



## **Rolled lawn as tool for industrial barren remediation**

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Fast development of the industrial and urban territories during last century has led to great disturbance of natural ecosystems in a lot of regions of the world. In the Far North the risk resulted from technogenic influence involves essentially more expressed negative consequences for the nature comparing to a regions of averages and southern latitudes due to higher sensitivity of northern ecosystems.

Since thirtieth years of last century industrial complexes on extraction and processing of nonferrous metals ores are functioned on Kola peninsula territory. They are powerful sources of emissions of acidifying substances and heavy metals. Long term influence of these emissions resulted in deep degradation of terrestrial ecosystems up to industrial barren arising in immediate proximity to industrial centre Monchegorsk. The most radical way of disturbed territories rehabilitation is biological remediation. In 2006-2008 innovative methods of high-quality grass cover performance was developed in local enterprise «VIPON» in Apatity. Vermiculite trademark «VIPON» is characterized by not broken structure of minerals combined with week reactance, high mechanical durability, favorable equal 6.5-7.0, valuable absorptive and ion exchange properties. Final product of proposed technology was rolled lawn which successfully applied for remediation of disturbed sites in urban territories as such as industrial plots with low contamination. One of abstract authors namely L.Ivanova is one of technology implementators. During 2008 the field test was performed near the smelter complex (67°51'N, 32°48'E) to estimate suitability of proposed method for site remediation in more severe conditions such as in industrial barren. The method is based on cultivation of perennial grasses using hydroponics with thermally inflated vermiculite from local deposit (Kovdor) followed by rolled lawn placement on very contaminated sites near Monchegorsk. Great advantage of rolled lawn is short term of cultivation (from 1 to 16 July 2008). Rolled lawn was characterized by high plant density 759.0±12.2 units per m<sup>2</sup>. That parameter achievement is not possible using traditional way of direct seeding in prepared ground that is common in Kola Peninsula region. Mass of 1 m<sup>2</sup> rolled lawn is about 5-7 kg. Rolled lawn cost is sufficiently lower than traditional (turf-grounded) one.

Grass seeds were choose as more adaptive for severe conditions and suitable for recultivation tasks:

*Festuca rubra* L. – 44.4%,

*Bromus inermis* Leyss. – 33.4%,

*Festulolium smaragdinum* – 11.1%,

*Festuca pratensis* Huds.– 11.1%.

Field experiment was carried out in three variants (1- mineral ground – flat site; 2- mineral ground- slope sites; 3- organogenic ground – flat site in depression in five replicates.

Growing in very contaminated ground resulted in 50% rolled lawn surface loss but with biodiversity maintenance. Grass roots proliferated in contaminated ground very slowly. It seems obvious that plant roots choose the best zones of soils to grow, and that they avoided toxic zones. More comprehensive results were received for mineral ground due to better natural washing compared to organogenic ground. In all variants we observed secondary roots formation.

Simultaneously with rolled lawn placement litterbag experiment was carried out with original vermiculite as filling. Short term (July- September 2008) alteration of nutritional status and contamination level of vermiculite was controlled and compared with quartz as inert material. Observations will continue during 2009-2011 to follow freezing influence and nutrient loss rate.