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Chapter 6: Estonia

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This report is part of a Council-funded research project entitled Environmental Resources and Constraints in the Former Soviet Republics. Twenty one reports, listed below, resulting from this project will be distributed seriatim by the Council, and will collectively become the chapters of a book to be published in 1994 by Westview Press. Eighteen of the 21 (written by other authors) deal with the fifteen former republics, and three (written by Dr. Philip R. Pryde, the Principal Investigator) are summarizing reports.

Chapter 1: The Environmental Implications of Republic Sovereignty. (Pryde)
Chapter 2: Russia - An Overview of the Federation. (Pryde)
Chapter 3: European Russia. (Kochurov)
Chapter 4: The Urals and Siberia. (Scherbakova & Monroe)
Chapter 5: The Russian Far East. (Strand)
Chapter 6: Estonia. (Soot)
Chapter 7: Latvia. (Dreifelds)
Chapter 8: Lithuania. (Kritkausky)
Chapter 9: Ukraine. (Stebelsky)
Chapter 10: Environmental Management in Ukraine. (Freeman)
Chapter 11: Belarus. (Cherp & Kovaleva)
Chapter 12: Moldova. (Dinu & Rowntree)
Chapter 13: Georgia. (Richards)
Chapter 14: Armenia. (Valesyan)
Chapter 15: Azerbaijan. (Wolfson & Daniell)
Chapter 16: Kazakhstan. (Smith)
Chapter 17: Turkmenistan. (Micklin)
Chapter 18: Uzbekistan. (Lubin)
Chapter 19: Kyrgyzstan. (Braden)
Chapter 20: Tajikistan. (Eicher)
Chapter 21: The View to the Future. (Pryde)
ENVIRONMENTAL RESOURCES AND CONSTRAINTS
IN THE FORMER SOVIET REPUBLICS

Estonia

Siim Soot

Executive Summary

The following paragraphs summarize the main contents and conclusions of a chapter on Estonia, which has been prepared as part of a larger work on the environmental and economic-geographic situation in each of the former Soviet republics. The full study, edited by Philip R. Pryde, will be published by Westview Press under the title "Environmental Resources and Constraints in the Former Soviet Republics. Funding assistance from the National Council for Soviet and East European Research is acknowledged with appreciation.

In this chapter, the history, physical geography and ethnography of Estonia is briefly summarized, followed by a survey of its main economic resources and any significant environmental constraints (climatic, geomorphologic, etc.) that affect the country's development. The contemporary state of the development of industry and agriculture within the republic is reviewed, with a focus on the environmental disruption that has resulted from this development. The current situation with regard to biotic preservation is also reviewed, including the establishment of nature reserves and parks, and the potential for ecotourism. The administrative structure for environmental management within the country is also briefly examined, as are non-governmental environmental efforts.

Particular discussion is directed to the pollution that exists within Estonia resulting from oil shale and phosphorite extraction, and the related problems of land disruption and water contamination. Estonia's significant air pollution and hazardous wastes problems are also reviewed.

The main conclusions of the chapter are that the future of Estonia will involve a dual focus, one to the West (especially towards Finland) with which it wishes to be economically aligned, but in the short run also towards Russia, whose contemporary economic ties and markets cannot be instantly severed. Estonia's severe pollution problems will likewise take many years to resolve, but doing so will be necessary in order to stabilize its industrial sector.

Philip R. Pryde, June 6, 1994
Figure 6.1
Estonia

- Cities
- Capital
- Oil Shale Region
- Phosphorite Region

Note: The boundary with Russia north and south of Lake Peipsi is not necessarily agreed to by the Estonian government.
The Estonian people have inhabited the shores of the Gulf of Finland and the Baltic Sea for thousands of years. Distinctly different from their Latvian neighbors to the south and the Russians to the east, the people have maintained a strong ethnic identity. For decades they have looked north to Finland as an economic and social model, which helped develop an early concern for environmental issues. In the 1970s an open letter was written decrying the ecological deterioration in the country and in the 1980s the public protested against phosphorite mining proposed by Moscow. Over time the opposition grew larger and more vocal. With the lack of a sympathetic response from the USSR government, the population increasingly demanded more independence, and ultimately in November of 1988 Estonia became the first republic to declare its sovereignty from Moscow. This action shook the socialist world and contributed to the dissolution of the Soviet Union.

