CONSIDERATIONS ON ZONING AND MICRO-ZONING OF THE DOLJ COUNTY AREA FOR POTENTIAL FOREST VEGETATION IN THE CONTEXT OF ANTHROPIC CHANGES IN FOREST LANDS AND CLIMATIC CHANGES

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ABSTRACT

The anthropic changes undergone by the forest lands in the Dolj county, to which the current climate changes have added up, have shaped the potential forest vegetation. Anthropic changes of the forest lands through the large-scale works that started in the interwar period by the embankment of the Danube and the Jiu rivers, the building of the dams on the vast surface areas of the Danube meadow, the creation of lakes and ponds and their transformation into cyprinid farms, the building of dams on the Danube and other rivers for water accumulation and their use for power generation, the irrigation of crops and water supply to the population. The development of the irrigation system in the Oltenia Plain on the right bank of the Jiu River and the Sadova-Corabia irrigation system by leveling the vast areas occupied by sand dunes altered the water regime in the soil. All these anthropic improvements have unfortunately been made by the deforestation of vast forest areas, both in the Danube meadow and the mobile sands on the left of the Jiu river. Up to 1990, the complex system of improvements had operated through the combined action of factors involved in the intensive exploitation of the agricultural land. After 1990 the state interventions ceased, the systems were slowly abandoned, the agricultural lands were not intensively cultivated, and the climatic factors impacted heavily on the forest lands and potential forest vegetation. Important changes have occurred in the soil water regime, atmospheric humidity and even the circulation of air masses in the area bordered by the Balkan Mountains and the Oltenia Plain. All of these anthropogenic changes have added to the current and ever more dramatic climate changes in the past decades. Thus the necessity of zoning and microzoning of the potential forest vegetation in the area of the Dolj county emerged. Remedying or even stopping the phenomenon of degradation of stationary factors can be done by the afforestation of these lands and the establishment of protective forest stands.

INTRODUCTION

The forestry unit or biotope is composed of elements of landscape, rock or parent material, soil and climate, and it represents the climate and edaphic substance and energy of biocenosis. The forestry unit is the prerequisite and the source of vegetal productivity (C.D. Chiriţă, 1977). The potential forest vegetation can only be established after the determination of the related factors and ecological requirements of each forest species capable of better harnessing the potential of the forestry unit.

The characterization of the forestry units in the Dolj County area was done by examining the literature on the landscape elements, parental material, soils and

climatic data measured and determined at the meteorological stations located in the targeted territory and in its immediate vicinity.

The drawing up of this paper underpins knowledge of the natural physical-geographic environment featuring the Dolj County area, including regional aspects, their evolution over time, the existing degradation and the measures taken to date, regarding the identified risk factors that have destabilized and degraded the agricultural land and forests.

The data were collected from the competent institutions: the Oltenia Regional Meteorological Centre, the Dolj Environmental Protection Agency, the Râmnicu-Vâlcea Forestry Guard, the Dolj County Pedological and Agrochemical Office, the Jiu Water Basin Administration of Craiova, the Agricultural Department of Dolj, The Forestry Directorate of the Dolj County, "Marin Drăcea" National Institute for Forestry Research and Development of Bucharest, as indicated by official statistics, and completed with field observations and analysis in the geographical area of the county, carried out over time and updated on this occasion.

Considering the scope, it has also been necessary to review a number of reference papers addressing the issues of land affected by destabilizing factors, as well as a more careful analysis of the large-scale works carried out over time, the operation mode, preservation and impact on the environment, in general, and on the agricultural and forest land, in particular, through their existence and then by their degradation or destruction.

The "Material and Method" section presents the characteristics of the main physical and geographic factors shaping the area and largely explains the present state of the land, and the following sections focus on the destabilizing-destructive factors in relation to vegetal production and, in particular, to the growth and the development of the forest vegetation in the county.

The correlation of the physical and geographic factors, the zoning and micro-zoning of the county area, which is important for the organization and management of the land, and especially for the potential forest vegetation, is achieved.

MATERIAL AND METHOD

GEOMORPHOLOG, LITHOLOGY

The Dolj county is located in the south-west of the country, in the Oltenia Plain, for the most part, and a quarter of its surface area lies in the Gaetic Plateau.

Geologically speaking, the area of the Dolj county corresponds to the eastern and south-eastern part of the Bălciţa foothills, and in the southern part it comprises the Oltenia Plain, two distinct units, yet showing a common evolution related to that of the Valahia Platform and the Gaetic Plateau. The two subunits, the Bălciţa foothills and the Oltenia Plain, are morphologically and morphostructurally different, the former being related to the genesis and evolution of the Gaetic Plateau, the latter representing a younger unit, developed to the detriment of the foothills, mainly due to the action of the Danube in the Quaternary, which formed here terraces with depressionary aspect through lateral erosion and displacement to the south.

The transition between the Bălciţa foothills (Plain) and the Oltenia Plain is complicated by the extension of the foothills in the form of spurs and the

penetrations of the plain in the form of bays along the water courses, such as Baboia and Desnăţui.

The hills north of the Jiu river are located in the Gilort and Amaradia Hills, showing north-south orientation.

Towards the end of the Pleistocene, the Danube advanced eastwards as it receded in the same direction of the lake in which it flowed, establishing a first course on the Vânju-Mare - Pleniţa - Radovan - Segarcea - Padea line, which also determined the delimitation to the south of the Bălciţa foothills. At the beginning of the Quaternary, the complete clogging of Lake Pliocen took place, along with the southern withdrawal of the waters.

The final shape of the current landscape took place in the Pleistocene-Holocene period, when the rivers created their meadows, and the wind activity led to the covering of the terraces with a loess and sands layer (the dune-like expanse continuing to this day).

