

## AGRICULTURAL LAND QUALITY IN MĂDÂRJAC COMMUNE, IAȘI COUNTY

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### Abstract

Fertility is the most important soil characteristic and it is defined by the whole set of physical, chemical and biological features that provide plants their nutrients during the vegetation period. All lands enjoy natural fertility, which originates in the soil genesis process, as well as artificial fertility, which is the result of human intervention in the natural soil evolution consisting of agricultural improvement measures. Agricultural production is influenced by complex environmental factors (soil, climate, relief and hydrological) and by anthropic factors the involvement of which consists of the modification of some natural factors or of some features of the crop plants. Agricultural land quality is determined by assessment, according to which, in Romania, agricultural land belongs to five quality classes differentiated based on their assessment grades. The assessment study is conducted on various agricultural lands, which should be as homogeneous as possible from the viewpoint of their environmental factors and vegetation factors. In the analyzed land, we identified 27 simple soil units and 7 complex soil units, which were divided, depending on their slope and exposure, in 153 elementary land units, which were homogeneous as concerns all their characteristics (EHL). According to the assessment grades of various crops and uses obtained by the 153 ecologically homogeneous lands, we concluded that the charted land belongs to the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> quality classes applied to arable land. The widest area of the 1369 charted hectares belongs to the 3<sup>rd</sup> quality class (37%), whereas 58% belongs to the 4<sup>th</sup> and 5<sup>th</sup> classes. Only 5% belongs to the 2<sup>nd</sup> class.

**Key words:** agricultural land quality assessment, ecologically homogeneous land, soil units

Fertility is a basic soil characteristic which provides the former its ability to generate and support life and which, together with the other features, contributes to its productivity. It is incessantly dynamic and strongly influenced by the accuracy of the anthropic factors.

Teaci D. et al. (1985), defines agricultural land quality assessment as the “complex operation of thorough knowledge of plant growth and fructification conditions and the determination of the favorability of these conditions for each use and crop, by means of a system of technical indices and assessment grades.”

The value of crops and the net cadastre revenue, for long periods of time, may be determined scientifically by cadastre assessment methods applied to agricultural land, thus preventing the undesirable consequences of approximations relying on uncertain data.

### MATERIAL AND METHOD

From the administrative point of view, Mădârjac Commune is in Iași County, being located

about 50-60 km south-east of Iași City, and from the geographic point of view, it lies in the north of the Central Moldavian Plateau. Mădârjac Commune lies in a hilly and plateau area, in the middle of a woody massif of over 15,000 ha. It actually looks more like a big clearing surrounded by woods.

The total area of Mădârjac territorial and administrative unit is 5263 ha, of which 1329 ha make up the agricultural area and 3934 ha the non-agricultural area. According to land uses, one may distinguish among the following categories: 636 ha of arable land, 434 ha of grazing land, 227 ha of grass land, 27 ha of vineyards, 5 ha of orchards, 3736 ha of woods, 18 ha of waters, 62 ha of roads, 111 ha of courtyards and buildings and 7 ha of barrens.

A pedological survey carried out by O.S.P.A Iași, on a 1:10,000 scale, was used and uniformly processed for the stocktaking and morphological characterization of the soil cover. The soil map was scanned and georeferenced by correspondence, then the soil units were vectorized and corrected according to the Digital Terrain Model. Thus, in the end, we outlined 110 polygons depicting simple soil units, complex soil units and other uses. As we dealt with an older pedological study, we needed to equate the types of soil in the Romanian Soil Classification System created in 2003 with the soils in the Romanian Soil Taxonomy System published in 2012.

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Arable land evaluation and grouping on quality classes observed the “Pedological Survey Development Methods”, 2<sup>nd</sup> part, I.C.P.A. Bucharest, 1987, using the BDUST ver. 9.5. software.

The cartographic material was collected by using the TNTmips v.6.9 and ArcGIS v.10.1 programs. An important stage in spatial modeling was the development of the Digital Terrain Model (DTM), by the vectorization of the contour lines on the topographic plans at a 1:25,000 scale. Thematic maps on hypsometry, land slope gradient and exposure, shading, etc. were created based on vectorized contour line processing.