History and Ethnicity

The earliest records of inhabitants in what is now Estonia date back approximately 10,000 years; had the ice age not removed vestiges of previous activity the period may have been longer. Regrettably, Estonia was not able to flourish as an independent entity throughout much of the last thousand years of this period. Occupying forces from Germany, Sweden, Denmark and Russia controlled the land. To the Germans, Swedes, and Danes, Estonia was a distant outpost from which wealth could be extracted, but to the Russians it was an important window to the West.

Estonia’s fate can be attributed to its strategic location. The irregular rocky coastline affords numerous natural harbors, providing protection from the ravages of storms and an ideal sailing venue (Figure 6.1). The 1980 Olympic sailing events were held here. Even more importantly, the warm currents provide a much longer shipping season than at St. Petersburg. Having lost its dominance over Finland at the beginning of the century, the Soviet Union was reluctant to relinquish its presence on the southern shores of the Gulf of Finland in Estonia.

During much of this century the population of Estonia has increased largely due to immigration of people from the east. The number of ethnic Estonians has changed very little. In 1934 Estonians constituted 88.2% of the population, with the Russians comprising the largest minority group at 8.2%. Germans and Swedes were the next largest groups. By 1989 the Estonian percentage was down to 61.5 while the Russian proportion was up to 30.3%.
Ukrainians and Belorussians replaced Germans and Swedes as the third and fourth largest groups. Although the total population since 1934 has increased from 1.1 million to 1.6 million the number of Estonians has actually declined, from approximately 992,500 to 963,000 today. There are few ethnic groups worldwide who have diminished in numbers during the last half century. Ethnic Estonians have consequently experienced the unenviable dilemma of seeing their own numbers declining while the number of in-migrants has grown.

Estonians are primarily an urban people (72% in 1989). The primary cities are Tallinn (482,000) and Tartu (114,000); no other cities in 1989 exceeded 100,000. Estonians are generally an educated people with high literacy rates, as reflected by very high per capita book and newspaper publishing figures. Estonia was the first Soviet republic to publish the complete works of Shakespeare in its native language.

As is common elsewhere, native Estonians tend to be more concerned with their natural environment than newer immigrants. This is noted also in the United Nations Conference on Environment and Development report (National Report, p. 9), which states "the sparing attitude towards nature is weaker with newcomers than with the native population, [and] has led to problems of abuse, wasting or mismanagement of resources".

Physical Environment and Natural Resources

With its location between 57°N and 59°N, Estonia is truly a Nordic country. It was the northern-most minority republic of the former USSR. Tallinn is at the same latitude as Stockholm and is between that of Juneau and Anchorage, Alaska. The moderating effects of the Gulf Stream and its proximity to the Baltic Sea provide Tallinn with a climate approximating Chicago in the winter but with much cooler summers. February is generally the coldest month, averaging -6°C (21°F) and July is the warmest with 17°C (62°F). There are typically 175 cloudy days during the year and approximately one day in three will have rain during the summer. The long-term trend over the past four hundred years shows a general warming of approximately two degrees centigrade since the early 1700’s (National Report, p.8). Still, it is not the winter cold which represents the greatest challenge but rather the length of winter nights. Winter days are frequently overcast which keeps the temperatures moderate but minimizes sunshine.

Topographically, the highest point in Estonia is the 318-meter (1043 ft) Munamägi (Figure 6.1). The area surrounding Munamägi consists of rolling hills interspersed with farms and forest stands, not unlike Wisconsin or Minnesota. Having been glaciated approximately 10,000 years ago, the northern and western portions of the country are relatively flat.
Numerous drumlins, eskers, moraines and 1440 lakes dot the landscape. Thirty-three percent of the landscape is covered by agricultural activity, forty percent by forests, and twenty-one percent by marshes and bogs.

Although at 45,100 square kilometers it is only one third the size of Illinois, Estonia possesses a variety of mineral and natural resources. The most prominent are the world’s largest exploited deposits of shale oil, as well as phosphorite, peat, limestone and dolomite. It also has extensive forests and fertile soils, providing the nation with a solid economic base.

The most distinctive resource is the oil shale in Virumaa (the northeastern part of the Republic), which is used to generate electricity and to produce household gas, commercial fertilizers and assorted chemicals. The extensive reserves (Table 6.1) would provide about a two hundred year supply at the current rate of extraction. Oil shale extraction dates from 1916, when production levels were relatively small. Much of the industry was lost during World War II, when all but 142 specialists with scientific degrees fled the country (Martinson, p.235). After the war production rebounded, peaked in 1981 at 31 million tons, was stable for many years and then began to decline.