In the northern part of the area (to the Pleniţa-Sălcuţa-Cârcea-Robăneşti line) lie the plateaus and the higher hills of the Gaetic Plateau (37%), and, to the south, the Oltenia Plain (47%), consisting of large fields with low inclination stretching to the low land of the Danube.

The Danube meadow is the youngest form of landscape as an alluvial plain, modified solely by the dunes of the Maglavit, Desa-Piculeţ area and by the ones of the Apele Vii - Dăbuleni area, extending about 50 km, which is why the Dolj county is rightly called a Danubian county.

The extreme extension of Bălăciţa foothill to the west of the Jiu river on the Palilula line (to the southwest of Craiova) Criva, Dâlga, Drănic, Padea caused the inflow of the Desnăţui stream from Radovan to the south and its flowing into the lakes of the Danube meadow rather than into the Jiu river.

CLIMATE ELEMENTS

The climate of the Dolj county is temperate due to the general circulation of air masses from the continental platform of Euro-Asia during the winter and the western air circulation in the summer, sometimes influenced by the circulation of the hot and dry air masses in the Mediterranean area or North Africa. Arctic masses rarely penetrate from the north.

Within the Dolj county area, the altitudes vary from 24-28 m in the Danube Plain to 295-356 m in the Bălciţa foothills and Amaradia Hills. In this case, the thermal gradient amounts to 1.43^0C/100 m in the Danube Meadow (Calafat) in Craiova and 0.42^0C/100 m from Craiova to Bâcleş (the western border of the county in the Bălciţa foothills).

Multi-annual average temperature (^{0}C) (timeframe: 1981 – 2010)

Table 1

Unit	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	annually
CALAFAT	0	1.6	6.5	12.3	18	21.7	23.9	23.2	18	11.9	5.4	0.8	12
BĂILEŞTI	-0.8	0.9	6.1	12.2	17.9	21.5	23.4	22.8	17.6	11.5	4.9	0.2	11.5
CRAIOVA	-1.1	0.8	5.6	11.6	17.1	20.8	22.9	22.4	17.5	11.5	5	0	11.2
BÂCLEŞ	-1.3	0.1	4.8	10.5	16	19.7	21.9	21.5	16.4	10.6	4.4	-0.3	10.3
TG.LOGREŞTI	-1.5	0	4.6	10.5	15.8	19.3	21.2	20.4	15.3	9.7	4.1	-0.3	9.9

Source: The Oltenia Regional Meteorological Centre

The multi-annual average temperature ranges from 11.2 to 12^{0}C in the plain to 9.9 - 10.3^{0}C in the Bălciţa foothills and Amaradia Hills (Table 1).

According to more recent research (Sandu, I. *et al*., 2014), the phenomenon of heat is characteristic of the Dolj county, registering the highest national values, > 51 in the southern part of the Oltenia Plain; 31-50 on the surface difference in the entire county. The heat unit is the difference between the daily maximum air temperature and the critical threshold of 32^{0}C in cumulated values during the summer (June to August).

Multi-annual average rainfall (mm) (timeframe:1981 – 2010)

Table 2

Unit	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	annually
CALAFAT	32.1	31.2	36.5	46.9	50.5	51.7	49.9	43.4	43.4	42.1	44.1	49.6	521.3
BAILEŞTI	36	33.8	36.4	49.1	52	53.6	54.6	45.9	43.8	42	45.3	51.4	543.9
CRAIOVA	37	33.7	38.7	50.9	61.6	70.1	66.2	52.1	43.2	42.1	49.1	52.1	596.8
BÂCLEŞ	34	33.2	39.6	54	60.4	57.5	60.5	48.8	47	41.3	42.4	51.2	569.9
TG.LOGREŞTI	36.6	37.5	36.1	51.7	63.8	72.1	69.5	69.6	49.9	44.5	44.9	51	628.6

Source: The Oltenia Regional Meteorological Centre

Characteristic of the Dolj County multi-annual pluviometric regime is the fact that there are non-periodic variations, which reveal the sequence of the rainfall excess and deficiency periods.

Climate changes in the last decades have manifested by the rapid succession of dry and rainy periods, and by heavy rains that cause rapid water accumulation on the slopes in naturally narrow valleys or narrowed through anthropogenic intervention. Heavy rains originate in clouds with the lower ceiling very close to the ground, with large vertical development, which sometimes gather on small surfaces and produce rainfall that often exceeds 70-80 l / sq m in a few hours.

Potential evapotranspiration is maintained at a very high level (Table 3).

According to the Palfay index ($\frac{P}{ETP}$), the area falls into the category of extremely (sandy area), highly and moderately affected by drought.

Potentialevapotranspiration (mm)

Table 3

Unit	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	annually
CALAFAT	0	1	18	52	98	129	148	133	86	47	14	2	728
CRAIOVA	0	0	17	52	95	125	146	127	85	46	14	0	707

Source: adapted from the data provided by the Oltenia Regional Meteorological Centre

The relative air humidity is one of the climatic factors that influence or compensate for rainfall in periods of extreme positive temperatures. In the plain area, it has minimum monthly values (67%) in Baileşti in July, 68% in Calafat, 69% in Craiova, in the plain area, and 70% in Bâcleş and Tg. Logreşti - 76% (Table 4).

Multi-annual relative humidity(%) timeframe:1981 – 2010

Table 4

Unit	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	annually
BAILESTI	88	83	77	72	71	70	67	69	75	82	87	89	77
BACLES	88	84	77	74	73	73	70	72	75	82	87	90	79
CALAFAT	86	82	77	75	74	72	68	70	76	83	87	89	78
CRAIOVA	89	83	75	72	71	72	69	70	74	80	86	91	78
TG.LOGRESTI	89	84	79	76	77	77	76	79	83	87	89	92	82

Source: The Oltenia Regional Meteorological Centre

In the micro-zones featured by large sand areas, potential evapotranspiration increases and relative humidity decreases, resulting in increased soil temperature above 50-60^{0}C and causing burns in the root collar of saplings of the forest species.

