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Chapter 14: Armenia

AUTHOR: ARMEN VALEYAN

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CONTRACTOR: San Diego State University

PRINCIPAL INVESTIGATOR: Philip R. Pryde

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NCSEER NOTE

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. (Bradcn)
Chapter 20: Tajikistan. (Eicher)
Chapter 21: The View to the Future. (Pryde)
Environmental Resources and Constraints
in the Former Soviet Republics

Armenia

Armen Valesyan

Executive Summary

The following paragraphs summarize the main contents and conclusions of a chapter on Armenia, 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 Armenia 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 problems of seismic danger (e.g., the 1988 earthquake), the desiccation of Lake Sevan, deforestation, energy shortages, and air pollution in Yerevan and elsewhere. The environmental consequences of the current conflict with Azerbaijan are also examined.

The main conclusions of the chapter are that the future of Armenia depends on achieving a permanent peace with Azerbaijan, and establishing stable economic ties with its neighbors. Being landlocked and having only moderate natural resources, Armenia must trade and import goods, especially fuels, from beyond its borders, and to do this normal relationships with its neighbors are essential. The current situation, involving fuel shortages that are causing a deforestation of the country, will lead to economic disaster if they continue.

Philip R. Pryde, June 6, 1994
Chapter 14. ARMENIA

A.L. Valesian

(translation by Holly Strand)

The Republic of Armenia covers 29,740 km² in the northeastern section of a wide mountainous area known as the Armenian plateau. Located at approximately the same latitude as northern Colorado, Armenia stretches 360 kilometers from northwest to southeast, and at its widest is 200 kilometers from west to east. It is bordered by Azerbaijan, Turkey, Georgia, and Iran (Figure 14.1). Declared an independent republic on September 21, 1991, there are 37 administrative regions and 21 cities in the republic, including the capital Yerevan.

An Overview of Armenia

The Armenian plateau is one of the ancient hearths of human civilization. The original culture of the Armenian people developed on this territory over the course of several hundred years. It has been suggested that the Armenians' name for themselves, khaj, comes from Khaiasa, a country mentioned in the Khettiskoi stone tablets from 1000 BC. The Kingdom of Ararat (Urartu, 9th - 6th cc BC) developed the traditions of an advanced civilization; the Armenian kingdom led into the golden age of Great Armenia (around 100 BC). However, the Armenians' subsequent history takes a tragic shift as Armenia lost its political independence for many centuries.

Armenia was the first state in the ancient world to adopt Christianity as its official religion. But throughout the 7th—15th cc, it was the target of repeated foreign invasions of Arabs, Byzantines, Seljuk Turks, Mongol Tatars, and Timur (Tamerlane). From the 16th to 18th centuries, Armenia was divided between Persia and Ottoman Turkey, and from the beginning of the 19th c. it was under Russian control. An independent republic of Armenia was proclaimed on May 28, 1918, but lasted only two and a half years, before the region was incorporated into the USSR.

The population of Armenia is 3,648,900 (1992), of which about 93% are Armenian. About 3% are Azeri, and less than 2% each are Kurdish and Russian. This is the smallest Russian population in any former republic. There are no ethnic sub-units; Nakhichevan, which is almost entirely surrounded by Armenia and Iran, is ethnically and politically part of Azerbaijan. Armenians, like Georgians, belong to the Indo-European ethnic family. Armenian is one of the oldest written languages; Mesrop Mashtots created the alphabet at the beginning of the 9th century.

