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# ЛІСОМЕЛІОРАЦІЯ ТА ЕКОЛОГІЧНЕ ҐРУНТОЗНАВСТВО

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## RESISTANCE OF THE RAVINE FORESTS OF UKRAINE AND LIGHTED FORESTS OF MOLDAVIA TO THE EROSION PROCESS IN THE MEDITERRANEAN SOIL-FORMING ENVIRONMENT

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The results of a development of the scientifically proved recommendations what about erosion, degradation and deflation control are presented in the given paper. Forest amelioration techniques are essential in an accumulation and a distribution of water, preventing occurrence of erosion. What is important, they stimulate growth of crops' efficiency. Authors recommend to use these techniques not only in the southern steppes of Ukraine, Crimea and republic Moldova, but also in the regions of the Mediterranean where were formed cinnamonic soils of high connatural potential.

*Keyword: protective forest plantations, erosion, deflation, degradation, forest amelioration.*

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ПРОТИЕРОЗІЙНИЙ ЕФЕКТ ЗАХИСНИХ ЛІСІВ УКРАЇНИ

ТА ГИРНЕЦОВИХ ДІБРОВ МОЛДОВИ З ТОЧКИ ЗОРУ СПЕЦИФІКИ  
ҐРУНТОУТВОРЮВАЛЬНИХ ПРОЦЕСІВ СЕРЕДЗЕМНОМОР'Я

Робота присвячена розробці науково обґрунтованих рекомендацій щодо боротьби з ерозією, дефляцією та деструкцією. Підкреслюється вологонакопичувальна та протиерозійна роль захисних лісових насаджень, яка може сприяти росту продуктивності сільськогосподарських культур. Рекомендується більш широке застосування лісомеліоративних заходів на найбільш ерозійно небезпечних територіях, зокрема в сухих субтропіках Криму, степовій зоні України та гирнецових лісах Молдови (Гербовецький лісовий масив). Не менший ефект лісомеліорація мала б у регіонах Середземномор'я, де сформувалися коричневі ґрунти високого природного потенціалу.

*Ключові слова: захисні лісові насадження, ерозія, дефляція, деструкція, лісомеліорація.*

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ПРОТИВОЭРОЗИОННЫЙ ЭФФЕКТ ЗАЩИТНЫХ ЛЕСОВ УКРАИНЫ  
И ГЫРНЕЦОВЫХ ДУБРАВ МОЛДАВИИ С ТОЧКИ ЗРЕНИЯ СПЕЦИФИКИ  
ПОЧВООБРАЗОВАТЕЛЬНЫХ ПРОЦЕССОВ СРЕДИЗЕМНОМОРЬЯ

Работа посвящена разработке научно обоснованных рекомендаций по борьбе с эрозией, дефляцией и деструкцией. Подчеркивается влагонакопительная и противоэрозионная роль защитных лесных насаждений, которая может способствовать росту продуктивности сельскохозяйственных культур. Рекомендуется более широкое применение лесомелиоративных приемов на наиболее эрозионно опасных территориях, а именно в сухих субтропиках Крыма, степной зоне Украины и гырнецовых лесах Молдовы (Гербовецкий лесной массив). Не меньший эффект лесомелиорация оказала бы в регионах Средиземноморья, где сформировались коричневые почвы высокого природного потенциала.

*Ключевые слова: защитные лесные насаждения, эрозия, дефляция, деструкция, лесомелиорация.*

## **1. An ablation and a wind erosion – threat to the soil fertility**

The steppe zone and Crimean arid subtropics in Ukraine both with the oak forests of Moldova (Gerbovetsky forest area) are the most erosion unsafe terrains.

To investigate the erosion and to suggest the scientifically proved recommendations what about an erosion and a deflation control, one need the methodological basis – a complex, comprehensive approach. For that reason in 1949 professor A.L. Belgard created the Complex expedition (Dnipropetrovsk national university) aimed on a research of the steppe forests of Ukraine and Moldova. Over the 60 years of work, the expedition had investigated all natural and artificial forests of a steppe zone of Ukraine, Crimea and Gerbovetsky forest. (Gerbovetsky forest is an oak forest that is situated in the depth of the Danubian region. It is growing in a steppe environment on the micellar-carbonate chernozem soil.) For these regions are typical (Крупеников, 1959; 1967) xerophytic forest chernozems that are very similar to the dark brown soils of the arid forests. Podzolized black soils were formed in the oak forests and together with xerophytic-forest chernozems could be called as the mesophytic-forest chernozems that are analogue of the ravine forest black soils of the Ukrainian and Crimean steppe zone.