Approximately half of the almost 20 million tons extracted in 1991 were removed by conventional shaft mining and the other half by strip mining, introduced in the 1960s to increase production. Unfortunately, both mining methods yield large residue mounds. These have seriously polluted the groundwater supplies of the region, affecting both human habitation and agricultural activity. The underground mining has caused subsidence in many areas; as a result, former agricultural areas have flooded, creating bogs and causing coniferous trees to prematurely lose their needles and die. The surface mining has totally altered the landscape and although much land is reclaimed, in northern climates it takes many years to restore original soil and vegetation. Still, over 80% of the 10,000 hectares affected by mining have been recultivated and reforested.

The oil shale region also includes Europe’s largest deposits of phosphorite (see Figure 6.1). Although the phosphorite has been mined in the Maardu area (20 km east of Tallinn) since the 1920s, major new reserves were discovered east of Rakvere, at a site 40 kilometers west of Kohtla-Järve. Due to public protests all phosphorite production ceased in 1991 after 391,000 tons were mined in 1990. It appeared to the local population that the extracted minerals would be largely shipped to the Soviet Union and since many of the employees were non-Estonians, the Estonians would only suffer from the environmental degradation and not receive any of the industry’s benefits. The phosphorite mining has produced both radioactive and self-igniting waste materials (Taagepera 1989).
<table>
<thead>
<tr>
<th>Resource</th>
<th>Explored resources</th>
<th>Mined Units in 1991</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Shale</td>
<td>3,800</td>
<td>19.6 million tons</td>
</tr>
<tr>
<td>Phosphorite</td>
<td>750</td>
<td>0.4(1990) million tons</td>
</tr>
<tr>
<td>Limestone, dolomite</td>
<td>250</td>
<td>3.1 million cubic meters</td>
</tr>
<tr>
<td>Sand, gravel</td>
<td>150</td>
<td>6.9 million cubic meters</td>
</tr>
<tr>
<td>Peat</td>
<td>2,400</td>
<td>1.8 million tons</td>
</tr>
</tbody>
</table>

A second important fuel is peat. There are approximately half a million hectares of peat bogs and fens scattered over 1600 sites, with at least 10 hectares each. They are easily accessible from all parts of Estonia and at the current rate of extraction, there are ample supplies for centuries. Peat is used locally and is also exported to northern European countries for a variety of agricultural purposes.

**Industrial Development**

Estonia's main industrial products are agricultural commodities, forest products, and mineral resource extraction and processing. Fishing is also an important industry.

Despite their northern location Estonia's farms are major producers of dairy products. Supply and market disruptions that have accompanied both the establishment of a free market economy and the separation of Estonia's economy from the rest of the former Soviet Union have caused recent declines in butter and cheese production.

In the long run, agricultural production, including grains and meat as well as dairy products, should rise with the conversion to a free market system, where owners have the incentive to produce efficiently and in quantity. By the beginning of 1991, there were 2339 privatized farms and another 2000 are in process. Agricultural products are also the basis for the wine and spirits industry.

Forty percent of Estonia is forested; its forest stands of 1.16 hectares per capita ranks behind Finland (4.1) Sweden (2.7), Norway (1.7), but ahead of Latvia (1.0) and Lithuania (0.5). Other countries in Central Europe such as Denmark, Germany and Poland have less than a quarter of a hectare per person. There are a total of 264 million cubic meters of timber, or 144 cubic meters per hectare. The increase in timber production from 2.887 million cubic meters in 1990 to 3.010 in 1991 (each year accounts for a little over 1% of the existing forest) indicates a basic reality in the current economics of industrial production: it is more lucrative to export raw materials then to sell them to domestic industries. As its economy matures, Estonia will need to sell more value-added products.

The forests consist principally of pines (41%), birch (28%), spruce (23%) and a variety of alder, aspen, oak, ash, linden and elm. These forest resources have been long appreciated; the forests of the major islands have been under some form of protection since 1254. The first written regulations regarding forest management were introduced in 1782. Much of the current timber production emphasizes short-term gain and even with reforestation programs, growth in this northern climate is slow. Environmental damage from acid rain, polluted groundwater and inadequate conservation techniques during harvesting have affected much of the existing forest.
Many trees are also afflicted with root diseases, in part caused by high water tables. Mistakes in drainage channeling and road building have raised water levels, now a problem in about 40% of Estonia’s forests (Environment '90, p.18).

