

V. Melnyk, PhD student
T. Kurbet, PhD in Agr. Sc., Ass. Prof., research advisor
S. Sukhovetska, Senior lecturer, language advisor
Zhytomyr State Technological University

PINE PLANTATIONS OF UKRAINIAN POLISSIA CONTAMINATED BY RADIONUCLIDES

Violation of the natural course of the forest ecosystems development is the result of the combined effect of many factors - abiotic, biotic, anthropogenic, social and technical. These factors cause deterioration of forest ecosystems' stability: the growth of stands reduces; the structure of forest soils undergoes significant changes; vegetation cover, underbrush and undergrowth degrade.

Ukraine is a sparsely wooded country. Degradation of forests, reducing their productivity and stability under adverse environmental factors cause the transition to sustainable forestry development.

The Chernobyl accident was one of the largest sources of radioactive contamination of forest ecosystems. Today, the radiation situation remains difficult in the woods. Soil radiation contamination is of mosaic character. Large value fluctuations of soil radiation contamination within a forest block or even stratum is typical.

Contamination of forests was detected in eighteen regions of Ukraine after the Chernobyl accident. During 1991-1992, about 3,2 million hectares of forest areas of the state forest fund were investigated and 1,23 million hectares (39%) had the density of ^{137}Cs soil radiation contamination above 37 kBq/m^2 (1 Ci/km^2). Forests of Ukrainian Polissia were badly contaminated by radiation. The large areas (32.4 thous. ha) with the highest levels of soil radiation contamination are located in Zhytomyr region. These territories are prohibited to carry out any activity, except protection forests from pests, diseases and fires.

High productivity and viability of plantations in man-made forests is provided by timely application of scientifically based forest management. A natural formation of space-parametric structure due to the falling away of the wood excessive amounts can be observed in forest stands that are left without thinnings.

The most nonfireproof, young and middle-aged pine monocultures dominate in dry and fresh types of forest conditions in Ukrainian Polissia forests. A large number of dead trees and the reduce of human activity in radiation contaminated forests cause the risk of forest fires and the threat of radiation contamination of boundary areas. Fires occur regularly in the forests which are located in areas of high radiation contamination and are left unattended. 17 000 hectares of forests were destroyed by fire for the period of 10 years after the Chernobyl accident. Thus, a rational system of forest management aimed to reduce the fire risk, to limit reproduction of entomopests and to restore damaged forests should be implemented in contaminated areas.

Scotch pine (*Pinus sylvestris* L.) is a common species for forest ecosystems in the exclusion zone and one of the most radiosensitive plants. That is why pine is used as an indicator of radionuclides contamination for the ecosystem monitoring and forecasting the environmental conditions in the Chernobyl exclusion zone. This type of species grows on depleted lands of 30-km exclusive zone of Ukrainian Polissia. Scotch pine

demonstrates a large number of deterministic and stochastic radiobiological effects. Characteristic features of such effects are the following: cytogenetic disorders, first of all in the form of chromosomal aberrations in plant mitotic cells; and some genetic effects. The rate of photosynthesis, transpiration, synthesis of certain metabolites, including some proteins, and other processes also reduce. The slow down of plant growth, the delay of some ontogeny phases and the increase of the growing season duration are also observed.

The development and growth inhibition processes are typical for coniferous species growing in burial grounds of "Red Forest" where the levels of ^{137}Cs and ^{90}Sr specific activity in plants are of hundreds kBq/kg. After the Chernobyl accident many researchers have paid much attention to the study of ionizing radiation effect on Scotch pine in conditions of radiation contamination. Unfortunately, these studies were conducted in different years and were not linked, thus, the results are fragmentary and unsystematic.

Cessation of the activities in forests which are located in the exclusion zones and zones of unconditional resettlement after the Chernobyl accident led to the appearance of a new category of man-made forests. The development and growth of these forests are governed almost without external interference. To predict the processes of vegetation formation or vegetation decay is extremely difficult because of the aftereffects (both positive and negative) of the previous forest activity and a large number of local and temporary abiotic and biotic factors. Today the need for management intervention in areas of radiation contamination density of 15-40 Ci/km² or even more than 40 Ci/km² is obvious.

Countermeasures against the decrease of the stability and productivity of pine stands should be the following: the transition from passive removal of contaminated trees off the sphere of economic activity to the strategy of active implementation of measures for rehabilitation forest areas. An integral part of such strategy should be a purposeful realization of complex cuttings as a part of forestry activity and forest regeneration measures.