Under the influence of a joint action of the natural and anthropotechnogenic factors a soil erosion of bedrocks and parent rocks is going on. The erosion products were found to move on the considerable distances. Processes of the soil erosion last very long time, changing relief, reducing depth of beams and increasing depth of gullens, flooding rivers' outfalls, lakes, artificial watertanks. Water erosion progress has gained disastrous diffusion. In areas with artificial irrigation usually occurs the irrigation soil erosion.

Wind erosion (blowing erosion) transposes small particles of bedrocks on the great distances with the help of east winds (dry winds).

Speed of a wind reaches 15 m/s. The raised dust reduces visibility, provokes diseases of respiratory tracts and impedes the work of aviation. Nearby fences and green plantations forms the "snow banks" of wind deposits in the negative landforms that reaches height up to 1,5 – 2,0 m. Dust (black) storms in the southern region of Ukraine cause sharp decrease of the grain harvest, what causes economic problems.

As a result of the predominating droughts and dust storms in the 18th century there were recorded 34 lean years in a steppe zone; in the 19th century – 40; in the 20th century – 1901, 1905, 1906, 1907, 1908, 1911, 1912, 1920, 1921, 1928, 1929, 1930, 1934, 1936, 1938, 1946, 1949, 1950, 1953, 1976, 1969.

## **2. Soil erosion control with the help of afforestation methods**

By the 2006 in Ukraine and Crimea a wind erosion was reduced with the help of the field-protective forest belts and tracts. 450 thousand hectares were planted in a pre-war time and 550 thousand hectares – in a post-war time. Watered soil has also played a positive role – there do exist up to 1 million hectares of irrigated lands, the ponds and the artificial "seas" on Dnieper river.

Unfortunately the changes in patterns of ownership and crisis events led to a lack of attention to the soil problems. A lot of protective forest plantations were destroyed and it led to the unfortunate results – dry winds appeared again. M.V.Zubets – the president of the Ukrainian Agrarian Academy of Sciences (newspaper «Голос України», 2008) marks alarming symptoms that repeat themselves for some years past and have much strengthened in 2007. After 40 years of the complete absence of black storms and dry winds, this dangerous phenomenon strikes again. East dry wind has captured 120 thousand kilometers of a steppe zone of Ukraine. A threat of the desert invasion raised again.

## **3. Degradation and destruction of soils.**

### **Scientific methodologies of overcoming these problems**

Increasing influence of the agroindustrial development is possible to call agro-anthropogeny. It proved to cause the erosion processes, to ruin historically existing elementary soil processes, to transform the bedrocks in a destructive way. However these destructive changes can be divided into reversible and irreversible ones.

Degradation-regradation. The regradation should not be understood as a restoration process that leads soil's condition to the natural one (Зонн, Травлев, 1989). After reclamation processes the soils get better, but do not return to the state they were before agrotechnogenic degradation.

#### 4. Destruction and restriction (soil restoration)

As a rule the modern machinery causes most soils to be destructed completely. Following processes are taking part: intensification of the plane and linear or ravine erosion, blowing erosion. According to its nature this kind of destruction could be divided into two types: natural-anthropogenous (all kinds of the ablation and wind erosion) and anthropotechnogenic (removal, degradation of soil). Nowadays the destructive processes could be blocked. However rates of erosion expansion of and deflation increase so fast, that agrotechnical control methods can not prevent catastrophic destruction of bedrock all alone.

#### 5. Pathes of building of protective wood plantations

A.A. Izmailskyj (A.A. Измаильский, 1937) and V.V. Dokuuchajev have proved the key role of greenery in a moisture accumulation and a prevention of the erosion. This technique of a soil protection was used in the USA during F. Roosevelt's presidency. Nowadays agrarians use such methods not so often so agriculture encountered droughts. That is the reason why in Ukraine it is planned to create additional 2,5 million hectares of protective wood plantations by 2015.

Methods of the forest reclamation are widespread in a steppe zone of Ukraine, Crimea and republic Moldova. In authors' opinion the countries of Mediterranean should try the forest amelioration techniques that will help not only in accumulation and distribution of water (moisture) but also prevent occurrence of erosion processes completely.