According to the De Martonne aridity index ($Iar = \frac{P}{T+10}$), it has annual values of 25.3 in Baileşti; 26.1 in Calafat; 28.2 in Craiova; and of 28.1 at Bâcleş in the hill area and of 31.6 at Tg. Logreşti.

Dry/wet years in Romania during 1901-2014

Table 5

Decade	20th century	
	Extremely dry years	Extremely wet years
1901-1910	1907-1908	1910
1911-1920	1917-1918	1911,1912,1915,1919
1921-1930	1923-1924, 1927-1928	1929
1931-1940	1934-1935	1937,1939,1940
1941-1950	1945-1946, 1947-1948, 1949-1950	1941, 1944, 1947
1951-1960	1952-1953	1954, 1955, 1957, 1960
1961-1970	1962-1963, 1964-1965	1969, 1970
1971-1980	1973-1974, 1975-1976	1972, 1974, 1975, 1976
1981-1990	1982-1983, 1985-1986, 1987-1988	1981, 1990
1991-2000	1992-1993, 1999-2000	1991, 1997
	21st century	
2001-2010	2000-2001, 2001-2002, 2002-2003, 2006-2007, 2008-2009	2005, 2006, 2008, 2010
2011-2014	2011-2012	2013, 2014

Source: Data processing based on "Geo-referential indicators system at different spatial and temporal scales for vulnerability assessment and adaptation of agroecosystems to climate change- ADER Project, 2011-2014

Wind is one of the meteorological factors that accelerate the evapotranspiration process. As the wind speed increases, water evaporates from the ground, with values up to ten times higher than when the atmosphere is quiet.

The plain area is open to winds from all directions. However, the most frequent ones blow from the west in Calafat 20.5%, Craiova 20.4%, Baileşti 11.4%, Bâcleş 22.1%, followed by those from the north-western part in Baileşti 20.1%, Calafat 14.5%, Craiova 5.1% and those from the eastern part in Craiova 22.4%, Bailesti 13.6%, Calafat 13.4%, Bâcleş 10.2%.

The wind speed varies between 3.8 m/s for northwest winds, 3.2 m/s for the

western ones and 1.8 to 1.5 m/s for northeastern and eastern winds. High winds (over 15 - 17 m/s), whirlwinds, often accompanied by hailstorms, take place several times a year, and in the last years have become more and more frequent. These phenomena usually occur in the 5th to 8th months of the year.

HYDROLOGY

The Danube borders the southern part of the Dolj county on a length of 152 km of its total length of 1,075 km on the Romanian territory, and it has formed the Oltenia Plain by its displacement to the south, which represents 47% of the county surface area. The Danube takes over the Jiu's waters that cross the county from northwest to southeast and south on a length of 142 km of its total length of 339 km. The Jiu river springs from the Southern Carpathians and Retezat Mountains. With a very large surface of the basin (10,080 km^2), the Jiu river takes over the waters from the mountainous area and from the Gaetic Plateau.

The density of the hydrographic network is below 0.3-0.4 km/km^2 in the low southern area, being among the smallest in the plain.

In the Dolj county there are currently a series of natural lakes and ponds of 3,810.42 ha, most of which are located in the Danube Meadow (3,651.67 ha), some of them being developed and used in the fisheries sector.

After 1959, in the Dolj county, five unsinkable dams were built: Jiu-Bechet (1959-1961) with a surface area of 5,728 ha, the longitudinal breakwater - 25 km and the 2.5-km subdivision; Ghidici-Rast-Bistreţ (1959-1962) with a surface area of 9011 ha, the longitudinal breakwater - 22.7 km and the partition area- 5.3 km; Bechet-Dăbuleni (1962-1964) with a surface area of 5646 ha, the longitudinal breakwater - 13.85 km, the partition area 7.30 - km; Dăbuleni -Corabia (1965-1966), with a surface area of 14445 ha, the longitudinal breakwater - 12.4 km; Bistreţ-Nedeia-Jiu (1967-1969), with a surface area of 21575 ha, the longitudinal breakwater - 39.13 km (Brăila Agricultural Research and Development Unit - Danube embankments - current and prospective problems, 2014). The total length of the longitudinal breakwater is of 133.08 km and the surface area amounts to 56425 ha.

The Dolj county has a surface area of 741401 ha, out of which 585756 ha of agricultural land, 88966 ha of forest land.

According to the Romanian Soil Taxonomy System of 2012, 8 soil classes and 18 soil types were identified in the Dolj county. (Table 6). Most of the county soils fall in the class of Cernisols (32%), Luvosols (29%) and Protisols (27%).

Cernisols are represented by different types and subtypes of Chernozems, characteristic of the Danube terraced plateau (The Băileşti Plain) and a significant part of the forest steppe area and the transition to the forest land (Phaeozems). The areas featured by Cernisols have predominantly agricultural use, with high yields of cereal crops, and the forests are very poorly represented. In order to diminish the aridization tendency, which is strong in this area, it is necessary to create protection curtains.