In terms of processing primary materials, northeastern Estonia has been as important to Estonia as the Ruhr region has been to Germany. It has met some of the energy needs of the country while providing a manufacturing base for export items such as chemicals, fertilizers and electricity. A large chemical facility is located at the Kohtla-Järve mines; two electric power plants are 40-50 kilometers to the east. The major products are sulfuric acid (450,000 tons annually), urea (200,000 tons annually for agricultural uses), and ammonia (as a raw material for fertilizer).

Regarding energy production, the emphasis has shifted over time from low quality household gas production to electricity, with power produced at two large facilities, the Estonia and Baltic Power Plants. The Baltic has a 1435 MW capacity and the Estonia 1610 MW. Estonia’s heating systems are run on petroleum products which it needs to import; Estonia formerly sent electricity to Russia and received heating fuel in return. Supplies were assured during the Soviet period but are not guaranteed any longer. Inadequate heat and hot water were major problems during the last several winters.

The shortage of heating fuel has placed additional emphasis on the Virumaa shale oil production, but the transition to a free market and concerns over environmentally unsound production methods have led to production declines. Electric production has decreased 7% in eight years, shale oil mining has declined 25% and mineral fertilizers are down 8%. The most serious decline occurred in the early 1990s. Electric production was down to 14,506 million KWHs in 1991 and was estimated at 12,000 in 1992, as compared to 18,900 million KWHs in 1980 (when production peaked). Russia’s inability to purchase energy for hard currency is a major factor. In 1990 Russia purchased 3,607 million kilowatt hours of electricity from Estonia, 1,598 in 1991 and none in 1992. At the same time Estonia continues to buy natural gas from Russia, but also in declining amounts. In 1992 it is projected to be at 60% of the 1.5 million cubic meters purchased in 1991. In 1993, Russia briefly shut off all gas supplies into Estonia, as part of a dispute over payments and the status of ethnic Russians in the republic. Latvia’s electric imports from Estonia have also dropped from 5,150 million KWH in 1990 to about 3,500 in 1991, but it too faces payment difficulties.

The economic problems of Estonia can be summarized in the words of Hendrik Meri, Deputy Chief of the Department of Planning, who in speaking of the Soviet era, said "all the Union Republics form part of one economy, one single complex...every republic is assigned
specific tasks...the attempt is to solve a problem not in the interest of a particular region but of the whole country" (Singh, pp. 50-51). There was a distinct effort to integrate the country economically and socially and while the social integration did not succeed, the economy of Estonia is still deeply intertwined with the CIS states. The abrupt discontinuation of raw materials and markets has been a severe shock to all. The Soviet command economy also left a system of "tremendous waste and corruption" (Martinson, p.237).

The World Bank is planning to make a $30 million loan to Estonia by the end of 1993, to be used for the conversion of boiler houses so that they can use local fuel, to reconstruct existing central heating systems and introduce new technologies in the energy sector. Until these sorts of structural, long-term changes are implemented, energy supply shortages are likely to continue.

**Major Environmental Problems**

A major source of Estonia's environmental problems is the great emphasis placed by the Soviet regime on industrial growth. Industrial output, rather than agricultural production, was seen as the way to build a strong economic empire. In Estonia, stress was placed on oil-shale mining, electricity generation and textile production. Oil shale production was used to generate electricity and to produce household gas, much of which was sent to St. Petersburg. The gas pipeline from Virumaa was first completed to St. Petersburg in 1948 and not extended to Tallinn until 1953, indicating that USSR needs overshadowed Estonia's needs. Additionally, little attention was given to the environmental consequences of meeting production goals.

Environmental issues have always been important to Estonians (Pryde, 1991, pp. 259-264). There is an emerging consensus that environmental concerns became the principal catalyst of the unrest which led to the ultimate independence of Estonia. An important early step occurred in 1977 when "18 Estonian environmentalists warned in an open letter against the on-going shameful exploitation and pollution of Baltic soil and sea" (Roos, p.65). Almost a decade passed before internationally noteworthy actions were taken. "Major protests in Riga about the environment in November, 1986 had been followed by similar demonstrations in Tallinn in spring 1987. The latter successfully blocked the plans .... to begin phosphate mining in north-eastern Estonia, already a major ecological disaster area" (Hiden & Salmon, p.149).

