

PROBLEMS OF SOIL RENOVATION ON FORMER MILITARY SITES IN LITHUANIA

G. IGNATAVIČIUS, P. BALTRĖNAS

Environmental Protection Department, Vilnius Gediminas Technical University, Lithuania, Saulėtekio al. 11, 2040 Vilnius, Lithuania

1. Introduction

The Soviet army left Lithuania in 1993. At that time they abandoned approximately 500 military installations including 277 Soviet military bases on which 462 military units had been housed [1]. The military sites occupied 67662 ha, or 1.04 % of Lithuania's total land area. Only a fraction of this territory (16.7 %) was needed to satisfy Lithuanian military needs. The rest has been transferred to civilian use.

2. Description of types of pollution

The military sites were installed without any environmental protections. Often they were located on valuable geological formations, such as gravel, sand or sandy loam (Fig. 1) [2].

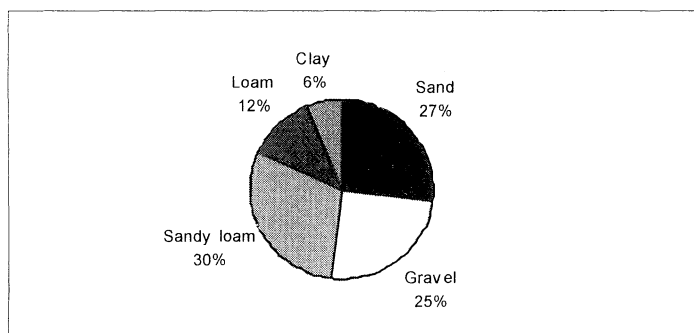


Figure 1. Soil types at military sites.

When Lithuania took charge of the Soviet military bases, an evaluation committee comprised of local experts was established to evaluate the environmental situation at the sites. One of their main tasks was to identify effective measures, which, when applied, could prevent further spreading of pollutants.

The committee identified 2743 sources of pollution on the former military lands (Table 1) [3]. Only 14 % of all the military bases were free of pollution sources (Table 2). The remains of 200 types of toxic chemicals and inflammable substances were found

on the remaining 86 % of the sites. Ruins of the former buildings and other sources of potential danger are present at almost every former Soviet military site.

TABLE 1. Types of damage and their distribution (Krüger Consult and Baltic Consulting Group)

Type of fixed damages	Quantity*	Area (ha)
Explosives	12	DC**
Landscape damage	438	7140
Radiation	9	DC
Oil products	566	399
Organic or biological pollution	137	14
Chemicals	56	DC
Destroyed soils	778	11137
Destroyed forest	249	3293
Rocket fuel	20	DC
Rubbish heaps	478	1288
Total	2743	23271

* - Number of pollution sources.

** - Dotted concentration.

As seen in Table 1, damage occurred primarily to soils and landscapes. The major sources of pollution identified were oil products and rubbish heaps prevailing in the military sites as well as the landscape and soil damages. The sources of oil contamination are listed in Table 3. Groundwater contamination by oil products was detected at all the investigated military bases (15) built on sandy and sandy loam soils [4]. At 119 sites the oil-contamination source is located within 200 m of surface water body (river or lake). In 35 of these cases direct evidence of oil contamination on surface streams was observed. A study of the site inventory indicated that environmental contamination from the military bases was usually related to surface run-off. However subsurface infiltration is an important factor in contaminant transport on a region scale where polluted groundwater discharges into surface streams.

TABLE 2. Distribution of pollution sources (Krüger Consult and Baltic Consulting Group)

Number of pollution sources per military site	Number of sites	Total number of pollution sources
0	41 (14%)	0 (0%)
1-5	94 (35%)	268 (10%)
6-10	59 (21%)	447 (16%)
11-20	50 (18%)	750 (27%)
21-50	27 (10%)	840 (31%)
More than 50	6 (2%)	438 (16%)
Total	277 (100%)	2743 (100%)

The 478 rubbish heaps found on the military sites comprise 17 % of all the environmental damage. There is about 333 000 m³ of waste on 1188 ha of land. Approximately half of the waste originates from military activity. The other half is mixed household waste (Table 4). Streams of wastewater and wind-transported heavy metal particles, oil dust, bitumen and other break-up products from the rubbish heaps, to clean sites. Natural ecosystems that have been severely affected by the long-term