

## ENGINEERING MEASURES FOR SOIL EROSION CONTROL ON AGRICULTURAL LAND IN THE PODOLENII DE SUS AREA, COZMESTI COMMUNE, IASI COUNTY

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### Abstract

Lands requiring improvement are placed on slopes larger than 15%, located Cozmesti commune, in Iași County. The total area of the perimeter is 50.4 ha and is located in the extravilan area. The categories of use in the area are agricultural, stretching over 22.96 ha, namely degraded pasture, very poorly productive and 27.44 hectares now become non-agricultural, of which 1.44 ha are roads operating damaged, impracticable and 26 ha unproductive due to excessive surface erosion, of the formations in depth, permanent excess moisture and vineyards aging, degraded, with destroyed biocenosis. Thus, it was proposed redevelopment the agricultural technological roads, grubbing up of vineyards the abandoned and degraded, to execute marginal and evacuation channels in order to protect the agricultural technological roads, leveling and modeling the lands on the slopes, creation of terraces on the arable, fertilization improvement, works of deep loosening, deep plowing, panting, disking and the application of measures erosion control specific to the land in slope with arable land use category. The fitting of slopes affected by surface erosion, depth erosion and landslides, with hydrotechnical works to control leakage and consolidation, grasslands and the improvement of degraded land contributes to the stabilization and creation of conditions for the evolution of soils, vegetation, biocenoses in ground.

**Key words:** erosion control, unproductive lands, Iasi County, hydrotechnical and agrotechnical works

The areas of the Podolenii de Sus improvement perimeter in area of 50.40 hectares are located in the outlying area, being delimited to the north by the right slope of the Valley of the Fund, to the east of the current degraded vineyards, to the south of the agricultural exploitation road situated on the Hill the Rotar, which connects with the localities Podoleni de Sus and Lower Podleseni; to the west of the Leurda Forest.

The development of the perimeter of the improvement area consists of a complex of hydrotechnical and agrotechnical works, elaborated according to the natural conditions, the intensity of the degradation processes of the lands and the requirements of the prospective development of the study area, proposed for the improvement of the lands affected by erosion, landslides and excess moisture.

Through the realization of the works exhibited, this, ensures the avoidance of the expansion of the areas out from the productive circuit and the exacerbation of the agricultural land degradation will be avoided on 22.96 ha due to very strong and excessive surface erosion and

depth erosion. At the same time, 26.08 ha of non-agricultural land will be reintroduced into the productive agricultural circuit, and fertility will be increased to the corresponding parameters of the agricultural lands currently strongly and very strongly degraded, which will lead to the restoration, their production for agricultural crops (*figure 1*).



Figure 1 Pasture degraded by slope processes

Hydrographic, the surface is located in the Siret River basin, and access to the area is made from DN 28A, Targu Frumos-Pascani, to Blăgești and then on a road on the left bank of the Siret River.

From the geological point of view, the perimeter belongs to the Sarmatian (Basarabian), superior (Khersonian) and Meotian Sarmatian,

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and from the lithological point of view, slope, up to an altitude of about 250 m, is made up of Khersonian deposits, formed of clays and sands with structure crossed with limestone concretions at the top. Most of the slope is made up of Meotian deposits with the following succession:

- at the base, emeritus benches, with intercalation of weak sandy clays;
- to the middle and upper part, a complex of cross-sands, sandy clays and clays.

Intersections of sands and sandy clays favor erosion in depth, and marms or clays frequent on the slope create the danger of slipping.

From a hydrogeological point of view, groundwater has a level generally at depths greater than 5 m and has a low flow rate due to the reduced receiving basin. Their daily occurrence was detected on a small area.

- the annual average temperature exceeds 9.5°C, with an annual amplitude of 24.8°C;
- absolute maximum temperatures exceeding 35°C are recorded from May to September, with the average freezing period being 181 days;
- average annual rainfall is about 523 - 550 mm;
- summer rains have a torrential character, causing acceleration of soil erosion;

For the pedological characterization of the studied perimeter, the County Office of Pedological and Agrochemical Studies Iași has developed detailed studies that have highlighted the following soil types:

- brown soil, typical weak-moderate clay - iluvial, formed on alternations of clays, marms, sandy clays and sands, with a low content of humus;
- loose soil, moles - clay - iluvial soil, from strong to excessively eroded, formed on clay - marmous deposits with low humus content.