In the 1980s Estonian environmentalists scored several successes: blocking plans to strip-mine phosphorite, build an oil terminal in Tallinn, and construct additional oil-shale burning power plants. In 1988 the Green Party was officially tolerated by the Soviet government as a political party. The same year the Congress of the Popular Front proclaimed its support for
ecology over economics and later that year an Estonian delegate to the USSR Supreme Soviet decried the pollution in northeastern Estonia and described the tumultuous demonstrations to close the facilities. The lack of resolve by the Soviet regime to address the root problems led the Estonian parliament to declare sovereignty by a vote of 58-1.

In the end, pollution "provided a crucial stimulus to the political reawakening of the Baltic republics" (Hiden and Salmon, p. 3). Soviet authorities simply did not appreciate the gravity of the Estonian concern for the environment, nor did the non-Estonians living in the republic at the time. In the 1987 Estonian Academy of Sciences survey appearing in the daily Rahva Hääl, 95% of Estonians responded affirmatively to the question: "Do you consider an unpolluted environment important?," while only 25% of non-Estonians responded similarly (Ilves, p.75).

Much of this concern stems from water pollution. Many of Estonia's lakes and rivers are seriously polluted. In 1989 there were no waste-water treatment facilities in Tartu, Kuressaare, or Tapa and only primary treatment facilities in Tallinn and Haapsalu. Rakvere and Pärnu were the only cities to have both primary and secondary (biological) facilities. In these latter cases the facilities are not always in operation, for want of spare parts.

Since the entire country is in the Baltic Sea drainage basin, much of this pollution is eventually discharged into the Baltic Sea. The Baltic is rather shallow and there is little water exchange with the North Sea; it is vulnerable to pollution from its ten bordering countries, each of which have at least some heavy industry near the shoreline. Estonia became a member of the eighteen-year-old Baltic Sea Convention in 1992, as well as a new Helsinki Convention established in 1992. These call for reducing heavy metal and organic contaminants discharged into the Sea. Because Estonia has few biochemical waste water treatment facilities, 285 tons of oil products and several hundred tons of phenols annually reach the Baltic Sea (by contrast the tanker "Kihnu" which ran ground in January, 1993 spilled 40 tons of petroleum). While the levels of phosphorus in the Sea continue to increase and will not likely stabilize in the next thirty years, the level of PCB, DDT, and oil products in the Sea are declining (National Report, p.24).

In Estonia, most of the 175 million cubic meters of water consumed in 1991 came from groundwater sources. Only Tallinn and Narva use treated surface water. In almost half of the country, however, the upper aquifers have been contaminated by nitrates, largely from fertilizers. The most serious problems are in eastern Virumaa (Kohtla-Järve area), where sulfates and phenols are among the hazardous substances in the groundwater.
Estonia also has some alarmingly serious air pollution levels, mainly SO$_2$ (sulfur dioxide) and NO$_x$ (oxides of nitrogen). Measured in per capita SO$_2$ emission, Estonia with 140 kilograms outranks the former East Germany (125 kg), Czechoslovakia (90), Hungary (58), Poland (56), and Lithuania (51). Countries such as Netherlands and Norway are under ten. The corresponding figure for Europe is about nine while North America’s is 19. Estonia may well lead the world in this dubious distinction (National Report, p.26). The annual discharge of NO$_x$ has been declining since 1986, as has SO$_2$, but it was still over 20,000 tons in 1990. In the mid-1980s, Estonia was identified as having the highest per capita air pollution among all fifteen of the Soviet republics (Pryde, 1991, p. 263).

Considering only stationary air pollution sources, Estonia produced 610,000 tons of pollutants in 1990. Of this, 302,000 tons were solid pollutants and 208,000 were SO$_2$. Approximately 75% of the main pollutants are emitted by the Baltic and Estonia Thermal Power Plants, which rank among the ten biggest sources of air pollution in Europe" (National Report, p.26). The Baltic plant is only 5 km southwest of the city of Narva and the Estonia plant, slightly smaller, is located 15 kilometers further southwest. Both burn fossil fuels derived from shale oil. The most common wind direction is estimated from the southwest, so that Narva is frequently in the path of these pollutants (as is St. Petersburg). Because the smoke stacks are more than 150 meters high, airborne pollutants are cast over a large region. In addition to contributing to pollution in the St. Petersburg region, it is estimated that these plants deposit 19,000 tons of sulfur annually in Finland. Estonia is also a recipient of foreign pollution; acid rain is a problem in southwestern Estonia, where no significant local polluters are found.