## RESULTS AND DISCUSSIONS

A basic requirement for the performance of agricultural land quality assessment works is the existence and use of pedological maps.

The pedological map plotting of the agricultural land in Mădârjac territorial and administrative unit enabled us to identify 27 simple soil units and 7 complex soil units (which include 17 simple soil units), belonging to the following soil classes: protosols, cernisols, luvisols, hydrisols and antrisol (*figure 1*).

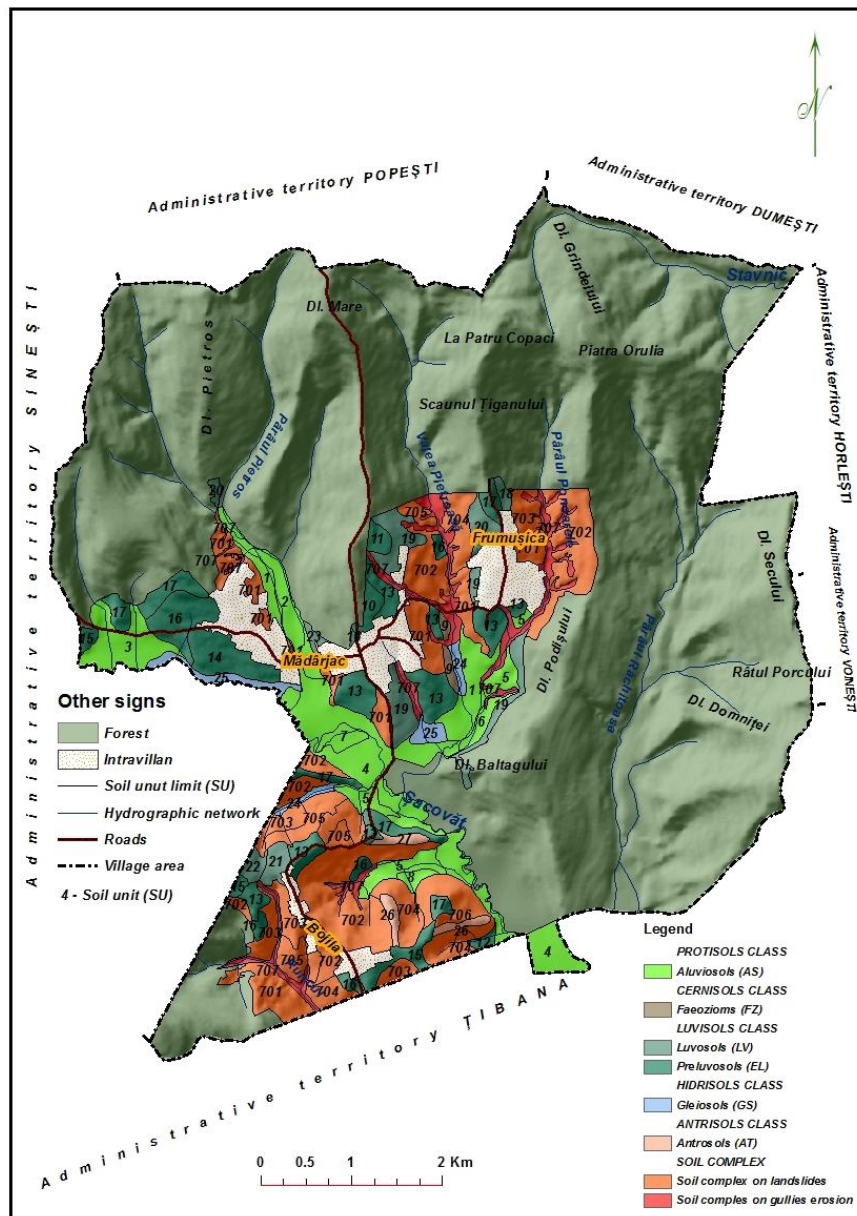


Figure 1 Map of soil units (SU)

The main pedogenetic factors, such as relief, climate and vegetation, conditioned the zonal-multilayered structure of the soils in the researched area.

