

## BIOLOGICAL AND AGROTECHNICAL AMELIORATION

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### Summary

Agro forest reclamation is a type of forest reclamation and protective afforestation, including some phyto-melioration, directed at the amelioration or improvement of the environmental parameters limiting agricultural activity. It is most widely practiced in arid regions as a means of combating drought and dry winds.

The main aim of agro forest reclamation in sub-arid and sub-humid belts is protection against erosion. Field protective belts aligned perpendicular to harmful winds (e.g. drying and snow-laden winds) are most widely used on flat land and gentle arable slopes. Run-off controlling forest belts, placed perpendicular to a line of runoff, are planted on sloping lands. Forest belts are also planted near ravines and gullies for protection against outwash and for melioration of adjacent territories. Forested areas are also established on coastal sand and at the bottom of ravines and gullies.

Protective forest stands reduce wind speed over the adjacent fields for a distance of up to 5x the height of the forest belt on the upwind side and up to 25x the height on the leeward side. They also afford protection against snowdrift in ravines and from sublimation up to 30% of the fallen snow, increase the moisture content of the soil and the humidity in a zone on either side of the shelter belt, and consequently they increase the yield of agricultural crops.

Due to the more even distribution of snow, PFS reduces the depth of soil freezing, increases the speed of water absorption, and thereby reduces surface runoff and outwash of soil. PFS fulfills a valuable meliorative, hydrological, recreational, nature protection

and social role.

## 1. Introduction

The Program of Action and Declaration on Sustainable Development in the Twenty-first Century adopted by the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, presupposes conservation of the environment and rational use of natural resources. The implementation of these objectives should ensure a dynamic balance between development and conservation, removing the contradictions between environmental damage and society's need for natural resources.

A significant proportion of the agricultural production on Earth is conducted under unfavorable conditions of soil and climate. Successful agricultural production in such areas therefore requires melioration of various kinds.

Agro forest reclamation—the improvement of conditions of agricultural production by the use of forest plants—is the most harmless kind of melioration from the ecological and economic points of view.

The historical experience of Russia, USA, and a number of the Mediterranean countries has confirmed the efficiency of agro forest reclamation: elimination of the consequences of the dust storms of the 1930s in USA, the Plan of Transformation of Nature in USSR (1948), massive work on protective afforestation in China, India, and African countries based on the outcome of research and the strong meliorative role of protective forest stands.

The role of protective afforestation is particularly important during the hottest part of the year. PFS also helps to reduce the damage from climatic extreme events (e.g. hurricanes, dust storms, drought, floods, etc.), and is also helpful in the battle against global warming, because of its role in carbon sequestration—removing carbon dioxide from the atmosphere.

## 2. Climatic factors unfavorable for an agricultural production

The agricultural production in many regions of the world is conducted under unfavorable natural conditions. Dry winds, droughts, snow-storms, cold winds, erosion and deflation of soil have the most frequent and significant effect. Their occurrence is confined to definite physical geographical zones and seasons. Dry winds are characterized by the running velocity of air mass (3 to 5 m/s and more), relative humidity at 13.00 (not more than 20-30 %) and air temperature (more than 25-30 °C). Dry winds are typical for all the arid and sub-arid zones of both hemispheres. Dry winds sharply enhance transpiration of agricultural plants, and the respiration rate of animals, reducing yield and productivity. Dry winds in flat country arise from the influence of the deserts and semi-deserts of Central Asia, Mongolia, China, Africa, and North and South America. In mountains dry winds (phenes) arise after a wet air mass has dropped its load of precipitation and descends the in-verse slope.

Drought is considered to be a natural phenomenon in which evaporation exceeds the

sum of precipitation. It invokes moisture deficiency, disturbance of the water balance of plants, and depression of the vital activity of animals. Atmospheric (physiological), edaphic and general droughts can be distinguished. Droughts are typical of the Volga river region, Ukraine, the Central Asian republics, east and north Africa, and various other localities. Drought often results in a total loss of yield, and death of livestock and horses. Snow-storm winds cause the transfer of snow from fields in a hydro-graphic network, i.e. loss of part of the fallen snow (sometimes up to 35-50 %), denudation of soil and frost damage to winter-crops, enhanced freezing of soil and reduced absorption of melted water. Evaporation and sublimation of snow increase (up to 20-30%) under the effects of snow-storm winds, and sometimes dust storms can arise.

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