Armenia’s pattern of settlement is quite irregular. Although the average density is 123 persons per square kilometer, this figure rises to 389 persons on the Ararat plain. For the country
<table>
<thead>
<tr>
<th>Elevation above sea level, meters</th>
<th>Square kilometers:</th>
<th>Percent of Republic:</th>
</tr>
</thead>
<tbody>
<tr>
<td>380 - 500</td>
<td>20</td>
<td>0.07</td>
</tr>
<tr>
<td>500 - 800</td>
<td>530</td>
<td>1.78</td>
</tr>
<tr>
<td>800-1000</td>
<td>2370</td>
<td>7.97</td>
</tr>
<tr>
<td>1000-1500</td>
<td>5430</td>
<td>18.26</td>
</tr>
<tr>
<td>1500-2000</td>
<td>9300</td>
<td>31.27</td>
</tr>
<tr>
<td>2000-2500</td>
<td>7290</td>
<td>24.51</td>
</tr>
<tr>
<td>2500-3000</td>
<td>3800</td>
<td>12.78</td>
</tr>
<tr>
<td>3000-3500</td>
<td>970</td>
<td>3.26</td>
</tr>
<tr>
<td>above 3500</td>
<td>30</td>
<td>0.10</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>29740</td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: Calculated by author.
as a whole, 68.9% of the population is urban. The largest cities are Yerevan, with 1,199,000 people in 1989, Gyumri (Leninakan) with 120,000, and Vanadzor (Kirovabad) with about 100,000.

Machine building, chemical, non-ferrous metallurgy, light goods and food production are major branches of industry in Armenia. Viticulture and orchards dominate agricultural production. Milk cows, meat cattle and sheep are the main animal stock. There are 820 kilometers of railroad tracks and 7,700 kilometers of public roads.

Since 1988 the republic has been in conflict with neighboring Azerbaijan for control of Nagorno-Karabakh, an Armenian enclave within the territory of Azerbaijan (see Figure 14.1). By 1993, armed conflict had resulted in Armenian forces temporarily occupying several portions of western Azerbaijan. A cease-fire was agreed to by Armenia and Azerbaijan in early 1994; peace talks will hopefully follow.

**Physical and Biotic Characteristics**

More than 90% of the republic’s territory is over 1000 meters above sea level (see Table 14.1). The highest point is the summit of Mt. Aragats, a very broad-based shield volcano rising to 4090 meters. The lowest points, located in the extreme north in a canyon formed by the Debed River, and in the south on the Araks River, are close to 400 meters above sea level. The complex structure of the relief, which is characteristic of the entire Armenian territory, gives the landscape a certain scenic appeal. Mountain ranges of over 3000 meters border the territory. An orographic map of the republic would distinguish three major forms of relief: intermontane basins, volcanic plateaus, and folded mountains.

The folded block ranges (Somkhet, Bazym, Pambak) of the central Lesser Caucasus stretch across the northeast of the republic, between which lie deep tectonically formed valleys. The Aiotsdzor, Bargushat, Eranos, Zangezur and other ranges form the Armenian plateau in the south and southeast. Mountain ranges occupy over half of the entire area of Armenia.

Young volcanic surface rock is widespread over the central part of the republic in the form of volcanic plateaus and shield ranges. In contrast to folded block ranges, the volcanic uplands and plateaus are less extensive, and less distinguishable on the surface. The Ararat plain is located at an elevation of 800–1200 meters in the southwest.

Practically the entire territory of the republic is seismically active; strong earthquakes are common (e.g. Gyumri in 1926, Spitak in 1988), as well as slumping, landslides and mudflows. The 1988 earthquake was especially devastating, killing an estimated 25,000 persons in the Gyumri, Spitak, and Vanadzor regions.
Armenia is located at the same latitude as Spain, Italy and Greece. Latitude, together with topography, determines the more important climatic characteristics. In the summer, continental air masses invade from the Iranian plateau to the south. In the winter the air on the Armenian plateau cools dramatically, and a zone of high atmospheric pressure is established. This results in many clear, cold days in the winter. An abundance of solar energy and high meteorological variability are characteristic of the climate, and vertical climatic/vegetation belts are well expressed on the mountain slopes. It is dry and almost subtropical on the Ararat plain, in Megrinskoye canyon, and in the extreme northeast; but with increasing altitude it becomes progressively cooler.

