. 1937  
 18. Ass. *Schoenoplectetum tabernaemontani* Rapaics 1927 Soó 1949  
 19. Ass. *Caricetum melanostachyae* Kosmod.1967 n.n.



Fig. 11. Sector of saline grassland in the floodplain of Sărata river (photo by MIRON)



Fig.12. Phytocenosis of Ass. *Salicornietum europaea* (photo by MIRON)



Fig. 13. Phytocenosis of ass. *Puccinellietum gigantea* in the floodplain of Delia river (photo by MIRON)



Fig. 14. Phytocenosis of ass. *Iridetum halophilae* (Cula river, Cornova village).

## CONCLUSIONS

In the Republic of Moldova, grass-dominated vegetation is

present on 348614.39 ha, in two types of habitats: calcicole and

sodic. The calcicole habitats are the most common, and, in xeric conditions, characteristic of the plateaus and hills from the east and south of the country, represent the zonal vegetation of steppes of the class *Festuca Brometea* Br.-Bl. et Tx. 1943, extended from the Eurasian area, and the intra-zonal vegetation from river valleys includes communities of hygrophilic herbs of the class Cl. *Phramiti-Magnocaricetea* Klika 1941, as well

as mesophytes and mezohygrophytes from the class *Molinio-Arrhenathererea* Tx. 1937. Herbs with sodic habitat are found in river valleys with mineralized groundwater and form communities of the class *Puccinellio-Salicornietea* ȚOPA, 1939, *Bolboschoenetetea maritimi* Vicherec et R. Tuxen 1969 ex R. TUXEN and HOLUB, 1971 and *Crypsietea aculeatae* Vicherec 1973.

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