Main types and classes of soils

Table 6

No.	Soil class	Main soil types	agricultural		forest		Total	%
			(ha)	%	(ha)	%		
1	PROTISOLS	Regosols, Psamosol, Aluvisol, Lithosol	140,124	24	26,880	44	182,745	32
2	CERNISOLS	Chernozem, Phaeozem	209,777	36	3,520	4	213,174	29
3	CAMBISOLS	Eutricambosoli	18,000	3	1,100	1	19,100	3
4	LUVISOLS	Preluvosol, Luvosol, Planosol	153,190	3	40,880	48	194,070	29
5	PELISOLS	Pelosol, Vertosol	17,800	3	450	1	18,250	3
6	HIDRISOLS	Stagnosol, Gleyosol	22,565	4	920	1	23,485	3
7	SALSODISOLS	Solonchack, Solonetz	1,300	-	225	-	1,525	-
8	ANTHRISOLSI	Erodosol, Anthroposol	23,000	4	430	1	23,430	3
TOTAL			585,756		84,405***		670,161	100

Source: Data processing based on Pedological and Agrochemical Office- 2011 and Forestry Development - 2015

Luvisols are specific to the hilly area and high plains (slopes with relatively small inclination, terraces, plateaus - wide peaks). In particular, Planosols and Luvosols display a poor water regime (an alternating regime), nutrient deficiencies in the leaching horizon. In this sector, there are forest lands of large surfaces, both on slopes with moderate inclination, as well as on inland rivers and plateaus.

Protisols are specific to Danube terraces in the Oltenia Plain, where sandy deposits exceed 170,000 ha, being the largest at the national level. These sandy surfaces generally contain very little humus (less than 1.5%), are subject to deflation, and dunes having SW-NE orientation have formed over time.

Psamosols in the Danube Meadow are different from those on the left of the Jiu river, in that they are subject to an alternate humidity regime corresponding to the floods caused by the overflowing of the river, except for the "Cioace" area that resembles the area on the left of the Jiu river. The introduction of these lands into the economic circuit, which is rather difficult, can be done through afforestation.

Aluvisols, present mainly in the Danube Meadow, as well as those in the inland meadows, are mainly occupied by soft and hard-core species (oak tree, ash tree, etc.) playing a special protection role.

Hydrisols, specific to low, flat or depressed areas, affected by excess surface water (Stagnosols) or ground water (Gleyosols), are soils whose improvement is necessary and possible, but difficult and costly. It is the case of soils in the dam areas and those adjacent to the outer part of the dams in the low land, without the possibility of draining the rainwater or the increase of the level of groundwater during the overflow of the Danube. Here, the forest vegetation also has the role of draining soils through water consumption and transpiration.

The Solonetz and Solonchack soils with a small-area of 2% are remarkable because they are closely related to the forest steppe conditions where the groundwater is shallow, which has favoured the salinization process, but especially because they are virtually unfit for forest cultures, without performing expensive pedo-remedial work.

According to recent data (O.S.P.A.-2011), land in the category of those unfit

for agriculture, some of which could be considered for afforestation (following a more in-depth analysis of the conditions) are presented in Table 7.

Types of degradation in the Dolj county

Table 7

Type of soil degradation	Afffected surface area (ha)	Percentage (%)
Erosion by water		
- surface	26,640	35
- deep	1,265	2
Erosion by wind	8,212	11
Humidity excess	28,626	37
Salt areas	2,927	4
Soils affected by:		
- landslides	1,334	2
- digging, tailings	1,213	2
- underdeveloped soils	5,730	7
TOTAL	75,947	100

Source: Pedological and Agrochemical Office(OSPA) -2011

The total land area, corresponding to the Dolj county, is of 741,401 ha, of which the agricultural land represents 588,945 ha (79.4%), the forest land 88,966 ha (12%), the rest being represented by other lands.

The structure of the agricultural land by type of use is presented in Table 8.

Structure by type of use

Table 8

County surface area (ha)	Agricultural land surface area (ha)	Types of use (ha)			Forest land surface area (ha)	Other lands (ha)
		Agricultural	Pasture and meadows	Vineyards and orchards		
741,401	588,945	489,588	71,768	27,589	88,966	63,490

Source: Pedological and Agrochemical Office of the Dolj County (OSPA)– 2011 and Forestry Development - 2015

The forest land in the Dolj county represents 12% (actual forest 11.4%).

By nature of the property, the surface area of the forest land (88,966 ha) is as follows:

- public property of the Romanian state - 58,983 ha (66.3%), public property of the territorial administrative units 270 ha (0.3%);
- private property of natural and legal persons - 29,713 ha (33.4%).

The distribution of forests (forest formations) existing on areas and at different altitudes is as follows:

- in the plain, including the forest steppe and the Danube Meadow, at altitudes of 28-100 (110 m) (CF and S_s) and the foothills, there are forests mainly made of acacia, groves including willows and selected poplars, meadows with pedunculate and striped oak, Turkey oak, Hungarian oak, Turkey and Hungaran oak stands, 80%;
- in the high plain and hills of altitudes between 110 and 250 m (FD_1), mesophores oak forests (Turkey oak, Hungarian oak, sessile oak and mixes), 12.5%;
- in the hills of altitudes between 250 and 350 (360) m (FD_2) - with oak stands (sessile oak, Turkey oak ± Hungarian oak and mixes, and hillsides as well as lower

altitude beech in the deep narrow valleys with north or north-east orientation, 7.2%.

The Turkey oak covers a vast area starting from the external forest steppe (Rebegi forest) up to the northern border of the county. In this area, it is associated with other species or it makes up pure stands. The prolonged drought of 1988-1994 showed that the Turkey oak is well adapted to these conditions.

Acacia is naturally well represented in areas with sandy soils with variable content of humus (0.5-2.5%). Through its qualities and its ability to root easily, but especially through the regeneration mode, it takes over the field in a short period of time, growing fast when very young. It is the species that will ensure the future of agriculture on sandy lands by lateral protection and by the slight decomposition of the necromass and its transformation into humus.