A large amount of solar radiation is typical for the republic, about 2700 hours per year on the average. On the Ararat plain and in the low mountains, the average July temperature is 25° to 27° Centigrade. The average January temperature is around -5°C, the normal absolute minimum is around -30°C. In the medium elevation mountains, summer temperatures average 18° to 20°C, and -8° to -12°C in the winter. An historic absolute minimum of -43°C was registered on the shore of Lake Arpi.

The average annual precipitation in the republic is 550 mm; the maximum falls in the spring and the beginning of summer, the minimum in the second half of summer and winter. The Ararat plain experiences the least amount of precipitation at around 200 to 250 mm. Heavy downpours and hail are common. Snowcover in the low mountains is variable, but in the middle and high mountains snow remains late into the spring with depths up to 100 cm.

The river system is distributed very unevenly over the territory. 70% of the annual flow occurs during the spring, when the snow melts and maximum precipitation levels are reached. Most (76.5%) of the territory is part of the Araks river basin, which begins in Turkey and flows along part of the Armenian-Turkish border. The main tributaries are the Akhuryan, Kasakh (and the Metsamor), Razdan, Azat, Vedi, and Arpa. A cascade of hydroelectric stations totalling 556,000 kilowatts has been built on the Razdan, and there are reservoirs on many rivers to regulate the flow. The Debed River, which flows into the Kura in Georgia, has the largest volume of water in Armenia after the Araks.

There are very few lakes in Armenia, and most of them are very shallow. The jewel of them all is Lake Sevan, at 1900 meters above sea level and occupying an area of over 1200 km.

Soil cover of the republic is extremely varied. Semi desert brown and gray soils are found at lower elevations—on the Ararat plain and in the extreme north and south. They are used for vineyards, orchards, and melon crops. Brown-chestnut and chestnut soils are common at elevations of 1300 to 1700 meters on dry steppes. These soils are suitable for cultivation of fruits and
tobacco; grapes can be found in the lower regions. Mountain chernozems can be found in mid-altitude mountains from 1600 to over 2000 meters. They are planted to grains, sugar beets, potatoes and other vegetables. Only about 12% of the republic’s territory is forested, mostly in the mountainous regions; alpine-meadows are found above 2000--2400 m.

The plant and animal kingdoms of Armenia are rich and diverse. About 3200 different species of plants grow here, including 180 endemics. There are 450 species of vertebrates and more than 10,000 non-vertebrates. In the extreme northwest and south, semi-arid landscapes occur, dominated by sagebrush, but with almond trees, wild pear, buckthorn and cushion plants being very common. Rodents include field vole, suslik, and sanderling, while Caucasus agama, Greek turtle, viper and Armenian viper are among the reptiles present.

The steppe is the most common form of landscape in Armenia. Needle grass, broom sedge, and various other grasses and forbs are characteristic forms of vegetation. Steppe fauna is similar to that of the semi-desert and is mainly represented by hares and rodents, together with their predators, such as foxes, badgers, raptors and wolves.

Deciduous species predominate in the forest, including beech, oak, elm, maple, and hornbeam; wild apple, pear, sweet cherry, prunes, dogwood shrubs, and wild rose are also present. The forest provides a habitat for roe deer, wild boars, bears, squirrels, and many other species.

Subalpine meadows stretch from 2200--2400 to 2800--2900 meters above sea level, and are dominated by forbs and mixed grasses. Alpine meadows occupy the summits of the mountain zone. The fauna of the alpine meadow is quite diverse: foxes, wolves, mountain goat, mouflon (wild sheep), quail and others.

Armenia has a rich variety in useful minerals. They include copper deposits near Alaverdi and Kafan, nephelite syenites (a source of alumina) in the Pambaks, iron veins near Razdan and in the Bargushats, molybdenum near Kadzharan, and gold near Zod. There are also polymetallic veins, signs of platinum, and concentrations of antimony, mercury and arsenic. Volcanic and sedimentary rocks provide excellent building materials. Volcanic tuff, in colors of orange, yellow, lavender, rose and black, is the best. There are rich deposits of marble, travertine and limestones, and a major salt deposit near Yerevan. The copper, molybdenum, and gold deposits are the most extensive and valuable (Shabad, 1969).