## MATERIAL AND METHOD

In order The detailed mapping carried out in the Podolenii de Sus perimeter led to the identification and localization of physico-geological processes, such as active, semi-active and stabilized landslides, ravines, surface with the excess moisture.

As a working methodology, was used the inventory of agricultural lands in the studied area, as they were recorded in the cadastral registers of Iasi County, on administrative units, on the most recent topographic maps and even with the help of the GoogleEarth site.

The agrotechnical, pedological and improved districting, according to the I.C.P.A. classification, was elaborated with the classification of the lands into categories of suitability on the criterion of the limiting factors and of the intensity of their manifestation. The

grouping of the lands was made by classes and subclasses of suitability with the highlighting of the necessary hydrotechnical and agrotechnical works and measures.

**Class II**, includes land with good suitability and reduced limitations for agricultural crops, on the surface of 2.20 ha (4.40%), imposed by the slope, the degree of erosion and the level of supply with nutrients, which are manifests with low intensity. The soils of this class are spread on sloping slopes.

**Class III**, lands with medium suitability and moderate limitations for agricultural crops, on the surface of 25.20 ha (50.00%) given by erosion, slope, unevenness of the land, texture and supply with nutrients, whose manifestation is moderate - weak.

**Class IV** - lands with low suitability and severe limitations for agricultural crops on the surface of 14.90 ha (29.5%) offered by slope (15 - 20%), strong erosion, unevenness of the land and poor supply with nutrients. There are soils spread on slopes with higher slopes (10-20%) and semi-stabilized landslides.

**Class V** - land with very severe limitations, slope data (20 - 25%), very strong erosion, very uneven terrain, texture and supply of nutrients, which are manifested with low intensity. It occupies the slopes with eastern and northern exposure with an area of 5.30 ha (10.50%) and are unprepossessed land for agricultural crops, but suitable for meadows after applying the necessary improvement measures.

**Class VI**- lands with extremely severe limitations, which cannot be used for agricultural crops in the absence of specific anti-erosion planning works, on the area of 2.80 ha (5.60%), comprising deep erosion formations (gulies and ditches) and land with high erosion

In order to know the complex problems of the quality of the ground-land units in terms of the sustainable use of land resources, a study was carried out on the current state of the land and land improvement works in the Podolenii de Sus area; at OSPA Iasi, APIA Iasi, North-East Region ANIF, Agricultural Chamber from Cozmesti County. Soil maps were also used at stairs 1: 200 000 and 1:100 000.

## RESULTS AND DISCUSSIONS

In the paper are presented a series of engineering measures, namely hydrotechnical and agrotechnical improvements, which aim to highlight degraded and non-productive land.

The improvement of the improvement perimeter Podolenii de Sus, includes a set of agrotechnical and hydrotechnical improvement works, elaborated according to the natural conditions, the intensity of the land degradation processes and the requirements of the perspective

development of the studied area, proposed for the improvement of the lands affected by erosion, landslides and excess moisture.

Thus, it is proposed to redevelop agricultural technological roads, deforestation of abandoned and degraded vineyards, executing marginal and exhaust channels in order to protect of agricultural technological roads, leveling works - modeling the lands on the slopes, establishment of banquet terraces on the arable land, realization of spring catches, improved fertilization, deep tilling works, deep tillage, sowing, disking and the application of specific anti-erosion measures on the slopes with the use category, arable.

The arrangement of the slopes affected by surface erosion, deep erosion and landslides, with hydrotechnical works for leakage control and consolidation, the establishment of meadows and the improvement of degraded lands, contributes to the stabilization and creation of the conditions of evolution of soils, vegetation, biocenoses. ground. These can be transformed into new, balanced and stable biotypes, able to edify ecosystems with their own flora and vegetation, only if the arrangements made in accordance with all the existing ecological conditions and factors, will be maintained permanently and periodically supplemented with specific works (figure 2).