The Hungarian oak is very well represented in the area, forming pure stands or mixed ones with the Turkey oak and the sessile oak. It very well exploits the heavy clay soils on the plateaus and the sunny slopes, even in climatic conditions with very low rainfall and very hot summer.

The pedunculate oak, a valuable species and important in capitalizing on the potential of meadows and lowlands, where it reaches large size and accumulates a large volume and wood of high value of use. It forms meadows and plains in combination with the ash tree and sometimes with tilia and hornbeam.

The Grayish oak, a very valuable and important species for this county, especially considering the fact that it finds very good natural conditions of growth in the new climatic conditions, confirms the truth that this species was simply eradicated from the area throughout history.

It is the species to which foresters should turn their attention, now and in the future, given that due to the intensification of droughts and aridization, the pedunculate oak together with other species of oak, mesoxerophytes or xerophytess, as well as accompanying species, can improve biodiversity and increase forest resistance to stress.

The sessile oak, covering a very small surface area currently in the hills, compared to the favourable pedoclimatic conditions in several microzone areas, as a consequence of its preferential extraction from the stands of Turkey and Hungarian oak, where this species existed especially on the slopes, as well as a consequence of its natural replacement by the Turkey oak.

The resinous species, the Douglas fir, the black pine and the silvery pine, in which many hopes have been put, have not fully confirmed.

Other species, useful for the consolidation of the oak forests, are: linden, elm, Norway maple, ash tree, as well as a number of auxiliary species (field maple, hornbeam, pear tree, whitebeam, apple tree) and shrubs suitable for the area and micro-zones.

A particular problem is the Danube Meadow and the inland river beds, where the expansion of the European and American poplars was exaggerated, at least after the great landscaping works in these areas and micro-zones during 1965 - 1985. In the near future, these trees need to be replaced, where they are in poor condition, by indigenous poplar species and even by oak species.

Under the circumstances, the only means available to people to combat the heat and stop the desertification is to increase the forest areas and set up field protection curtains to reach a percentage of afforestation of over 30% of the county surface.

Soil salinization processes take place in arid and semi-arid climates and usually on flat lands, when the groundwater exceeds the critical level (1-3 m).

Such salt soils (Solonchack and Solonetz types) frequently occur in dams where pedo-remedial measures have not been applied and which are subject to an alternate regime of groundwater humidity. Large areas of this kind are found outside the dams in the Danube Meadow where the rainwater accumulates and the pumping systems have been abandoned, the land turning into swamps, or with alternating groundwater regime. These lands can be reintroduced into the economic circuit by afforestation with appropriate species, ensuring the biological drainage of the soil and maintaining the groundwater at an adequate level.

Sandy soils (Psamosols) occupy very large areas in the Dolj county, over 125,000 ha, holding the "record" at the national level.

Given the nature and intensity of highly specific factors, including those of a restrictive and destabilizing nature for the wood vegetation, it is important to know and highlight how this manifests, as well as to better exploit it in the territory of the county.

RESULTS AND DISCUSSION

The anthropic changes described above by: the embankment of the Danube and the inner rivers, the building of the dams in the Danube Meadow, the irrigation system in the Oltenia Plain to the west of the Jiu river, the irrigation system of Sadova-Corabia to the east of the Jiu river, the leveling of the lands on the left side of the Jiu river have caused the significant change of the factors and stationary determinants on the territory of the Dolj county. The achievement of the above mentioned objectives was also made by the deforestation of large areas or by the drainage of some ponds from the Danube meadow. The clearing of large forest areas and the drainage of the ponds have impacted on the climatic factors - rainfall, temperature and wind. To all these, global climatic changes have added up, leading to the worsening of the factors and stationary determinants that have gone beyond endurance levels for the forest species existing before these changes took place.

Thus, the need for zoning and micro-zoning of the potential forest vegetation on the territory of the Dolj county has arisen, using the existing data base published in the numerous papers presented in the previous section, as well as our own experience in the forestry field.

3.1. **Zoning and micro-zoning of the Dolj county area for forestry purposes**

Although the Dolj county is situated at a relatively low altitude (15 - 350 m), in this case, due to the almost systematic change of temperature and rainfall, depending on the altitude, there is a very clear "climatic change" of vegetation spreading (forest species), of course with some deviations due to the local landscape (topography) and even due to the substrate and hydrology, which by their intensity of manifestation can create discontinuities in the zoning, but which, from a practical point of view, are especially important for the rational capitalization of the land.

The consequence is that within the geographic area we refer to, two bioclimatic zones are distinguished: the forest steppe and forest area (Figure 1).

A. The forest steppe zone

It is widespread, starting from the Danube to a boundary running along Pleniţa - Caraula - Mărăcinele - Târnova - Fântânele - Radovan - Lipova de Sus - Calopăr - Drănic, west of the Jiu river, and along Rojiste - Castranova - Dioşti, east of the Jiu riiver, separating the Chernozem soils typical of the forest steppe, the reddish Preluvosol (the former reddish brown soils and reddish brown Luvisols), characteristic of the plain forest area.

Within this area there is a great diversity of substrate - landscape - soil conditions, which makes it necessary to differentiate between the following sectors and ecopedological micro-zones.

A_1. – The Danube Meadow sector (the dam - bankside area), of widths ranging from 200 (300)m to 2,500 m

It is featured by river beds, alluvic deposits, islands, predominantly made of eutric, mollic and umbric Aluvisols, sometimes also enthic (on the peaks of the river beds) and in typical mollic islands or Gleyosols, most of which have a clay - sandy texture, rarely of clay - silt (in the case of ponds), showing a neutral - low alkaline reaction, with periodic flood whose duration decreases with the increase of the hydrograph (from about 200 days corrsponding to hydrograph 4.5, to about 30 - 50 days corresponding to hydrograph 7, in the normal climatic years).

