

Soviet military heritage: brown and green – recovery and enhancement

H. Järv¹, A. Raukas², K. Sepp¹, J. Raet¹ & R. D. Ward^{1,3}

¹*Department of Landscape Management and Nature Conservation, Estonian University of Life Sciences, Estonia*

²*Institute of Ecology, Tallinn University, Estonia*

³*Biogeography and Ecology Research Group, University of Brighton, UK*

Abstract

Estonia has been for centuries a strategically important area in Eastern Europe, in particular due to its relatively long coastline (including islands about 3,800 km). Therefore it has been subject to military invasions by various foreign powers. Each of them has built numerous military facilities, most of which originate from the Second World War or subsequent Soviet occupation period. Almost the whole coastal area of Estonia and large inland areas were in use by the military and closed to the public. The Soviet military had left behind both, green and brown heritage. After the withdrawal of Russian troops, Estonia regained control of approximately 87,000 hectares of land formerly under military control, suffering from a high pollution load. Conversely, the military presence and strict limitations left large areas in a natural state largely untouched by human activities. After regaining independence, 40 new protected areas were established in the Estonian Green Belt zone, which was a heavily guarded Soviet military territory in Estonia. In Estonia, the regional differences are considerable. The pristine natural environment and valuable objects of cultural heritage are considered to be the strongest advantages for the development of rural areas, thus it is extremely important that former military sites are remediated and made safe. After the collapse of the Soviet Union, the extent and character of pollution caused by the Soviet military was studied. This article provides an overview of the extent of the pollution, the recovery of brownfield sites as well as green heritage.

Keywords: *green belt, Estonia, military heritage, rural development, land remediation, protected areas, Soviet military, military pollution.*



1 Introduction

Estonia due to its location, as a gateway to Russia (and from Russia to west), has experienced frequent invasions and subsequent occupations since the 13th Century. Each successive invasion destroyed the infrastructure of the previous invaders and left behind a new layer of infrastructure and artefacts. Estonia has such a sufficiently small land area, the longest diagonal measurement from the north-west to the south-east is approximately 300 km, that few areas have been untouched by military activities over the last 800 years. Nevertheless, the quantity of military installations, factories and assorted administrative and support facilities constructed by the Soviet armed forces far exceeded any of the previous occupying forces. Much of the territory of Estonia was covered with military installations, although the concentration was especially high on coastal areas and islands. The coastal areas and islands of Estonia formed the westernmost border of the former Soviet Union and hence they had to be heavily guarded. Officially the high concentration of military installations in the westernmost border areas was to protect the Soviet Union from external enemies, but in reality it was also to prevent defection of its own citizens and to prevent uncensored information from leaking in that would promote independent thought and shatter illusions constructed by the state. The Soviet occupation of Estonia lasted for almost 50 years, but its influence will last for a much longer time. Soviet policies in the occupied territories included the deportation and repression of local residents, replacing them with people faithful to the regime and taking maximum advantage of natural resources. As a result of these policies the population of Estonia increased ca 1.4 times, the number of workers and employees ca 3.8 times, the excavation of mineral resources ca 15 times and the production of electric power ca 100 times during the Soviet period.

Estonia regained its independence in 1991, but the transfer of all production and military facilities took much longer with the last of Soviet Army troops leaving Estonia in September 1995 [1]. Due to the strict censorship imposed on the dissemination of information in all spheres of society in the Soviet era, people did not receive any truthful information about the Soviet military's pollution and destruction of the environment. Only in the aftermath of the withdrawal of Soviet military forces did Estonia become aware of the extent of the pollution some of which were of an extent to be of international concern in some locations.

2 Brown heritage: Soviet military pollution and elimination operations

The most common environmental problem of industrial, civic and military waste occurs when hazardous materials enter surface water and top soils. Prolonged presence in these environments may subsequently lead to hazardous materials seeping into the bedrock and groundwater. For several decades, the environment did not receive any substantial attention in military sites of Estonia and almost no measures were taken to avoid contamination. Essentially, waste