Armenia has almost no fossil fuel resources. The armed conflict of the early 1990’s caused all fuel pipelines into the republic to be severed. However, in 1993, Turkmenistan agreed to sell natural gas to Armenia, although the method by which it would be delivered was not specified.
Table 14.2. Human impacts on the Armenian environment

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge of polluted wastewaters:</td>
<td>249 million cubic meters</td>
</tr>
<tr>
<td>Emission of pollutants into the atmosphere:</td>
<td></td>
</tr>
<tr>
<td>from stationary sources:</td>
<td>631,000 tons</td>
</tr>
<tr>
<td>from automotive transport:</td>
<td>150,000 tons</td>
</tr>
<tr>
<td>from automotive transport:</td>
<td>480,000 tons</td>
</tr>
<tr>
<td>Loss of land from non-agricultural causes:</td>
<td>9,100 hectares</td>
</tr>
<tr>
<td>Timber logged:</td>
<td>8,000 cubic meters</td>
</tr>
<tr>
<td>Total amount of water used:</td>
<td>3,786 million cubic meters</td>
</tr>
<tr>
<td>from groundwater:</td>
<td>1,217 million cubic m.</td>
</tr>
<tr>
<td>water used for industry:</td>
<td>504 million cubic m.</td>
</tr>
<tr>
<td>potable water used:</td>
<td>134 million cubic m.</td>
</tr>
<tr>
<td>Volume of treated sewage water:</td>
<td>309 million cubic m.</td>
</tr>
<tr>
<td>above, as a % of that requiring treatment:</td>
<td>55%</td>
</tr>
</tbody>
</table>

Source: Okhrana ..., 1990, pp. 9 and 42 (most data is from 1988-89).
Numerous mineral springs arise from artesian wells and fissure-veins. The most famous are Dzhermuk, Dilizhan, Vzhni, Ankavan, and Sevan. Armenia is also rich in semi-precious and decorative gemstones such as agate, jasper, amethyst, heliotrope, obsidian, turquoise, and onyx.

Natural Resources and Environmental Problems

The following factors are characteristic of natural resource problems in Armenia: 1) intense geological and geomorphological activity and changes due to the relatively youthful landforms and relief, seismicity, continental climatic conditions, active slope processes and a number of related phenomena, 2) a relatively long and continuous history of human influence on the natural environment, 3) high density of population and production, 4) a rapid rate of industrialization and urbanization, 5) increased proportion of economic activity directly based on exploitation of natural resources, and 6) predominance of extensive (and therefore often wasteful) methods of land use.

A wide variety of ecological problems have developed in the republic, with negative repercussions on public health, as well as on future economic development (Table 14.2). The areas whose environments have been most adversely affected include:

1) the Yerevan metropolitan area where more than a third of Armenia’s population lives, and where more than 60% of the industrial potential (including chemical processing, thermal energy, nonferrous metallurgy, and raw materials for construction) are concentrated (Figure 14.2);

2) Other industrial cities: Vanadzor (formerly Kirovakan) has chemical and thermal energy production industries; Razdan specializes in construction materials and thermal energy, and asbestos is produced in the town of Ararat. All have high population densities and industrial concentrations, resulting in a degraded environment, accompanied by a serious decline in public health;

3) Regions where mining and enrichment facilities for non-ferrous metallurgy exist (Kadzharan, Kafan, Agarak, Akhtala, Zod), as well as areas of extensive extraction of non-metallic minerals (Artik and elsewhere), which have resulted in decreased fertility or loss of arable land, severe soil erosion and destruction of forests;

4) Lake Sevan which suffers from eutrophication, degradation of water quality, loss of 40% of its water volume, and the disappearance of unique, endemic species of trout;

5) Resort and health spa zones with mineral springs (Arzn, Dzhermuk, Dilizhan) where degradation is being caused by anthropogenic impacts;

6) Those regions of northern Armenia which suffered the most as a result of the severe 1988 Spitak earthquake (Figure 14.3); and

7) Regions suffering from military actions arising from the Armenia-Azerbaijan conflict.
Figure 14. View southward over the city of Yerevan, with smoke from the heavily polluted industrial district in the background. The haze and pollution prevents Mt. Ararat, 70 km away in Turkey, from being visible.
The following paragraphs look at the state of the environment in more detail.