It is the sector in which the salicaceae species abound, especially the European and American poplars, but also allowing for the cultivation of indigenous poplar species alongside oak and ash trees, etc., especially for the purpose of increasing the biodiversity of forests. **A_2. – The Danube Meadow – dams sector**

Generally low altitude landscape - depressions, but also flattened land, whose connection with the Danube flood was interrupted as a result of building dams on more than 2/3 of the length of the Danube course (about 70 km), starting from the Rast village.

The pedological layer is quite varied, especially from the textural point of view, in terms of the humus content and the supply of groundwater and therefore with regard to fertility.

However, sandy soils with low or average content of humus prevail (micro-zones 19, 22, 24), along with fine texture limnols, richer in organic matter, but sometimes affected by secondary salinization processes (micro-zones 12, 17).

It is highlighted that these soils are highly dynamic with respect to the evolution of their attributes as a result of their removal from the flood regime.

The agricultural and/or forest use of these lands requires first a detailed mapping to determine their suitability for different crops (forest species).

A3. - The Ciuperceni Plain

A low land, situated at altitudes of 35 - 45 m, adjacent to the Danube Meadow, up to approx. 55 m (when passing to the Bălăciţei Plain), with vast areas of dunes (about 45,000 ha) on the Danube terraces II and III, generally with groundwater at 2-3 m depth.

These sandy deposits of the Danube are usually carbonate, show neutral to slightly alkaline reaction (less acidic - weakly acidic), with a humus content of 0.5-2%, higher in the interdune area. From this point of view, the following ecological units of soils are delineated: Mollic Gleyosol Psamosols (micro-zone 3, 18); non-cohesive sands and enthic Psamosols (micro-zone 23); locally occurring salt Psamosols, affected by moderate - strong salinization processes (microzone 13, 16, 26).

This geographic area is known as favourable to highly favourable (on mollic Psamosols with groundwater intake), differentiated, according to the soil, for acacia, but also for the pedunculate oak.

Hydrotechnical works carried out on the Danube have led to the significant lowering of groundwater levels, especially in the interdune area, which has changed the conditions of vegetation, especially for European and American poplars.

In old times (14th-15th centuries), there were large oak forests (for example, those of Smârdan and Baileşti), deforested by the Turks, as it also happened in Dobrogea, either for strategic military purposes or for commercial ones.

The intensification of the deflation process - the removal of sands (which even resulted in the relocation of some villages) made it necessary to take special measures to stop this scourge by afforestation with acacia (this was done for the first time in 1852 at Ciuperceni, with highly beneficial effects).

A_4. – The Băileşti Plain

It corresponds to the Danube III terraces and it develops in the altitude range of 50 - 55 m in the south, to 130 - 160 m in the north (this is also the forest steppe borderline). The lithologic substrate is predominantly represented by loess and sandy loess, and rarely by sands.

The groundwater depth ranges from 3 to 5 m to 1-3 m in the Ciuperceni Plain from the north to the south (now there is a tendency to lower the groundwater level).

The soil layer is made predominantly of Chernozems and Phaeozems, sometimes affected by secondary salinization processes (microzones 1, 2). The Chernozems with a soft - sandy texture corresponding to flat dunes occur in the form of stripes having NW - SE orientation (micro-zones 7 and 18.) Locally in the meadows of the streams, especially those with intermittent water courses (Balasan and Baboia), besides the typical Stagnosols, Gleyosols and Aluvisols (microzones 8, 10), especially on the lower course of the rivers (microzone 26), salt soils are encountered. In the Desnăţui river meadows, typical and mollic Aluvisols, Gleyosols, with a generally fine texture, rarely sandy (micro-zones 3, 10) are common.

Their physical state (predominantly loose or clay-sandy texture, good and very good porosity and permeability), high humus, nitrogen, potassium and phosphorus content and, of course, the humidity regime, often groundwater, is geographically the most favourable for pedunculate oak and not only (this species can be associated with other hardwood species such as tilia, ash tree, Norway maple, field maple, which can form genuine forest steppes).

The major problem for this area is to maintain the balance of ecopedological factors and, in particular, to keep the groundwater level under control (to avoid accentuation of secondary salinisation or loss of groundwater), a decisive factor for sustainable soil fertility in the area.

A_5.- The Romanaţi Plain

It is the largest sandy area in Romania (about 80,000 ha, in total).

Unlike the sandy deposits on the Danube river, these are brought by the Jiu river and are poorer in basic cations (especially calcium), richer in silicon and iron oxides, poorer in organic matter (and in nitrogen), show higher acidity (the reaction in the upper layers of the soil is around 5.5 and it increases slightly in depth, up to about 6.5). The controlling factors of soil fertility in these dunes change not only in the area of the dunes, but also in the geographical one.

From this point of view, the following situations and spatial distribution of soils are considered: soft Psamosols and Chernozems (micro-zone 1), which are favourable also for the pedunculate oak, tilia, walnut tree, etc.; lamellar Psamosols and lamellar Preluvosols and enthic Psamosols and non-cohesive sands, as well as enthic Psamosols in combination with lamellar Psamosols (micro-zone 2), all of which are favourable for acacia or other

species depending on their location in the dune area.