(mis)management practices by the five main categories of the Soviet armed forces (Strategic Rocket Forces, Ground Forces, Air Defence Forces, Air Forces and Navy) and Soviet industry are the most common of the identified causes of Estonia's past pollution, which comprise examples in different environments. The Soviet military left behind large quantities of a variety of wastes, including scrap metal, tires, plastic waste, building material debris, etc. The estimated aggregates of the extent and loads of this waste are represented in table 1. A large amount of the waste from the army's industrial parks and that related to facilities maintenance was dumped directly into adjacent natural areas. Following the Soviet withdrawal the troops took along only the most valuable items and the most secret documents when leaving Estonia. The military equipment that was not possible to remove was sold or destroyed. At the same time, it has to be admitted that several military objects were left behind in a satisfactory state by the troops, and were later destroyed and vandalized (mostly for the value of the metal) later by local people. The departing Soviet soldiers and also scrap metal thieves, who came along later, dumped thousands of tons of rocket fuel components, mineral oils, paint waste, petroleum products and other chemicals into ground. Chemicals diffused into the soil over the course of a longer or shorter time, dependant on soil type, and caused extensive contamination. In one example at the Tapa military airfield, so much fuel was discarded into the ground that the almost all the soil and water in the town were polluted. Water was undrinkable in an area of about 16 sq km. In some bore holes the free petrol layer was more than 5 m thick. The amount of free fuel under the surface around Tapa was estimated at 400–1,600 tons. At the Sillaotsa fuel storage within the Tartu military airfield, several major accidents occurred, as a result of which thousands of tons of fuel were deposited into the ground. As a result, the upper soil layer in an area of 20 hectares was saturated with oil products, in some places to a depth of 3.5 meters [2].

The damage caused to the environment by the Soviet military is difficult to assess financially, but has been estimated by Estonia's Ministry of Environment

Table 1: Soviet Military waste (excl. radioactive waste) in Estonia 1995 [3].

Waste	Area (hectares)	Quantity (tons)
Oil spillage	4,335	761,427
Iron, steel and non-ferrous metals	850	48,544
Construction debris	673	743,304
Wood and paper	52	941
Oil products and fuel	N/A	12,038
Household garbage	88	126,256
Plastic and rubber	125	44,191
Manure and untreated sewage	81	48,431
Paint and varnish	16	6,439
Lead accumulators	8	59
Chemicals	68	8,257
Other (coal ash etc.)	8	20,800



at 3.6 billion € or 5 billion US\$ [2]. As a comparison, Estonia's national budget in 1994 was about eight times smaller, as the country was still building its independent statehood [4].

Shortly after regaining independence, The Estonian Ministry of the Environment (MoE) conducted an exhaustive analysis of the state of the environment and the use of natural resources, during which almost 40 substantial environmental problems were identified. The most important aspect underlying the prioritisation of environmental problems was the maintenance of human health. The environment affects human health primarily via polluted air, water and soil. Therefore, pollutants caused by Soviet industrial, agricultural and military activities were among the ten highest priority environmental problems [5]. The MoE created a special Commission tasked with both financing and carrying out the works necessary to clean-up or localise the military pollutants of the environment. The Commission identified 1,565 Soviet military sites, which varied in area from as small as 0.10 ha to over 31,000 ha and covered a total of 87,000 hectares (table 2). Each site was categorised, regardless of area, according to the load (presence) of hazardous materials (table 2). The measures were targeted at preventing the further spread of pollutants and eliminating or neutralizing the existing pollutants. The methods included: the collection and disposal of hazardous waste at authorized sites; the collection of mineral oil containers, the utilisation of waste materials where feasible, and the construction of oil separators at sites of major soil contamination. All toxic substances (chemicals, Ni/Cd accumulators, mercury vapour lamps, heavy duty plastic containers of transformer oil), explosives, combustible substances and other dangerous substances found at the sites of the former objects of the Soviet Army were either used or disposed of at authorized sites. The sites concerning radioactive material at Sillamäe and Paldiski were considered to be the most serious environmental threats and the most expensive to handle (table 2). As it will be impossible to describe the situation and elimination processes of all

Table 2: Environmental hazard categorization of Soviet contaminated military objects in Estonia.

Type of military object	Number of military objects	Hazard category
Nuclear reactors	1	Serious International
Nuclear waste	1	Serious International
Uranium mining	1	Serious International
Large airfields, large missile bases, large artillery range	17	Serious National
Fuel stores, small missile bases, chemical depot, naval ports	155	Major
Signal stations, border guard stations	280	Minor
Small airfields, small artillery ranges	290	Low
Accommodation, supply depots, lighthouses	820	Safe

Total: 1,565



former military sites, the Sillamäe and Paldiski cases, which are the most serious, will be briefly described below.