Figure 2 Formation of deep erosion and removed from the agricultural land

In order to restore / improve the productive potential of the land, it is necessary to realize a complex of works and measures hydrotechnical and agrotechnical, consisting of:

- specific works to combat surface soil erosion, depth erosion and the removal of excess moisture due to coastal springs;
- improved fertilization on the entire area provided in perspective with categories of agricultural use;
- scarification in order for loosening the soils with small porosity to increase their capacity for water and air; on surfaces with large slopes, this operation will be replace with the ploughing deep;
- sowing with perennial herbs for permanent grazing on the surfaces that will be arranged as meadows and the banquet terrace patios;
- the application of specific measures on land use in a slope with arable land use; antierosional

agrotechnics, by performing agricultural works on the level curve; antierosional crop system and protective overflows with additional application of crops in strips; terraced lands.

**I. Hydrotechnical improvement works.** Specific works are foreseen for an area of 50.40 ha, consisting of:

**1. Redevelopment of agricultural technological roads.** In order to avoid the accentuation of the phenomenon of ravines and to ensure the access to the agricultural exploitation and the maintenance of the development works, it has been provided for the redevelopment of the anti- erosion work of 3,77 km of roads in the technological, and the leveling of the drainage and gully as formed along on their route.

**2. Dismantling existing roads and paths** on an area of 0.73 ha. Current agricultural roads and paths that are no longer maintained, especially those from degraded vineyards, will be dismantled and transformed into agricultural - arable, leveling, scarification, deep plowing and fertilization.

**3. Deforestation,** namely mechanical and manual deforestation of the old vineyards, deserted, degraded, partially invaded by bushes and destroyed biocenosis, on an area of 12 ha. After deforestation up and removing the stumps, these areas will turn into farmland and meadows.

**4. Marginal and exhaust channels** in order to protect of agricultural technological roads and for the interception and directed evacuation of excess water from the slopes, it was provided for the arrangement of 3.32 km marginal and evacuation channels.

**5. Levelling works-land modeling.** Were proposed on a total area of 12.20 ha, of which:

- leveling - modeling works on 6,20 ha area. In order to achieve one continuous and as far as possible uniform slopes of the slope, avoiding the concentration of surface leakage that favors the soil washing and ensuring the mechanized execution in optimal conditions of the agricultural works on the level curves;

- leveling-modeling works of land with microrelief of landslides, located on old landslides semistabilized in area of 5.80 ha, in order to correct the slope of the land with attenuation of its kneading, talusing unstable exits, elimination of microdepressions in which water puddles and clogging cracks; by doing this, a continuous slope of the land and a system of gullies that allow regularization of surface leaks, avoiding the rapid infiltration of water in the depth and create conditions for the execution of works for the capture of springs and exploitation of the land by categories of agricultural use;

- levelling of pipes and fields in the area of 0,20 ha.

On an area of about 4.50 hectares, arranged with terraces within the old vineyard plantation, the leveling works will be done by keeping / reconstructing the existing terraces, in which purpose the slopes will be restored where degradations occurred, drains and gullies, and executes terraces in the area of ruined paths and roads.

**6. Banquet terraces on arable.** On an area of 13.70 ha of arable land with an average slope of about 14-15%, there were provided a terraces with the purpose of ensuring a surface leakage control. These terraces must provide a reduction of drainage speeds below the non-erosion limit.

**7. Spring catch.** It was foreseen to capture 4 coastal springs that appear up-to-date at the base of the cornices or on the slope, consisting of:

❖ **springs capture chambers** - The water is collected by the capture chamber and through by the interception - capture drains , placed on both sides of the chamber in the direction of the level curves, being taken up by the collecting drains and discharged into the emissary.

❖ **interception drains-capture**, with a length of 0.81 km, with dual purpose of interception and taking over groundwater that feeds the slips, but also removing excess moisture from the soil profile.

❖ **collector drains, with a length of 0.61 km**, which ensures the take-over by the capture chambers or visiting rooms on the flows captured and transported by the interception - capture drains and their discharge into the emissary, respectively the exhaust channels through the reinforced exhaust vents.

❖ **visiting chambers**, 9 pieces, provided on collector drains when connecting with interception - capture drains, and changes of direction or slope.

❖ **exhaust ports**, for discharging the collector drains into the emissary.