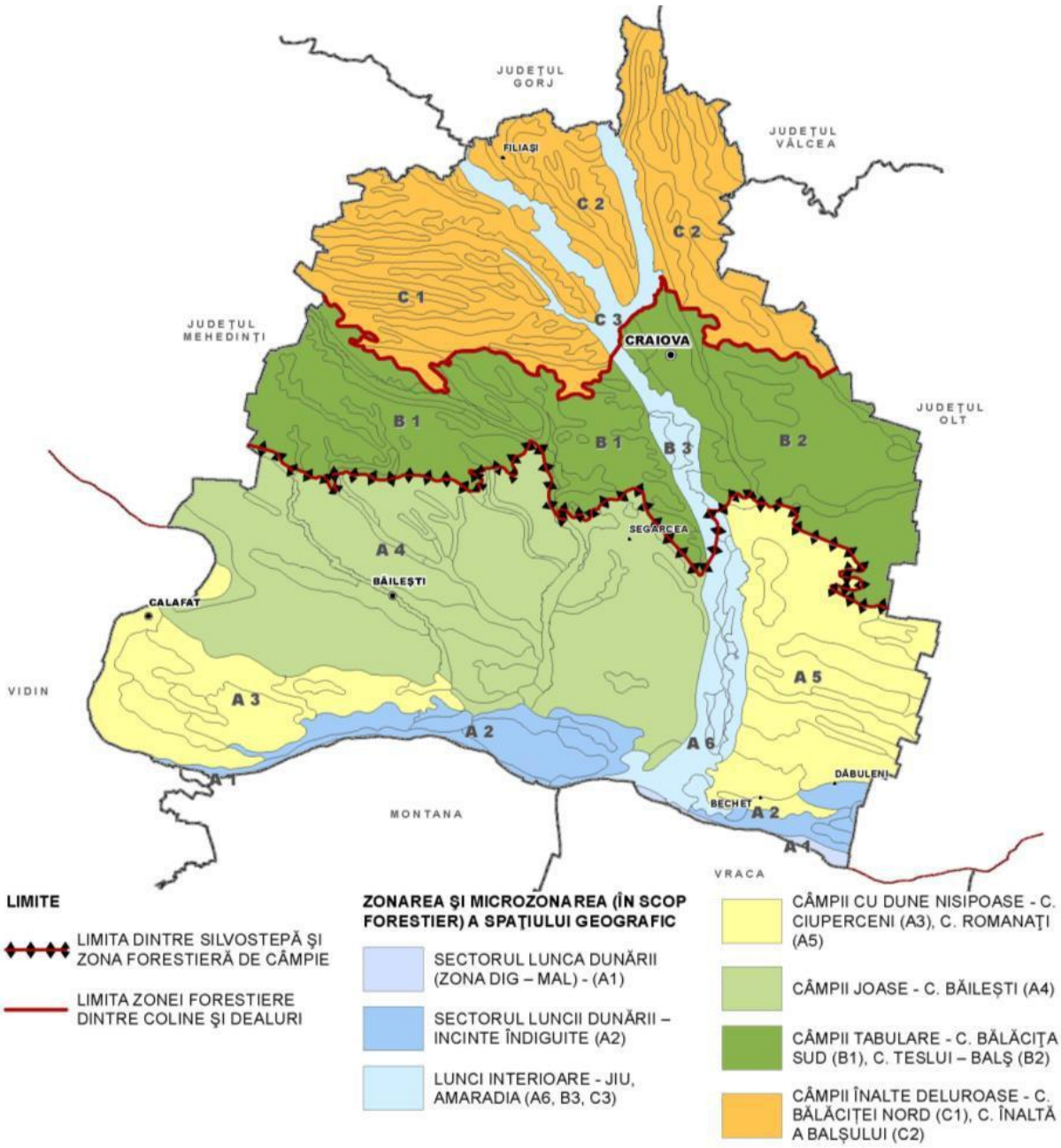

Figure 1 Zoning and microzoning of the potential forest vegetation of the Dolj county area

As a particular phenomenon, characteristic of this area, it is the general decrease of the groundwater level and improvement of climatic conditions, which have led to the drying of poplars in the interdune area and, of course, to the degradation of the conditions and vegetation state of other species (especially acacia), both in interdune area and on the slopes of the dune.

Therefore, the problem of replacing poplars and acacia trees arises, especially in the interdune area, where there are also problems of soil salinization and introduction of other species for afforestation.

A_6. – The Lower Jiu Meadow

On the one hand, we note the presence of Aluviosols of different types (but especially of mollic nature and Gleysols), with predominantly fine texture (micro-zones 5, 6), and, on the other hand, the presence of stretches of salt soils, practically unproductive, adjacent to the Jieţ river (micro-zones 15 and 18). In fact, the Jieţ river, which runs parallel to the Jiu river, has a meadow that poses special problems.

Within micro-zones 5 and 6, the forest vegetation finds good conditions, enhancing growth, there are trees of a great diversity of species (oak, ash, tilia, elm, white poplar, black alder, swamp cypress, hornbeam, field maple), but also European and American poplars, which usually replaced oak stands.

It is worth noting that after the land management works performed in the Jiu meadow, the vegetation conditions behind the dam have worsened significantly, which raises the problem of the ecological reconstruction of forests in this sector, depending on the specificity of the micro-zone.

B. The forest low land (F.C.)

Above the level of the forest steppe, to the north, there are the South Bălăciţa plain (to west of the Jiu river) and the Teslui - Balş Plain (to the east of Jiu), extending to the border passing near Bălciţa, Carpen, Terpeziţa, Craiova, Şimnic, Robanesti.

The lanscape is weakly fragmented by large fields (with a few creeks), of altitudes ranging from 130 - 150 m, in the southern part, to 210 - 230 m in the northern part, and relief energy of 50 - 100 m.

The deposits in the vast fields are almost exclusively represented by reddish clays.

B_1. – The Bălăciţa Plain (South Bălăciţa Plain)

The characteristic trait of the pedological layer in this plain is given by the overriding presence of reddish mollic Preluvosols (microzone 6) (locally in the south cambic Chernozems are encountered): clay content 35-45%, strong compactness but medium - high humus content (2.5 - 6%) and high trophicity.