2.1 Sillamäe radioactive waste storage site: a threat for the whole Baltic sea region

After World War II Estonia was, for about ten years, one of the biggest uranium producers in Europe [6]. Initial production was based on processing locally mined graptolite argillite (*Dictyonema* “shale”) with a mean uranium content of 80–120 g/t. Between 1945 and 1963, Sillamäe’s total production of uranium from local low grade ore was only 65 tons. Once higher grade uranium ore had been discovered in Eastern Europe, approximately 4.2 million tons was transported between 1963 and 1990 mainly from Czechoslovakia and Hungary, to be processed at the Sillamäe plant and some 12,000 tons of uranium was produced [7, 8]. During this time period, the plant also processed radioactive loparite from Kola Peninsula, as well as rare earth metals such as niobium and tantalum. Initially, the waste from the processing of the ore was stored on the surface of a marine terrace. In 1959 a depository was created for the waste slurry, using sand banks as the containment material. The depository changed its shape and was expanded several times over the ensuing ten years (1959–1969). In 1970 the depository was measured as covering a total area of about 350,000 m² and an elevation of about 25 m above sea level. The MoE, prior to the containment project of 1999–2008, estimated the volume of the depository at about 8 million m³, of which 50% consisted of the processing waste of uranium ore that contained 1,830 tons of uranium and 850 tons of thorium and 7.8 kg (3×1,014 Bq) of radium [6]. The Baltic Sea’s natural accumulation of 4 Bq per kg of radioactive nuclides [9] whereas the concentrations in the solid waste in the tailings varies for uranium from 200 to 11,000 Bq/kg, and radium from 300 to 222,000 Bq/kg [10]. There was a danger that water trickling through the waste layers could have created a sliding plane on the soft Cambrian clay, which lies under the depository and is tilted toward the sea and consequently the radioactive waste could have leaked through the sand containments into the Gulf of Finland. The risk probability was exacerbated by marine storms that eroded the coastal terrace and destabilised the depository. Further to the threat to the waters of the Gulf of Finland, the depository released large amounts of radon gas into the atmosphere. The natural occurrence of radon in the atmosphere is 5–13 Bq per cubic metre, with the risk of lung cancer increasing by 64% per 100 Bq per cubic metre [11]. The mean concentration of radon in air measured near the depository between September 1992 and May 1993 was 310 Bq per cubic metre [10]. Since the conditions of the depository did not meet the standards of international environmental protection, remediation actions were necessary to guarantee the long-term safety of the site. The project at Sillamäe comprised three phases: First, to strengthen and protect the containment banks to prevent leakage into the Gulf of Finland; second to cover the depository to prevent wind erosion from the dried surface waste and radon emissions into the atmosphere. Finally, in order to halt coastal erosion a protective bulwark of boulders was constructed [6].



2.2 Paldiski town and the Pakri Peninsula – *terra incognita*

The highest density of Soviet military objects in Estonia was in the Pakri Peninsula, which includes the coastal town of Paldiski and the site of the Soviet Nuclear Submarine Training facility, which was one of the most expensive and secret military constructions in the whole of the Soviet Union. Because of the establishment of top secret military objects in Paldiski and Sillamäe, both towns were closed for ordinary citizens. Pakri peninsula became a military base of Soviet Union as early as 1939. In 1944, the Soviets laid the foundations for extensive construction work, which included adapting the harbour to receive submarines and later, in the 1960's, the construction of a training centre for Soviet nuclear submarine crews. The reactor area of the Training Centre occupied an area of about 20 ha, which was surrounded by a fence made from concrete panels. The Training Centre consisted of a complicated system of buildings [1]. The core of the facility was the Main Technological Building, measuring 208x40x22 m, which accommodated nuclear submarine simulators with nuclear reactors, one Delta class and one Echo class [12]. Each 50m long simulator contained a working nuclear reactor, one of which was 7.5 m in diameter (with 180 fuel rods) and produced 70 MW of power, the other was 9.5 m in diameter (with 250 fuel rods) and produced 90 MW of power. The first reactor was launched in 1968 worked a total of 20,821 hours, the other reactor went critical after 5,333 hours in 1983 [12].

The MoE assessed six key areas of the training facility as being the most hazardous to the environment: the solid radioactive waste storage, the liquid radioactive waste treatment facility, the liquid radioactive waste storage, the ventilation facility, the laundry facility and the radiochemistry laboratory. Under the terms of the bilateral agreement concerning the handover of Soviet military bases to the Estonian government, Russian technicians removed the fuel from the reactors, dismantled the non-radioactive components and systems and some of the associated auxiliary facilities and transported them back to Russia in October 1994. Russia also undertook to construct two concrete sarcophagi around the nuclear reactors. The Russians were not however obliged, under the terms of the agreement, to clean up the contaminated areas or handle the radioactive wastes.