A specific characteristic of the researched area is the surface erosion affecting about 70% of the pedogenetic stock. Zonal soils, which are more or less typical, are to be found only on some quasi-

horizontal areas, such as interfluvial plateaus and slopes with very low gradients. The soils on moderately and very steep slopes are in various stages of erosion. In some cases, the erosion is so serious that it was impossible to determine the soil's genetic type or we even found pieces of rock. Given this geomorphology, which is specific to the slopes of the Central Moldavian Plateau, 63% of the pedologically charted area had preluvosols and luvosols and 9% had anthrosols, most of which were erosive-preluvic subtypes, whereas the lowlands and narrow valleys were covered by alluvial soils (24%) and gleyosols 3% (figure 2).

For assessment grading purposes, the soil units were divided, depending on their slope gradient and exposure, into elementary land units, which were homogeneous as concerns all the soil and land characteristics, called ecologically homogeneous lands (EHL). The ecologically homogeneous land is the basic unit for which assessment grades, quality classes, favorability

classes, availability classes, etc. are calculated based on indicators.

The plant map (figure 3) and land exposure map (figure 4) reveal the consistency of the valleys, which split the massif on the back side of the cuesta, with generally southern exposure, on which Mădărjac Commune lies. The result of this splitting on the charted land is no less than 153 simple and complex EHLs.