Non-stationary sources account for another 130,000 tons of pollutants, mainly from cars, trucks and tractors. The 1990 level of 147 private vehicles per 1,000 inhabitants exceeded the figure of 128 in Lithuania and 99 in Latvia (Pihlak, p.2). It is less than 50 in Uzbekistan, Kazakhstan, Azerbaijan, Moldova, Kyrgyzstan, and Tajikistan. The high level of motorization, the age of the equipment, and the type of motors (many run on 76 octane leaded fuel) contribute to airborne pollutants. All of Estonia’s major cities, including Tallinn (484,000) Tartu (115,000), Narva (82,000) and Kohtla-Järve (77,000) are adversely affected.

Nuclear fuel was produced for many years in Sillamäe, a coastal city northeast of the Kohtla-Järve. It is estimated that the presently closed Sillamäe military facility has left behind radioactive waste including 1200 tons of uranium and 750 tons of thorium (National Report, p. 28). Without an extensive clean-up it is likely that the radioactive waste will eventually contaminate the local groundwater and ultimately enter the Gulf of Finland. Assistance with
Table 6.2  Hazardous Waste Produced in Estonia  
(in tons)

<table>
<thead>
<tr>
<th>Town or district</th>
<th>Produced in 1990</th>
<th>Dumped in special sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narva East-Virumaa</td>
<td>4,800,958</td>
<td>102,333,898</td>
</tr>
<tr>
<td>Kohtla-Järve</td>
<td>2,017,137</td>
<td>61,658,355</td>
</tr>
<tr>
<td>Tallinn</td>
<td>518,271</td>
<td>9,976,571</td>
</tr>
<tr>
<td>Harjumaa*</td>
<td>25,907</td>
<td>3,437,569</td>
</tr>
<tr>
<td>Tartu</td>
<td>3,059</td>
<td>219</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>11,367,028</strong></td>
<td><strong>250,527,156</strong></td>
</tr>
</tbody>
</table>

*District surrounding Tallinn

<table>
<thead>
<tr>
<th>Type of Waste</th>
<th>Produced in 1990</th>
<th>Dumped in special sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste containing vanadium</td>
<td>396</td>
<td>477</td>
</tr>
<tr>
<td>Waste containing mercury</td>
<td>60</td>
<td>37</td>
</tr>
<tr>
<td>Waste containing phosphorus</td>
<td>460,000</td>
<td>9,410,000</td>
</tr>
<tr>
<td>Waste containing arsenic</td>
<td>870</td>
<td>6,186</td>
</tr>
<tr>
<td>Waste from batteries</td>
<td>575</td>
<td>63</td>
</tr>
<tr>
<td>Oil and oil products</td>
<td>10,278</td>
<td>2,434</td>
</tr>
<tr>
<td>Waste containing phenols</td>
<td>2,584</td>
<td>37</td>
</tr>
<tr>
<td>Utilized cooling liquids</td>
<td>991</td>
<td>405</td>
</tr>
<tr>
<td>Waste containing fluorine</td>
<td>35,009</td>
<td>565,251</td>
</tr>
<tr>
<td>Oil shale production waste</td>
<td>10,455,590</td>
<td>230,104,203</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11,367,028</strong></td>
<td><strong>250,527,156</strong></td>
</tr>
</tbody>
</table>

this problem is coming from specialists in Finland and Sweden, where they have had many decades of experience in the handling and disposal of nuclear waste.

Information on the impact of environmental contamination on public health has not been made publicly available, but cases of hair loss among children, improper bone development, anemia, and other medical abnormalities have been recorded in eastern Virumaa (Uibu, 1989). The lack of concern about industrial waste and the blind drive to meet the goals of the Soviet five-year plans has given Estonia a legacy of large hazardous waste dumping sites and a continued pattern of waste production (Table 6.2). Note that for several waste products, the amounts deposited in waste storage sites is less than the annual accumulation. The most visually obvious accumulations of waste are near the Kohtla-Järve facility, where numerous high mounds of ash residue are located. Currently, 20 square kilometers is covered by 160 million tons of ash. Some are located close to densely inhabited settlements (see Figure 6.2), but the most extensive accumulations are near the power stations. Since many of these mounds are over twenty years old, many now support a variety of vegetation including stands of trees (Figure 6.3). Still, these mounds represent an environmental hazard. The ash contains both sulfuric acid and heavy metals; when it rains the acid dissolves the heavy metals and the resulting toxic run-off contaminate rivers and groundwater supplies.