In 1949 I.P. Gerasymov marked out that the cinnamonic soils are a special kind of soils that form in the Mediterranean arid subtropical forests or brushwoods like a "macchia". I.P. Gerasymov concentrated on the following types of soils: sol brun forestier montagne (img. 1), red-cinnamonic soils (img. 2), cinnamonic soil of the dry forests and



Image 1. **Brown upland-forest soil (sol brun forestier montagne)**

Photo by I.V. Kostenko



Image 2. **Brown (reddish) soil on a slide-chalkstones (Luvi-Calcic Rastanozems)**

Photo by I.V. Kostenko



shrubs (img. 3). One of the most special features of cinnamonic soils is a strata claying caused by the high amount of silt. High amount of clay usually provoked by a metamorphization or *in situ* (Зонн, 1986).



Image 3. **Cinnamonic soil of the dry forests and shrubs**  
Photo by I.V. Kostenko

Here the “skeletal soils” are formed, as Y.N. Vysotsky and N.M. Sibirtsev proposed to call them. The soil development processes in them are not cyclic, but direct ones (Opanasenko N.E., 2004).

It is well known that the chemical composition of parent rock plays an important role as in the direction and in the rate of soil erosion and soil formation. The release of bases and oxides slows down the processes of podzolization and stabilize humus acids; creates geochemical barriers, such as cemented layers on the way of infiltrating calcium and magnesium solutions; leads to the formation of magnesian, carbonate, and alkaline soils.

We consider that in arid zones, where the lack of precipitation slows down the rate of soil erosion, the influence of rocks on the processes of soil formation is lesser and does not change its direction radically. So, black soils on skeletal silicate rock do not differ much from black soils on the carbonate loess-like loam.

It is suggested to distinguish the following soil groups according to the volume content of skeletal fragments in % in 0-50 cm layer: weakly skeletal (< 10%), medium skeletal (10-25 %), strongly skeletal (25-50 %), and very strongly skeletal (>50 %).

Soil-saving plantations successfully created on the chernozem ordinarie de congelation profund (img. 4).

To create soil-saving plantations in Moldova republic scientist use widely the calcaric cinnamonic soils that were formed in the tracts of *Quercus pubescens* (Крупеников, 1967). These soils are very similar with the dark-brown carbonate forest soils of Balkan and Mediterranean.

For the purposes of a creation of the field-protective erosion-preventive plantations prof. A.L. Belgard (Dnipropetrovsk national university) created the typology of the artificial forests of a steppe zone.

The typology of A.L. Belgard (1971) is based on the three typological units with different rank:

1. phylum of the forest-growing conditions;
2. phylum of an ecological structure;
3. phylum of a stand.

The typological schema of the growing conditions of forests in a steppe environment includes: bottomlands, arenas, azonal complexes, ordinary chernozems, southern chernozems, dark chestnut soils (saline and nonsaline). Instead of a "fertility" ordinate it is an extent of mineralization of the soil solution. Gigrotopes have eight gradation of humidification.

The typology of A.L. Belgard gives chance to create stable, longevous wood plantations, to transform environment in five microlandscapes: watershed- braced, valley-terraced, valley-ravine, watershed-hollow, liman-terraced.

Creation of the erosion-preventive artificial plantations will provide conservation of soils from erosion, deflations and degradations (img. 6). Also they will stimulate growth of crops' efficiency not only in the southern steppes of Ukraine, Crimea and republic Moldova, but also in regions of the Mediterranean where were formed cinnamonic soils of high connatural potential.



Image 4. **Chernozem ordinarie de congelation profund**  
Photo by A.V. Kotovich

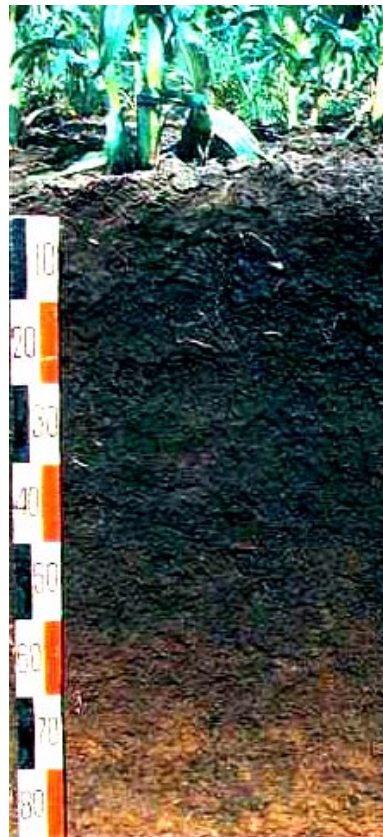


Image 5. **Calcaric cinnamon soil formed in the tracts of Quercus pubescens**  
Photo by N.I. Poluupan



Image 6. Conservative soil-reclamation forest plantations in a steppe environment

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