In addition to the radioactive threat to the environment, the area surrounding the training centre posed major soil, surface and groundwater hazards through the presence of oil products. An estimated 400 tons of crude oil had contaminated 12,000 m³ of soil. The geology of the Pakri Peninsula, in particular the weak protection afforded by the topsoils to the underlying rocks and the proximity to the open sea, poses an environmental hazard unless liquid wastes and pollutants are handled, stored and treated correctly. Soviet management practices at a number of facilities on the Peninsula left a legacy of major environmental hazards.

A serious hazard was the Central Boiler House of Paldiski, located near the limestone escarpment on the east boundary of the town. During the course of the Soviet period, thousands of tons of crude oil leaked from storage tanks into the limestone cracks over an area of 6 ha. Calculations have shown that a daily average of 160 kg of fuel oil, as much as 400 kg on rainy days reached the sea

because of inefficient oil traps and the reckless treatment of crude oil. The wastewater treatment system of the Pakri Peninsula was constructed at the end of the 1950's and restricted to Paldiski. Within 20 years the system was sufficiently worn out to require a replacement that was only half completed in 1994. Lacking water treatment on the coast of the Peninsula an assortment of facilities manned by the Border Guard facilities and the Air Defence Forces dumped untreated sewage directly into the sea for a period of almost 50 years. Two of the missile sites of the Air Defence Forces at Leetse and Paju (or former Pakri village) were located on 43.2 ha of land covered by alvar within 200 m of the Gulf of Finland. The effects of continuous mismanagement over 20 years of oil products, solid and liquid rocket fuels and untreated sewage had a detrimental effect on the fragile ecosystem of the alvar.

The municipal landfill, located since 1939 in an old quarry at the centre of the Peninsula, was also a big polluter. The site covered 3.6 ha and in 1994 consisted of an estimated 28,500 tons of heterogeneous waste (military, industrial and house-hold). The landfill was located in a limestone area overlain by a thin (less than 1m) layer of shingle and gravel and therefore all pollution drained directly into the groundwater and the Gulf of Finland. The residual pollution, left by Soviet military forces within the Pakri Peninsula is far from being completely eliminated and will provide work for decades [13].

3 Green heritage – accidental outcome of the Soviet restrictions

The natural development of Estonian nature conservation ceased in autumn 1944 when the Soviet Army reoccupied Estonia. All legal instruments of the independence period (1918–1940), including the ones regulating nature protection, were repealed, and the general management of nature conservation discontinued. National nature conservation was legalized in Estonia in 1957 and after that a number of different nature reserves were established. At the same time, large areas of the Estonian coast and the majority of islands were closed to any major activity by the military. For nearly half a century Estonia's coastal areas experienced only three forms of activity: fishing kolkhoz, mineral extraction and the presence of the Soviet armed forces. The legacy of these activities, by 1992, was the paradoxical combination of natural areas of biodiversity preserved intact but also vast areas of land contaminated by toxic waste and a wide range of derelict military and industrial buildings. In spite of lack of nature conservation activities employed by the Soviet defence forces, the limited of anthropogenic influence in military areas provided, as a product, enhanced nature conservation. After regaining the independence, the public rediscovered the previously closed areas and started to appreciate the natural values of these areas. Most particularly, the heritage protection and recreational value of these areas stood out.

Development activities and human pressure in formerly closed areas was unexpectedly high and therefore to prevent damage to the fragile and valuable ecosystems, several new protected areas were established after regaining the independence in 1991.



By 2007, 17.9% of Estonian land was under protection [14]. Nature conservation in Estonia, from the beginning of 2000s, has been characterized by assuming the obligations of European Union (EU) nature conservation directives and policies. Nature conservation in the EU is based first and foremost on bird and habitat directives. They form the basis of the Natura 2000 areas, which have been established in Estonia and largely protect marine coasts, lake shores and river banks [15]. The Estonian government has defined the coastal zone “as a 200 metre wide zone landwards from mean sea level” [16]. In 2006, Estonian coastal areas were considered to be part of European Green Belt (EuGB). EuGB is an ecological network, which runs along the former Iron Curtain route from the Barents Sea to the Black Sea. This network unites protected areas of different countries and serves as an important migration corridor for different species [17]. Estonia is strategically important area for this network, as its coastal areas have a rich biodiversity in a variety of landscapes, areas of natural beauty, semi-natural habitats and wetlands, which lying on the East Atlantic Flyway are hugely important to some 3 million migratory birds on an annual basis [15].