Due to its strategic location, Estonia was home in the early 1990s to twenty-one rocket bases, six military airfields, six abandoned bases, two military naval bases and an assortment of other training and manufacturing facilities. Of particular concern are the discarded hazardous by-products of this military activity. An hour's drive west of Tallinn is the Paldiski harbor, which houses two nuclear submarines. The Estonian government as of early 1993 had been unsuccessful in persuading the government in Moscow to remove these submarines.

**Governmental Structure: The Environment**

In November of 1988, Estonia declared its sovereignty from Moscow and within a month the parliament approved the Concept of Nature Protection and Rational Utilization of Natural Resources, which together with numerous other legislative acts has to guarantee the stable and environmentally secure development of Estonia (National Report, p.3). Currently the most comprehensive legislation is the February 23, 1990 Law on the Protection of Nature in Estonia. It is the third law since 1935 defining the rights, environmental responsibilities and liabilities of citizens and enterprises. Later that year regulations were passed which identified pollution taxes and compensation penalties for environmental damage.
Figure 6.2. Ash mounds, residue from oil-shale mining, located near a high-rise residential complex near Kohtla-Järve.

Figure 6.3. Trees growing on ash mounds, with varying degrees of success, near Kohtla-Järve, January, 1992.
In 1990 the Ministry of the Environment was reorganized. The Environmental Protection Fund, Forest Department, and Fisheries all report to the Minister. The Ministry also includes a special office for the Chief Inspector of Nature Protection, and has over 20 units and departments such as the Water Department, Nature Conservation Department, Sea Agency, Monitoring and Data Processing Center and Institute of Fish and Sea Research. This is supplemented by 19 local environmental protection departments. These units have established a comprehensive system of protected areas in Estonia including the 644-square-kilometer Lahemaa National Park and five state nature reserves (Figure 6.1 and Table 6.3). There were also in 1992 fourteen landscape preserves, six botanical-zoological preserves, 29 bog preserves, twenty ornithological preserves, and other assorted preserves including fifty-three locally protected areas. A major issue in Estonia's environmental management has been the division of authority and responsibility between local and central government.

The Environment Fund was established in 1983 and continues to provide financial support for environmental protection and to generally reduce pollution. It receives much of its revenue from pollution taxes and penalties. In 1990, 4.8 million USSR rubles were expended on numerous programs. The "development of the material base of environment protection" and "execution of research and project activities" each received about 28% of the fund. Less than one percent was devoted to environmental education and 3.5% to protected areas.

An integral part of environmental management and planning has been the development of a computerized set of environmental maps at a scale of 1:500,000. The regions of Virumaa and Tartumaa are being implemented first. Virumaa is the center of the oil shale industry and Tartumaa has suffered from the mismanagement of local Soviet air bases; groundwater supplies have been severely contaminated by gasoline and aviation fuels.

**International Trade and Tourism**

Given the limitations of the Port of St. Petersburg, Tallinn is the closest alternative. With its proximity to the deeper waters of the Baltic Sea, and its favorable natural harbor conditions, Tallinn is an excellent location for a port.

The Port of Tallinn consists of three major facilities: the City Port, Kopli (fishing and bulk goods harbor), and the new Muuga Harbor. The City Port has developed into a mixed use facility with passenger service and bulk cargo handling. With the completion of the Muuga Harbor in 1986, there is excess capacity and the port authority is beginning to shift functions and will redesign the City Port for strictly passenger service in the future, as a scenic entry into the country. With a draft of 18 meters, the Muuga Harbor can handle any vessel entering
Table 6.3: Preserved Areas in Estonia

<table>
<thead>
<tr>
<th>Type of Preserve (a)</th>
<th>Number</th>
<th>Total area (b)</th>
<th>Average size (b)</th>
<th>% of Republic (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature Reserves (&quot;Zapovedniki&quot;)</td>
<td>5</td>
<td>625.13</td>
<td>125.03</td>
<td>1.39</td>
</tr>
<tr>
<td>Biosphere Reserves</td>
<td>0</td>
<td>0</td>
<td></td>
<td>0.00</td>
</tr>
<tr>
<td>National Parks</td>
<td>1</td>
<td>649.11</td>
<td>649.11</td>
<td>1.44</td>
</tr>
<tr>
<td>Natural Monuments (&quot;Zakazniki&quot;) (c)</td>
<td>57</td>
<td>2037.00</td>
<td>35.74</td>
<td>4.52</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>3311.24</td>
<td>52.56</td>
<td>7.34</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nature Reserves (date created)</th>
<th>Hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endlaskiy (1985)</td>
<td>8162</td>
</tr>
<tr>
<td>Matsalu (1957)</td>
<td>39697</td>
</tr>
<tr>
<td>Nigula (1957)</td>
<td>2771</td>
</tr>
<tr>
<td>Vil'sandskiy (1971; 1910)</td>
<td>10689</td>
</tr>
<tr>
<td>Viydumyae (1957)</td>
<td>1194</td>
</tr>
<tr>
<td>Total</td>
<td>62513</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>National Parks</th>
<th>Hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lakemaa (1971)</td>
<td>64911</td>
</tr>
</tbody>
</table>