The woody vegetation in this geographical area, displaying favourable conditions, is very poorly represented: a few Turkey oaks, Hungarian oaks and acacia trees, the consequence of the particularly strong anthropic influence and mismanagement, under stress conditions.

Although poorly represented, it is necessary to pay attention to the afforestation of the soils affected by erosion on the right slope of the Jiu river and the local slope of the Desnăţui river (micro-zones 21, 25, 27).

B_2. – The Teslui – Balş Plain

At the interference of the southern sands with the finer clay deposits of the Teslui terraces, as well as the clay soils of the Balş Plain, this territory presents various conditions, especially from a lithological and pedogenetical point of view, which influence their suitability for vegetation forestry.

In this respect, we highlight: typical reddish Preluvosols, but with loose clay and sandy texture (with coarse sand content of 15 - 20%) and with lower humus content (1 - 2.5%), more favourable for the species mixed with other hardwoods, vulnerable to the drying process, it is especially the case of the Hungarian oak (micro-zone 6); the presence of soils of vertical character (Stagnosols, vertisols with high clay content, over 45% (in the Bty area), more favourable to the Hungarian oak, reddish Luvosols (with a sandy substrate), located on the left bank of the Jiu river in Craiova, which due to the friability of the lithological substrate and the slope are exposed to erosion and deflation (micro-zone 9), which is why complex stabilization works are required.

B_3. – The Lower Jiu Meadow (II)

An area with various surface deposits, especially of varied texture, with reduced salinization conditions, but which can be extended to the area.

Typical and mollic Aluvisols are present, which at higher altitudes turn into mollic Eutricambosols (micro-zones 4 and 5), but quite frequently, especially upstream of Craiova, typical and enthic Aluvisols with some gravel, not very favourable to the European and American poplars. In the depression micro-zones (11), quite commonly, fine alluvial deposits with Aluvisols and Gleysols are present, with a tendency for drainage. Due to the poor soil quality, the small streches of Solonetz (micro-zone 28) are worth mentioning.

Generally, the Jiu meadow was favourable for European and American poplars, but due to the high variability of the water supply and lower soil trophicity, indigenous poplar culture as well as other hardwood species seem to be fit.

It is a phytogeographical area that, through the varied landscape and pedohydrological conditions, requires the diversification of the forest flora spectrum.

C. – The forest land of low hills and high hills(levels FD_1 and FD_2)

It develops in the geographical area located at an altitude ranging between 210 - 220 m, locally less than 190 m in the southeast, and 310 - 325 m to the north reaching the Gaetic Plateau.

The area is crossed by a hydrological network that runs to the west - east, and the deposits on the flat surfaces have predominantly clay and silt content and are heterogeneous on the slopes (all with limestone intrusions). These characteristics lead to very different conditions for the forest vegetation, both topographically and pedogenetically.

In this sense, it is necessary to differentiate between the units and subunits (sectors, pedogeographical micro-zones), with major implications in the distribution and management of the forest.

C_1. – The High Plain of Bălăciţa (The North Bălăciţa Plain)

With wider flat areas in the south and more fragmented in the north, with deposits of predominantly fine texture in the flat land and more friable on the strongly inclined slopes, however, only a few recurrent situations are present in the area: flat land with vertical Stagnosols (with limestone content), as well as typical Vertisols with a high content of clay (40 - 55%) with poor humidity regime, especially those located in the south ("Seaca de Pădure " area) (micro-zones 14, 20), featuring the Hungarian oak and the Turkey oak, and only locally the sessile oak (on slopy lands oriented to the north); slopes of over 15 - 20^0, with high erosion potential (especially in the absence of forests), rezicalcaric Preluvosols and Luvosols, and calcaric ± eroded Eutricambosols (micro-zone 25) where the maintenance of a diverse forest vegetation, even if not highly productive, is particularly necessary for the protection of soils and prevention of the torrentialization of the hydrological network.

C_2. – The High Plain of Balşul and some extensions of the Amaradia Hills

Located to the east of the Jiu river, it has ecopedologically similar characteristics with the previous unit, being different in the following respects: the hydrographic network, which develops to the north - south direction, strongly enough, due to the higher relief energy; the wide Amaradia Meadow rich in alluvial detritic materials.

It enhances forest vegetation (like in sector C1), as closely related to the specificities of the soils of the heights and slopes, highly exposed to surface and deep erosion. Like in sector C1, complex land management works are required to prevent and stop the continuous degradation of the landfill.

C_3. – The Lower Jiu Meadow (III)

The meadow becomes wider from 3-4 km to 5-6 km in the Filiaşi area, and the surface deposits are quite heterogeneous, from sand-gravel and sandy clay to silty clay in the macro-depressions, all of carbonic nature.

The soils closely follow the substrate, but, of course, they identify

themselves quite clearly, depending on the humus content and humidity regime.

Taking into account these features, the following situations are encountered in the case of forest vegetation: mollic Aluvisols with clay content, well supplied with water (5%, micro-zones 6, 11); enthic and typical Preluvosols on positive micro-zones, less favourable for European and American poplars (in place) than for indigenous poplars (5%, 11% micro-zones); Gleyosols and Aluvisols (micro-zone 20).

CONCLUSIONS

The zoning and micro-zoning of the potential forest vegetation underlie the selection of species that optimally harness the stationary potential in the case of the extension of the forest land to the agricultural land unfit for agricultural use, and the extension of forest protection curtains in territories where their design has not been carried out.

The paper can be used in the grounding and design of the works in the existing forest land for the purpose of its recovery and of the substitution works of the stands that do not optimally exploit the current stationary potential.

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