As the European Green Belt connects nature areas throughout Europe along former Iron Curtain, it is suitable to use this territory as an example in the context of the green heritage of military areas. The Estonian Green Belt (the Estonian section of EuGB) is located along the Northern-Estonian coast and continues along the coastline of Estonian major islands: Saaremaa, Hiiumaa and Vormsi. The Estonian Green Belt is not just a line but 25 + 25 km wide zone along coastline: 25 km landwards and 25 km seawards, Fig. 1. To study the nature values of Estonian Green Belt zone, the following map layers of Estonian Nature Information System (EELIS) were analysed in a GIS (MapInfo): limited-conservation areas, protected areas, and seminatural communities. Additionally two EU Natura 2000 area layers were also analysed: Special Protection Areas (SPA) and Special Areas of Conservation (SAC). Protected areas located within the Estonian Green Belt zone were found and analysed. As a large sea area was incorporated into Estonian Green Belt territory, the territorial sea area of Estonia was also included into calculations. Protected areas located in Estonian Green Belt were also analysed in the context of the establishment: areas established before regaining independency in 1991 and areas established after August 1991 (parks and dendrariums were excluded).

Results showed that 40 new protected areas have been established along the Estonian Green Belt zone after 1991 (Fig. 1). The biggest of these is Põhja-Kõrvemaa Nature Reserve with an area 13,158 hectares (96% of it is inside the Estonian Green Belt zone) located in Northern Estonia (Fig. 1). During the Soviet time it was the largest training area of Soviet armed forces in Estonia. Almost one third (29%) of protected areas established after regaining the independence are located inside the Estonian Green Belt zone. The biggest nature reserve established after regaining independence is located outside the Green Belt zone but was also under military control. It is named Alam-Pedja Nature Reserve (area 34,396 hectares) and about half of its territory was used as a bombing range by Air Forces during the Soviet period.

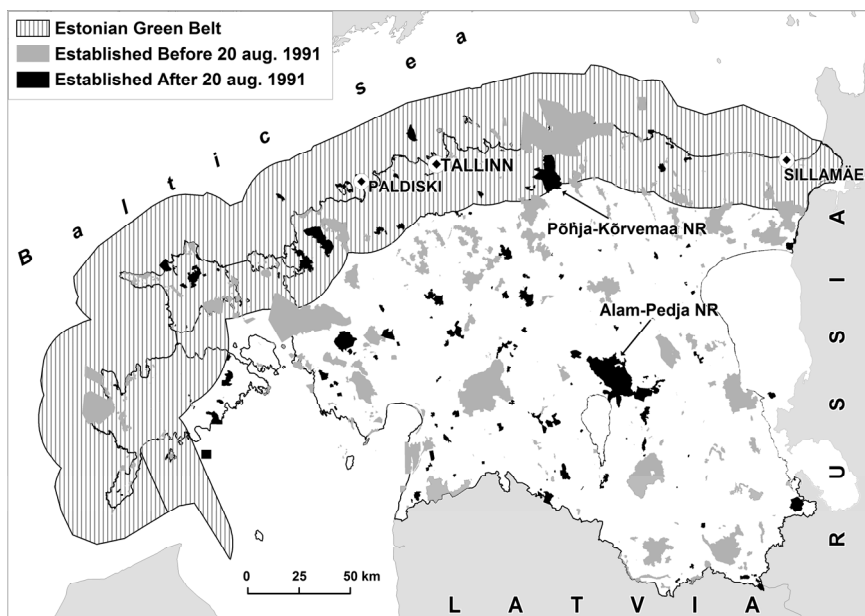


Figure 1: Protected areas of Estonia and the Estonian Green Belt zone.

The wealth of natural values of Estonian Green Belt (EGB) is represented in table 3. More than 75% of limited conservation areas, almost 1/3 of all protected areas and around 40% of seminatural communities' territories of Estonia are located in the Green Belt area. If sea areas are excluded of comparative calculations is the seminatural communities' share of Estonian Green Belt is even higher: 2.7% (Estonia as whole corresponding number is 1.7%). About 40% of Estonian Natura 2000 areas (SPA and SAC) territories are located inside Green Belt zone.

The number and extent of protected areas in former military zone shows that strict control and presence of military has also left a positive legacy in Estonia – some areas with an intact natural environment and interesting objects of cultural heritage. If brown heritage is mainly related to problems of remediation at great

Table 3: Protected areas in Estonian Green Belt zone compared to Estonia.