(a) For the definition of each type of preserve, see Appendix 2 to Chapter 1.
(b) In square kilometers.
(c) Data are from late 1980s USSR sources; at least 69 such areas existed in 1993.
(d) The area of Estonia is 45,100 sq. kilometers.

the Baltic through the Straits of Denmark. A totally new facility, it has the most modern silo complex in Europe, with a storage capacity of 300,000 tons and refrigeration facilities capable of handling 5,000 tons (Laving, p.10). The port was built in part to handle large grain imports into the Soviet Union, but such activity has begun to decline in recent years for both economic and political reasons. Coal shipping however, has increased, as has the use of the harbor facilities by the Danes and Swedes for storage purposes.

The currently planned Via Baltica motorway will provide Estonia with a vital link to central Europe and beyond. Connecting Tallinn, Riga and Kaunas with Warsaw and Budapest, it will provide a variety of travel services such as rest areas, motels, service stations and restaurants on a facility designed for 100-120 kph travel. Another roadway, the Hansa Way, is being planned, connecting St. Petersburg through southern Estonia to Riga, Kaliningrad and points west.

For the last two decades international tourism to Tallinn--a quaint city of gothic architecture and cobbled streets--was extensively promoted to attract Western capital. The ferry crossing on the "Georg Ots", from Helsinki to Tallinn, takes less than three hours, just enough time for tourists to frequent the many bars and duty-free shops, which provided the Soviet Union with Western currency. In recent years slot machines and a casino were added to increase potential earnings. The service had the imagined advantage to the Soviets of allowing Estonian residents to see firsthand the behavior of foreign tourists, many of whom were rather intoxicated.

In recent years there has been an explosion of service to Tallinn. In addition to two more ferries, hydrocraft service is also now available. In the summer of 1990 the firm Estline initiated service to Stockholm: the "Nord Estonia" currently departs Stockholm in the evening and arrives about twelve hours later in Tallinn. This increase in service has allowed the passenger total to rise from 960,000 in 1991 to projections of over one million in 1992. In 1985 there were only 132,000 tourists from capitalist countries (ENE, p.343).

Air service to the West began in the late fall of 1989 when Aeroflot and SAS agreed to fly between Stockholm and Tallinn. It was the first post-World War II service by a Western carrier to the Baltic republics. Tallinn was chosen for a variety of business reasons, but perhaps above all because it had a world class airport, totally rebuilt to handle the 1980 Olympic yachting traffic. There had been uncertainty about demand, but over 4000 reservations were made in the first month after the service was announced. It was one of the most successful start-ups in the history of SAS.
International air service is now also provided to Helsinki by Finn Air. Lufthansa flies to Frankfurt from Tallinn and Estonian Air flies to numerous destinations including Frankfurt, Copenhagen and Amsterdam, and has replaced Aeroflot's service to Stockholm and Helsinki. In 1990, 20,319 passengers flew between Tallinn and Helsinki and 31,364 flew between Tallinn and Stockholm. Tallinn and Estonia in general are well connected with Western Europe and will continue to promote tourism. It is one of the clear economic potentials of the country. The number of visitors from the former eastern bloc countries has declined recently but Western visitors have increased.

Conclusions

Due to political and economic changes Estonia has lost Russia as its major export market, as well as its access to cheap petroleum products. Considerable pressure exists to provide much needed hard currency by increasing electricity production and by mining phosphorite again, even though such moves would have negative ecological consequences. At the same time, Estonia has signed numerous international environmental agreements designed to preclude serious environmental damage resulting from tempting short-term economic solutions.

While its future is unclear, Estonia's past is not. Five decades of mismanagement and disregard for the environmental consequences of large scale industrialization and military occupation have seriously damaged the quality of Estonia's air, land and water. It is to be hoped that the environmental movement that helped topple an empire will continue to play a key role as difficult economic choices are made by a newly capitalistic and independent Estonia.

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Bibliography