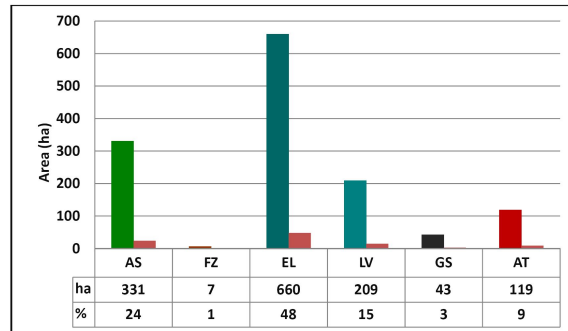


Figure 2 Percentages of soil types

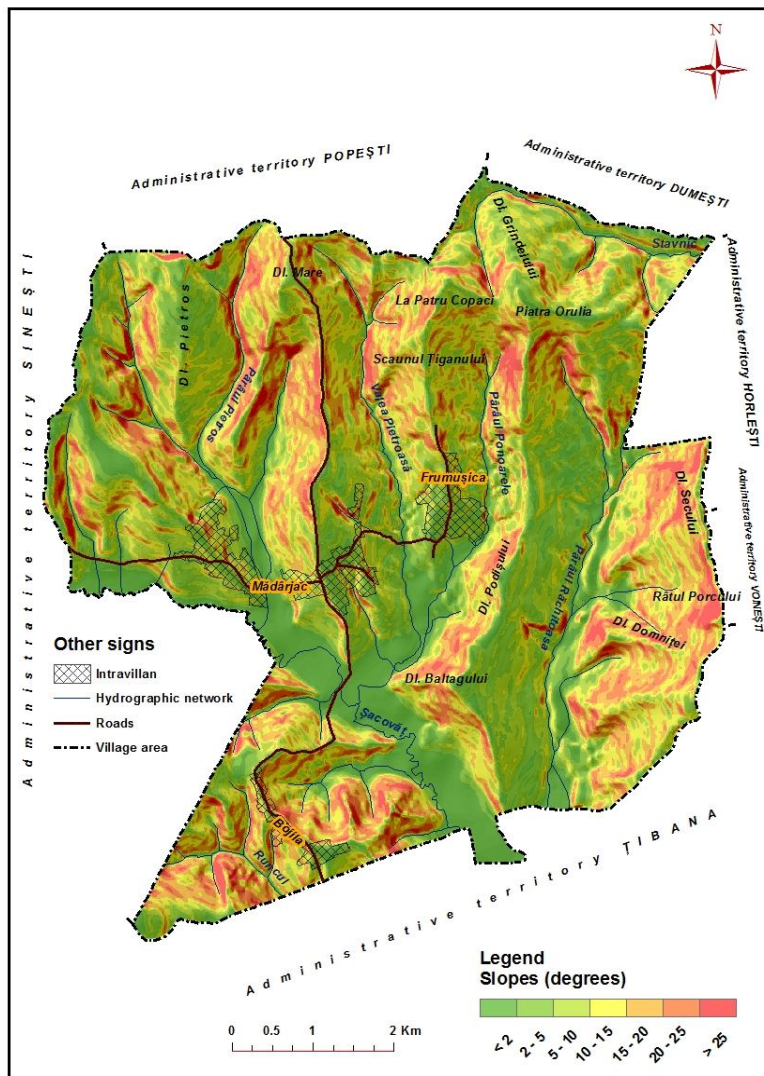


Figure 3 Map of slopes

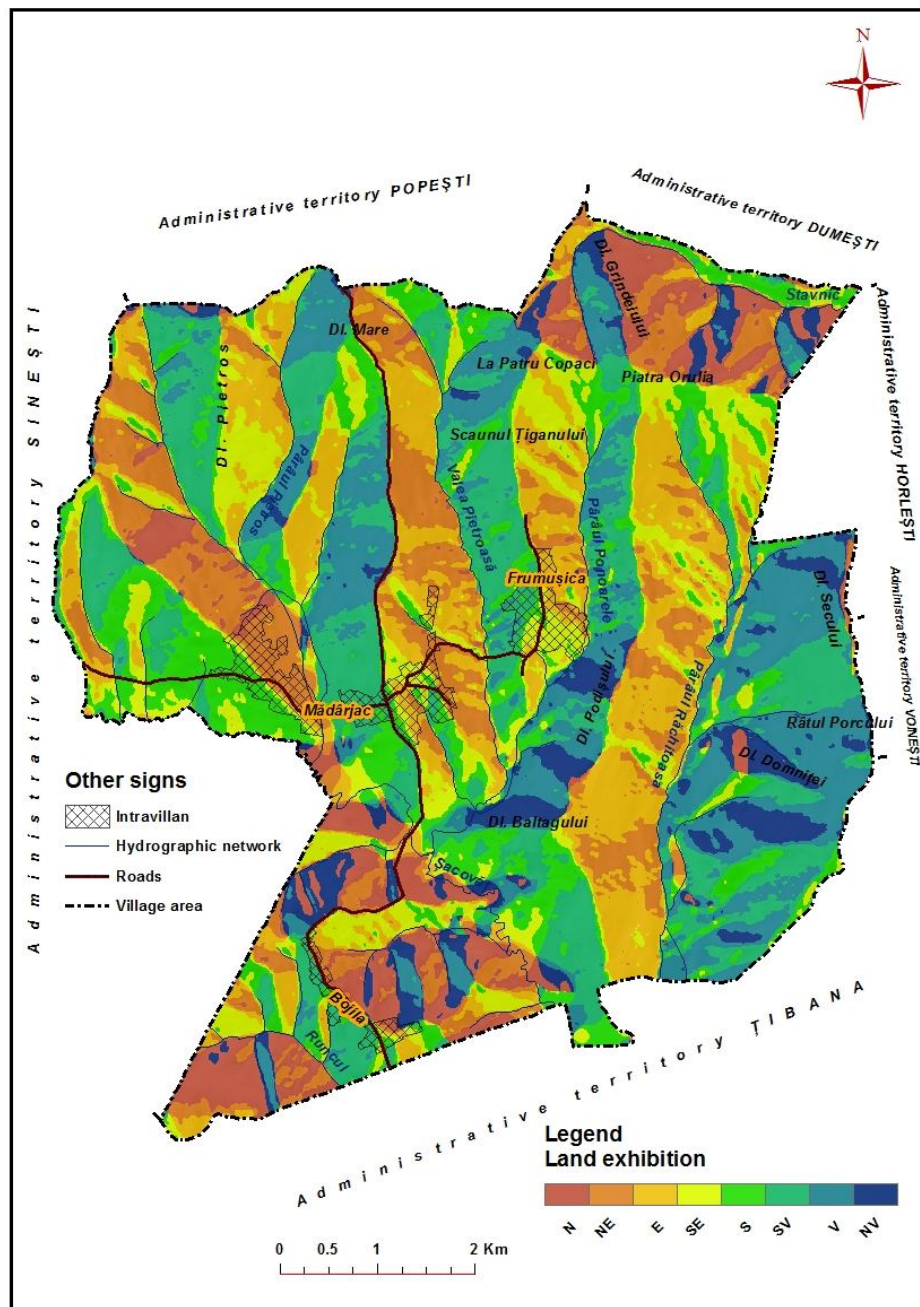


Figure 4 Map of land exposure

Since no land development and improvement works have been done in the analyzed commune, the crop quality assessment grade for natural conditions, more precisely for the ecologically homogenous lands, was calculated by multiplying the product of the 17 land quality assessment coefficients by 100, according to the standards provided by the “Pedological Survey Development Methods”, 2<sup>nd</sup> part, I.C.P.A. Bucharest, 1987, appendices 3-2, ..., 3-18.

The arable land quality assessment grade was calculated with the observance of the regulations in effect, namely as the arithmetic

mean of the grades for the 8 most widely spread crops (wheat, barley, corn, sunflower, potatoes, beet sugar, soy and peas-beans).

As far as the soil units are concerned, the land quality assessment grade was calculated as the weighted mean of the land quality assessment grades for the constituting ecologically homogeneous lands. According to the assessment grades, we concluded that the charted land in Mădăraș Commune, Iași County, belongs to the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> quality classes applied to arable land (figure 5).