	Located in the EGB (ha)	Total area in Estonia (ha)	% of Estonian total located in EGB	% of EGB area	% of Estonian territory (with territorial sea 7,017,700 ha)
Limited-conservation areas	575,561.2	766,167.0	75.1	20.4	10.9
Protected areas	217,291.2	686,479.7	31.7	7.7	9.8
Special Protection Areas	590,125.4	1,265,792.2	46.6	20.9	18.0
Special Areas of Conserv.	457,742.9	1,154,955.7	39.6	16.2	16.5
Seminatural communities	30,267.7	72,607.5	41.7	1.1	1.0
Species' protection sites	25,706.0	93,885.3	27.4	0.9	1.3

expenditure then green heritage offers opportunities to stakeholders to make good use of it. However the results of recent studies indicate that the potential of former military sites and objects has still not been realized and several human activities (i.e. littering, construction works) have negatively affected the objects [18, 19].

4 Soviet military heritage in Estonia: recovery and enhancement

Since regaining independence the Ministry of Environment has partly financed and carried out works necessary to clean-up or localise the military pollutants of the environment. But still there are numerous military sites which are eyesores and may even pose a threat to human health. Additionally, most of the military sites, even those that have undergone remediation, still remain unused. The main reasons for that are lack of good ideas and finances, huge workload and, in some cases, the unfavourable location. There are arguably three methods of treating military heritage objects (MHOs). They can be totally eradicated; they can be neglected, intentionally due to cost or unintentionally due to lack of awareness of their existence; and they can be cared for as a valuable element of cultural heritage and a tourist site [20]. Although there are some positive examples in Estonia (i.e. seaplane hangars in Tallinn, recently renovated by Estonian Maritime Museum; Military Museum in Hiiumaa etc.), the owners of the military sites have typically implemented the first two options.

Since joining the European Green Belt network an increasing amount of attention has been paid to natural values and cultural heritage on former military sites. In 2009-2010 a comprehensive study of cultural heritage objects was conducted in the coastal zone of Estonia [18]. Inventory results showed that about 30% of all studied objects of cultural heritage were military objects, and from these 83% originated from the Soviet period. The condition of each surveyed object was evaluated against a six-level scale, the results showed that 40% of the objects were “well preserved” or “very well preserved”. The condition of the objects is often affected by various human impacts, in the case of military objects it was, in most cases, a decrease in human activity. The inventory also specified the human impact, which could affect the objects in the future. In 24% of cases, it was found that the object might be damaged or demolished in the coming future. The risk of littering was highlighted in 17% of cases. The risk of a decrease in human activity was described in 12% of cases and construction works by 11% of cases [18].

Military objects from the Soviet era are not considered to be as valuable as other objects of cultural heritage and therefore the State does not support their reconstruction, especially if they are privately owned. Most military objects are located in low-density areas, where socio-economic problems are much deeper than in densely populated areas. Therefore local initiative is weaker and finding a reasonable function for military objects is even harder.

In spite of the small territory of Estonia regional differences are considerable. A characteristic of this is the big difference in living standards and



competitiveness between the urban area of Tallinn (to some extent also urban area of Tartu) and other regions in Estonia. So far, several regions in Estonia have not been developed at the same pace as the major growth regions. According to Regional Development Strategy of Estonia for 2005–2015, the Estonian Government plans to ensure balanced regional development, where all regions, taking advantage of their specific assumptions, would contribute to development of the country as a whole. The Estonian Government is aiming to make all Estonian regions attractive with regards to living and conducting business, however, the Government believes that the initiative for development must come primarily from the local and regional level and only in some cases at national level [21].

The natural environment is considered to be nationally important for Estonia and a major promoter for regional development, which clearly refers to the desire to develop nature tourism [21]. The development plans of practically all local governments of Estonia prioritize tourism as instrument for balanced regional development and as a tool for improving the socio-economic situation.

In Estonia rural tourism is gaining more importance each year. Rural tourism is a small-scale tourism activity occurring in rural areas, based on local resources, and to destinations where the population is less than 10,000 and population density less than 150 people per square kilometre. In Estonia, tourism accounts for an essential part of the gross domestic product (about 8% of the GDP) and employment. In recent years, the number of tourists visiting Estonia, including the number of tourists who travel beyond Tallinn, has exhibited a growing trend (excluding the temporary decline due to the economic recession in 2009). About 60% of people, who visited Estonia in 2011, were holidaymakers who travelled in order to use local holiday and entertainment services, to visit cultural events, and to explore Estonia's nature and cultural objects [19].

