213c Pollutant Fallout and Non-Wood Biological Resource Monitoring

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Nowadays application of non-wood forest bio-resources (NBR) is a promising and perspective business area. Medical, food and fragrance industries use bio-active substances (BAS) extracted from NBR (plant, animals, forest exploitation waste). In order to carry out this procedure safely, it is necessary to survey “ecological quality” of territories where natural material is collected and maintain monitoring. Regional monitoring concept has been developed . It includes such basic aspects as chorological (typology of territories), parametric (metrics selection), chronological (inspection interval background), informational (network database mating, data base processing, management and security), and analytical (development of assessments, forecasts, decision-making alternative criteria and metrological facilitation). The key objective of the monitoring is to give foundation to the alternatives while decision-making. It comprises a survey system of anthropogenic emissions when source classification is needed as well as monitoring polluted objects regarding data on atmospheric fallouts. The conducted research revealed that regional impact zones have a typical size of about hundreds of kilometers (regional scale, sources – urban agglomerations and transboundary fallouts) and of about several kilometers (local scale, determined by local sources). In this regard, two types of various scale monitoring tasks can be distinguished. At the “regional level” these are “area indicators” – forest areas, species composition and sanitary-forestry pathological situation, anthropogenic factors of forest exploitation (size of clearing, scope of forest remediation activities and forest treatment, ratio of ploughed fields and forests), as well as zones in natural disasters – fires, windfalls, pest attacks. Local monitoring is to be conducted regarding natural environments of NBR sources (soil, water bodies, air and biota) and regarding sources of man's impact. Besides, phytotoxicants (Hg, As, Cd, Pb, Ag), ions (Fe, Mo, Co, Mn, Cr), as well metals which reduce the content of BAS in tissues (eg., Ni) are to be monitored in soil and ground waters. To guarantee raw material control it is necessary to have a deep knowledge of local geo-chemical conditions as well as factors influencing transmission of elements from soil into a plant : lithogenic, biogenic, lateral, and data on the grade of the pollution. Inspection of soil characteristics is also mandatory, including the balance of nutrition components, acidity, physical condition, and contamination. Simultaneously, data on water bodies monitoring networks, solid wastes, and atmospheric fallouts in environment where pollutants are accumulated due to migration and geo-chemical barriers should also be available. Development of an NBR monitoring system is based on the studies conducted in the Kirov region (Russia). Soil biogeochemical provinces were determined after the concentration of 22 heavy metals taken at 1090 test sites (square area of 15 x 15 km) had been analyzed. The conducted investigation showed that pollutant concentration in natural environments, as well as raw material (in pine conifer) in particular ecotopes is characterized by significant variability. This factor influences their content in finished products. Regional zoning for the described above heavy metals settled in mosses (Hylocomium splendens and Pleurozium schreberi) and forest pine conifer (source of BAS – chlorophylls, carotenes, prenols, etc.) highlights the regional character of fallout due to urban agglomerations and transboundary transport. Regional concentration of heavy metals in moss tissues are lower than in most of industrially advanced districts; while lead (connected with motor transportation) and vanadium concentrations are close to the average level registered in the North of Russia. Evaluation of ecotope condition for heavy metal content in plants of the Kirov region is given in Table 1. Thus, accumulation of heavy metals in plants is determined by affiliation to the specific biogeochemical province, atmospheric fallouts and local conditions – landscape transitivity and accumulative capacity, conditions of accumulation in soil, presence of geochemical barriers and heavy metal migration mobility. The totality of man-made and natural conditions determines “ecotopes of geo-chemical risk ” for NBR. Monitoring of NBR found within such bio-geochemical provinces is seen as essential. TABLE 1 Average value of metal mg/kg and standard deviation of heavy metal concentration in dry conifer matter of Pinus Silvestris Element Kirov regionN = 320 Impact zone M s Spread of heavy metal concentration Lead 0,33 1,76 0,36 – 3,2 Molybdenum 0,06 1,53 0,06 – 0,77 Copper 1,20 1,71 0,6 – 4,8

Zink 5,50 1,72 3.4 – 14 Nickel 0,60 2,23 0,65 – 1,7 Cromium 0,63 2,61 2,8 – 6,8 It is stated that regarding chorological aspect of NBR monitoring, regional zoning based on deciduous and dark coniferous forest areas (according to Razumovskiy) can be considered as an appropriate type of zoning. Remarkable differences between zones on soil biogeochemical barrier level are detected for this typology: lead (figure t of Student's criterion is equal to 2,3), chromium – 2,6, nickel – 2,8, cuprum – 2,6, thorium - 7,1, strontium – 9,6. For Ag, Zn, Zr, Co, B, U, Mo, V, Ba, Ti, Mn, Ga, Nb, Sn deviations are insignificant - 0,05. Alongside with these zone there are also impact areas; therefore it is essential to set up key sites to supervise influence of economic activities. It should be stressed that primary providers of data for NSR monitoring are owners of soil inspection networks (agrochemical, forest, ecological and hygienic, etc.). However, there is no unity as far as chorological, parametric and other aspects of monitoring are concerned. Thus, development of models to conduct complex evaluation of territorial pollution, which was previously characterized by various indicators and belonging to various organizations, is one of the urgent issues.