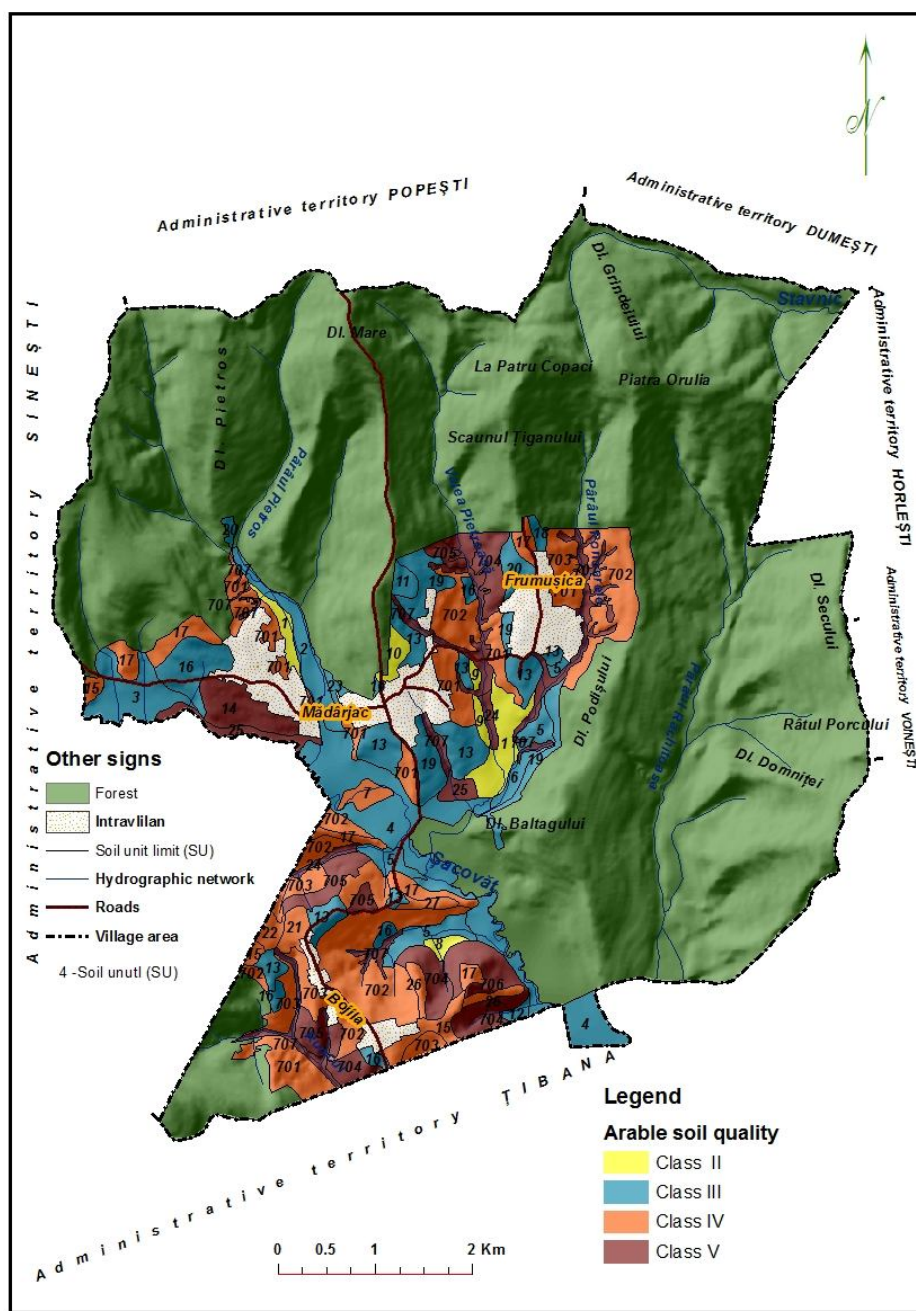


Figure 5 Distribution of arable land quality classes

Considering the geomorphologic indicators specific to Mădărjac territorial and administrative unit, consisting of steep slopes, landslide, deep erosion (gully), and considering also the morpho-physico-chemical analysis of the land from the viewpoint of its very low organic matter content, moderately-strongly acid soil reaction, clayish or alternating (in landslide) soil texture, strong gleying and stagnogleying, we concluded that 58% (803 ha) of the pedologically charted area belongs to the 4<sup>th</sup> and 5<sup>th</sup> arable soil quality classes.

The 2<sup>nd</sup> quality class, which takes up only 5% (65 ha) of the agricultural land, is the opposite

of the quality classes described above. The medium texture, relatively flat relief and good organic matter content are pedo-geomorphologic features that improve the fertility of these soils.

Most of the charted land belongs to the 3<sup>rd</sup> quality class, making up 37% (501 ha) of the whole analyzed area, lying preponderantly in the Sacovăț lowland, as well as on some of the back sides of cuestas. The slopes are relatively mild, the texture is medium and they enjoy proper amounts of organic matter.

## CONCLUSIONS

The pedological map plotting of the agricultural land in Mădârjac Commune enabled us to identify and outline 27 simple soil units and 7 complex soil units, belonging to the following soil classes: protosoils, cernisols, luvisols, hydrisols and antrisol. Preluvosoils and luvisols take up 63% of the pedologically map plotted area, alluvial soils 24%, anthrosols 9%, gleyosols 3% and phaeozems 1%.

Agricultural land quality for natural conditions was determined by calculating the land quality assessment grades on crops and uses for the 153 elementary land units, which were homogeneous as concerns all the soil and land characteristics (EHL).

Based on the land quality assessment grades calculated for the soil units as the weighted mean of the land quality assessment grades for the constituting ecologically homogeneous lands, Mădârjac Commune, Iași County, belongs to the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> arable land quality classes. Most of the whole 1369 charted hectares belong to the 3<sup>rd</sup> quality class (37%), 58% belong to the

4<sup>th</sup> and 5<sup>th</sup> classes and only 5% in the 2<sup>nd</sup> quality class.

For the efficient use of the researched agricultural land, we suggest adequate uses and crops, the use of advanced crop technologies and the use of modern agricultural machinery.

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