**II. Agrotechnical improvement.** In order to improve the unproductive and degraded agricultural land in order to be transformed into a higher useable category, arable and meadows respectively, to ensure the transformation of the non-agricultural use categories into agricultural use, and the increase of the production capacity of the agricultural lands as a result of the improvement of the hydrotechnical works the following agro-technical works and measures were foreseen:

**1. Improved fertilization** with organic and chemical fertilizers on the entire surface of the

perimeter foreseen to be transformed into agricultural on 49.04 ha;

**2. Deep loosening works** (scarification) 50-60 cm, on an area of 4.88 ha, to improve soil permeability for water and air, which will be achieved in two ways.

**3. Deep plowing with basement**, on 16,78 hectares for settling soils and small porosity, on the areas where the big slopes over 12% can not be scarified and the depth is 32,26 ha.

**4. Sowing and overseeding with perennial herbs**, on 6.25 ha, of which 4.88 ha for the establishment of grasslands and 1.37 ha for the consolidation of the embankment terrace.

**5. Disking** on 49.04 ha, work that will be performed twice.

**6. Application of specific anti-erosion measures on arable land with:**

- agrotechnical antierosion, by performing all the cultural works only on the level curve, on 27.38 ha;

- system of anti-erosion and protection crops, including, besides carrying out all the cultural works on the level curve, the use of crops in strips and a small share of hoeing crops on 3,08 ha;

- terraces on 13.70 ha area.

**7. Use in the first 2 years of meadows set up or improved only as pasture**, until a well-made herbaceous carpet is built and only after this period is used where necessary as pasture.

By realizing the complex of hydrotechnical and agrotechnical works for the improvement of Podoleni de Sus perimeter, first of all, it is ensured the exploitation of unproductive or strong and very strongly degraded lands, by rebuilding or increasing their production capacity for agricultural crops. At the same time, there will be an improvement in environmental conditions, with beneficial effects on the rural community in the area.

The proposed works for the improvement of the perimeter of improvement are aimed at the protection and restoration of the degraded lands that will contribute to the establishment of a natural, currently degraded natural balance.

By carrying out the exposed works, thus, it is ensured to avoid the extension of the surfaces removed from the productive circuit and to accentuate the degradation of the agricultural lands on 22.96 ha due to the very strong and excessive surface erosion and the deep erosion. At the same time, 26.08 hectares of currently non-agricultural land will be reintroduced into the agricultural productive circuit and the fertility rate will be increased at the corresponding parameters of the currently heavily and very strongly

degraded agricultural lands, which will lead to the restoration, respectively the increase of the capacity of their production for agricultural crops.

Thus, through planned development work, ecological changes are expected in wider spaces, including climate, flora and fauna.

Meadows with a rich herbaceous carpet also contribute to the braking of leaks, the maintenance of fertile soil in the perimeter and the cessation of landslides

## CONCLUSIONS

The realization of the proposed hydroameliorative and agropedoameliorative works is aimed at valorising the water regime and improving the environmental conditions of the degraded or non-productive land in the perimeter of improvement.

The investment is necessary to ensure that the expansion of the set-aside land and the degradation of the other 95.75 hectares of agricultural land due to surface erosion, the expansion of deep erosion formations and the excess moisture at the base of the slope.

By improving the degraded lands, the appearance of the currently desolder perimeter will become more pleasant, the microclimate will change positively and biocenosis will improve with great complexity and stability with the gradual restoration of the local flora and fauna as a result of the new conditions resulting from the modification of the water regime and optimal development of meadows with a well-rounded herbaceous carpet.