Virtually everywhere along the Estonian coast there is a potential for small-scale tourism and opportunities to create recreation facilities (i.e. Saka Cliff hotel and Spa and Käsnu Maritime Museum in former Soviet border guard stations). In case developed without negative environmental impacts, tourism and recreation should be tolerated in coastal zone. Even the nature conservation areas of the coastal area can be used for tourism if managed properly [22]. Today the management of protected areas is undergoing major changes and they are increasingly considered to function also as instruments for regional development [23]. It is also believed that nature conservation areas have a twofold impact in the context of the regional development in Estonia. The conservation regime imposes restrictions on economic activities in rural regions, which can have a negative socio-economic impact. However, conservation areas also help to preserve natural resources as a potential for the development of the tourism economy in rural regions [21]. Matsalu National Park in Western Estonia is good example of integrating conservation and tourism interests. The vast number of migrating birds in March-May and September-October attract many Estonian and foreign birdwatchers to use the well-developed network of marked nature paths, bird observation towers and recreation facilities. The Council of Europe has awarded Matsalu National Park with the European Diploma for Protected

Areas in 2003, underlining successful combination of protection and openness to public [22].

The existing sights alone are not sufficient for the continued sustainable development of the tourism industry. In order to remain competitive, it is necessary to develop the sector continuously; to increase its efficiency and quality, while also developing new tourism products. As a result of several studies, it has become clear that Estonia has potential as a destination for military tourism. For example, a survey conducted by Etverk [24] in 2000 among local tourists revealed that there is interest in military tourism, with Estonia's beautiful and pristine nature cited as one of the reasons. The respondents would be glad to visit military objects if they were presented safely, improved as places to have an adventure in, or as museums for educational purposes. In addition, a large proportion of the respondents could participate in activities imitating the Soviet military, play war games etc. One third found that visiting a reconditioned military object/museum should be included in schools' history programmes [24]. The Bonn International Center for Conversion (BICC) found that the precondition of visiting military objects are reconditioning and safety [25]. Thus, the providers of military tourism must ensure the safety of tourists and to some extent, the aesthetic appearance of the object/area, to promote the preservation of military objects and improving their condition.

5 Conclusions

Soviet military and industry are the most common of the identified causes of Estonia's recent past pollution. After regaining the independence, 1,565 former Soviet military sites were studied in Estonia – not taking into account the contaminated soil, nearly two million tons of pollutants and waste materials which covered thousands of hectares of land were found. Although the pollution of most hazardous objects has been remediated by today, further work and attention is needed in former military sites.

Conversely former military sites are also rich in green heritage. The concentration of nature areas is especially high in coastal areas and islands (Estonian Green Belt area) which were under strict military control and closed to the public during the Soviet period – 75.1% of limited conservation areas, 31.7% of all protected areas and 41.7% of seminatural communities' territories of Estonia are located in the Green Belt area.

Ecosystems within former military sites in Estonia have been enhanced since regaining independence in august 1991. A number of new protected areas have been established on the territories of former military sites and the abundance of large areas is remarkable. The largest protected areas established on former military sites in Estonia after 1991 are: Alam-Pedja Nature Reserve (area 34,396 hectares); and Põhja-Kõrvemaa Nature Reserve (area 13,158 hectares).

Despite the high potential of the former military sites as tools for balanced regional development and resources for sustainable tourism, they have, as yet, not been utilised fully.



Sustainable military and nature tourism would provide local communities and stakeholders of low population density areas in Estonia, especially in coastal areas, an opportunity to take advantage of intact natural environment and well preserved objects of cultural heritage (incl. military objects). Military tourism is, therefore, a good instrument for achieving the general goals of the state (balanced regional development), offers local communities an opportunity to decrease social and economic gap compared to densely populated areas and helps to improve the state of military sites and objects.