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## REFERENCES

- Ambarus D.; Biali Gabriela, 2000** - *Tendințe în dinamica proceselor erozionale determinate de restructurarea actuală a categoriilor de folosință de pe versanții unui bazin hidrografic*. Studiu de caz, Analele Univ. „Ovidius”, Constanta.
- Ailincăi C., 2007**- *Agrotehnica terenurilor arabile*, Editura Ion Ionescu de la Brad, Iași.
- Ailincăi C., G Jitareanu, D Bucur, D Ailincăi, 2007**- *Influence of sewage sludge on maize yield and quality and soil chemical characteristics*, Journal of food, agriculture & environment.
- Ailincăi C, Jităreanu G., Bucur D., Mercus A., 2011** – *Protecting the soil from erosion by cropping systems and fertilization in Moldavian Plateau*, Soils erosion in agriculture, pg. 295-314,.
- Agenția pentru protecția mediului Iași - *Planul local de acțiune pentru mediu județul Iași 2014-2018*.
- Băcăuanu V., Barbu N., Pantazica M., Ungureanu A., Chiriac D., 1980** - *Moldavian Plateau. Nature, Man, Economy*. Bucharest, Scientific and Encyclopedic.
- Biali Gabriela, 1998** - *Stadiul actual al implementării tehnicii sistemelor informaționale ale teritoriului în studiul eroziunii și al proceselor asociate*. Referat nr.1 în cadrul doctoraturii. Universitatea. Tehnică “Gh. Asachi” Iași.
- Bojoi I., 1992** - *Eroziunea terenurilor*, Rotaprint, Universitatea „Al.I.Cuza”, Iași.
- Bonard C. 1991** - Stabilization of landslide: a possibility or a challenge. *Symposium Statiunea de Cercetari Stejarul, Piatra-Neamt*.
- Bucur D., Moca V., 2012** - *Tile Drainage on Agricultural Lands from North-East Romania- Experimental Variants and Technical Efficiency, Drainage Systems*.
- Cîmpeanu S., Bucur D., 2006** - *Combaterea eroziunii solului*, Relal Promex Publisher, Bucuresti, 245 p, ISBN 973-85863-6-4
- Florea N., 1997** - *Degradarea terenurilor și ameliorarea solurilor*, Universitatea Creștină „Dimitrie Cantemir” – București, Facultatea de Geografie-Turism, Sibiu.
- Hilborn D., Stone R.P., 1999** - *Gully Erosion Control Agricultural Engineering Service, Resources and Planning*, Ontario Ministry of Agriculture, Food and rural Affairs (OMAFRA), Queen's Printer for Ontario.
- Ioniță I., 2000** - *The relief of cuestas within the Moldavian Plateau*. Corson Publishing House, Iași, pp. 109
- Jităreanu I., 2008** - *Valorificarea terenurilor în pantă erodate din sudul Câmpiei Moldovei cu unele culturi agricole anuale și perene*. Teză de doctorat, Universitatea de Științe Agricole și Medicină Veterinară „Ion Ionescu de la Brad”, Iași.
- Județele Patriei 1980** - Iași. Monografie, Edit. Sport-Turism, București.
- Merlescu E., Teșu C. 1982** - *Solurile României*. Institutul Agronomic, Iași.
- Popa N., Nistor D., Nistor Doina 2005** - *Amenajarea și Exploatarea terenurilor agricole degradate prin eroziune*. Ghid practic Tipografia Moldova, Iași
- Popovici N. 1994** - *Stabilizarea versanților*. Univ Tehnică „Gh. Asachi” Iasi.
- Preda M., Filip Maria, David Ana-Sofia 1994** - *Județele și orașele României în cifre și fapte, Vol. I, Județele României*, Edit. Departamentul pentru Administrația Publică Locală.
- Prioteasa C., Popovici N., 2001** - *Studiul degradării terenurilor agricole din județul Iași prin procese de alunecare și propuneri de reconstrucție ecologică*. În lucrările simpozionului „Îmbunătățiri funciare între prezent și viitor” Zilele academice Timișorene, editia a VII a, Ed Politehnica Timișoara.
- Prioteasa, C., Popovici, N. 2000** - *Studii privind Inventarierea terenurilor degradate din fondul funciar agricol în scopul aducerii terenurilor în circuitul productiv” din județele Iași, Vaslui și Bacău*, ISPIF Filiala Iași.
- Pujină, D. 2008** - *Landslides within the Moldavian Plateau*. Performantica Publishing House, Iași.

**Savu P., Bucur D. 2000-** *Combaterea eroziunii solului, componeta majoră a menținerii echilibrului ecologic în Podișul Moldovei.* Iași: Lucrări științifice, Seria Horticultură. Vol. 1(43). Ed Ion Ionescu de la Brad.

**Savu P., Bucur D., Dascălu C., 1995 -** *Starea actuală și perspectivele combaterii eroziunii solului pe teritoriul județului Iași.* Lucrări științifice. Seria Agronomie, vol.38, U.S.A.M.V. Iași.  
\*\*\* Soil surveys, at 1:10 ,000 and 1:200 000 scale, carried out by O.S.P.A. Iași