References

- [1] Varvas, M., Putnik, H., Valge, J. (eds). *Paldiski endise tuumaallveelaevnike õppekeskuse tuumaobjekt – üleandmine Eestile ja saastusest puhastamine [The nuclear object of the former nuclear submariners training centre in Paldiski – assignment to Estonia and decontamination]*. Ministry of Economic Affairs and Communications, A.L.A.R.A.: Paldiski, 2005.
- [2] Raukas, A. (ed). *Endise Nõukogude Liidu sõjaväe jääkreostus ja selle likvideerimine [Past pollution of the Soviet Army in Estonia and its liquidation]*. Ministry of the Environment: Tallinn, 1999.
- [3] Raukas, A. (ed). *Nõukogude okupatsiooni poolt tekitatud keskkonnakahjud [Environmental damage caused by the Soviet occupation]*. Estonian Encyclopaedia Publishers: Tallinn, 2006.
- [4] Ministry of Finance of the Republic of Estonia. <http://www.fin.ee/riigieelarved-1995-2007>.
- [5] Raukas, A., Sustainable development and environmental risks in Estonia. *Agronomy Research*, **8**, pp. 351-356, 2010.
- [6] Kaasik, T., Sillamäe jäätmeohu oli ohuks kogu Läänemere regioonile [Sillamäe waste disposal was a threat for the whole Baltic Sea region]. *Nõukogude okupatsiooni poolt tekitatud keskkonnakahjud [Environmental damage caused by the Soviet occupation]* ed. A. Raukas, Estonian Encyclopaedia Publishers: Tallinn, pp. 81-90, 2006.
- [7] Nosov, V., Environmental problems in Sillamäe. *Proc. of the Int. Conf. of Ecological Security of the Baltic States, Nordic Countries and North-West Russia*, eds. P. Vares and G. Lassinantti, Estonian Academy of Sciences: Tallinn, pp. 64-68, 1995.
- [8] OECD Nuclear Energy Agency, *Uranium 2003: Resources, Production and Demand*. OECD, pp. 128-129, 2004.
- [9] Walker, M.I., Rose, K.S.B., The radioactivity of the sea. *Nuclear Energy* **29(4)**, pp. 267-278, 1990.
- [10] Kalam, J., Rajamäe, R., Ratas, R., Sillamäe tööstuskompleks ja jäätmeohu [Sillamäe industrial complex and waste disposal]. *Endise Nõukogude sõjaväe jääkreostus ja selle likvideerimine [Past pollution of the Soviet Army in Estonia and its liquidation]* ed. A. Raukas, Ministry of the Environment: Tallinn, pp. 70-73, 1999.
- [11] World Health Organization, Fact sheet N°291, 2009. <http://www.who.int/mediacentre/factsheets/fs291/en/index.html>



- [12] Sinisoo, M., Paldiski – radioactive waste and its disposal. *Proc. of the Int. Conf. of Ecological Security of the Baltic States, Nordic Countries and North-West Russia*, eds. P. Vares and G. Lassinantti, Estonian Academy of Sciences: Tallinn, pp. 81-88, 1995.
- [13] Kink, H., Metsur, M., Miidel, A., Ecological security of the Pakri Peninsula. *Proc. of the Int. Conf. of Ecological Security of the Baltic States, Nordic Countries and North-West Russia*, eds. P. Vares and G. Lassinantti, Estonian Academy of Sciences: Tallinn, pp. 69-80, 1995.
- [14] Klein, L., (ed). *Estonian Nature Conservation in 2007*. Estonian Environment Information Centre: Tallinn, 2008.
- [15] Vollmer, E., Sepp, K., Raet, J., Estonian Green Belt: Values and Management Issues. Estonian University Life Sciences, Institute of Agricultural and Environmental Sciences: Tartu, 2010.
- [16] Ehrlich, Ü., Krusberg, P., Habicht, K., Land Cover Types and Ecological Conditions of the Estonian Coast. *Journal of Coastal Conservation*, **8** (2), pp. 109-117, 2002.
- [17] The European Green Belt. <http://www.europeangreenbelt.org/indoor.html>
- [18] Lõhmus, L., Sapelkov, K., Semm, M., Sepp, K., Järv, H., Inventory of the shore areas in the Estonian Green Belt. Estonian University of Life Sciences: Tartu, 2011.
- [19] Lõhmus, L., Sepp, K., Järv, H. and MTÜ Liivimaa Arenduskeskus, The potential and possibilities of military tourism in Estonian Green Belt. Estonian University of Life Sciences: Tartu, 2012.
- [20] Sepp, K., (ed). *The Estonian Green Belt*. Estonian University of Life Sciences: Tallinn, 2011.
- [21] Estonian Ministry of Internal Affairs. Regional Development Strategy of Estonia 2005-2015. <http://www.siseministeerium.ee/31236/>
- [22] Mardiste, P., National report from Estonia concerning the Baltic Green Belt (the coastal zone). <http://www.ccb.se/documents/NationalreportEstoniaconcerningBalticGreenBeltthecoastalzone.pdf>
- [23] Mose, I., (ed). Protected Areas and Regional Development in Europe: towards a new model for the 21st century. Ashgate Publishing: Farnham, 2010.
- [24] Etverk, K., Turism endiste nõukogude militaaralade võimaliku arengusuunana: Eesti näide [Tourism as a potential development direction for former Soviet military areas on the example of Estonia]. University of Tartu: Tartu, 2000.
- [25] BICC-Bonn International Centre for Conversion GmbH, Study on the Re-use of Former Military Lands. Bonn, 1997. http://www.bicc.de/uploads/pdf/publications/other/bmu/bmu_en.pdf