**Land resources.** The generally steep relief, abrupt changes in elevation, active seismic processes, landslides, erosion, and avalanches serve to greatly limit land use suitability. Without counting damage from the Spitak earthquake, these processes have rendered 130,000 hectares of formerly productive land unusable in the past few years. Intensification of erosion and mudflows is caused by improper methods of plowing, watering, grazing, irrigation and road construction. Each year losses of the fertile soil layer approach 8 million tons, and about 1000 hectares of earth are lost due to gully (Figure 14.3). Secondary salinization of the soil is another critical problem. Other problems associated with conserving the land resources in the republic, such as the isolation and insignificant size of some land plots, not only complicate remedial measures but make soil conservation measures more expensive. Unfortunately, the existing procedures to protect land resources in Armenia still do not produce the needed effect.

**Forest resources.** The republic’s forests are not in satisfactory condition. This is partly due to the natural processes described above, as well as to anthropogenic pressures, such as solid waste disposal, logging, roads, livestock farms, recreational activities, etc. In the 25 year period ending in 1991, the forest cover of the territory grew by only 2%. According to the Ministry of Forestry, illegal forest logging has increased 8 to 10 times as a result of the energy crisis of the last few years. 25,000 separate cases were registered in 1992 alone, and the city of Yerevan was extensively deforested during the winter of 1992–93. Cutting the forests leads to a change in the species composition: for example, oak forests change to hornbeam forests. The small amount of forest cover in Armenia is one of the reasons why erosion and mudflows are such a problem, which in turn decreases the productivity of arable land.

**Water Resources.** Taking into account the natural flow from Lake Sevan and half of the border rivers Araks and Akhuryan, the average surface water flow of the republic is 6.54 billion cubic meters. There is 8 times less water per person than in the rest of the former USSR. In these arid conditions, without large rivers, and with unequal distribution of flow and extremely intense demand, water problems are of great significance.

The chief polluters of surface waters are collective farms (81.8%), the chemical industry (11.2%), and the agro-industrial complex (3.3%). According to the Ministry of Environment, among the polluting substances thrown into water bodies in 1988 were: 2,413,000 tons of sulfate salts, 2,302,000 tons of chloride salts, 454 tons of nitrogen, 250 tons of oil by-products, 235 tons of nitrates, 132 tons of phosphorous, 22 tons of iron, and 3 tons of copper. The Pambak-Debed, Razdan, Akhuryan, Agstev, and Vokhchi are the most polluted rivers of the republic.
Figure 14.3. A rural region near the earthquake-destroyed city of Spitak, Armenia, showing typical buildings vulnerable to seismic damage. Picture taken prior to the earthquake.
Lake Sevan’s situation deserves special attention. The problem began in the 1930s, when water reserves which took millennia to form were used up for irrigation and the production of hydroelectricity over a 50 year period, thus drying up much of Lake Sevan. It was proposed to leave a small lake with an area of 239 square kilometers in the middle, to be called Little Sevan. By the time it was publicly acknowledged that Sevan’s water should be preserved for future generations as well, the lake level was already down 18.5 meters, its area reduced by 13%, and the volume of water by 42%. Both the oxygen regime and the lake’s chemical composition had been altered, the water became three times less transparent, and eutrophication had begun. Many species of endemic fish had disappeared for good. Newly exposed areas became subject to wind erosion.

Additional inflow of water was necessary to raise the falling lake level without completely ignoring the demand for irrigation and hydroelectric energy. Therefore, water from the Arpa and Eksegis rivers was fed to Sevan through a 48.4 km tunnel. Sevan received about 250 million cubic meters of water through this tunnel every year, which was enough to support the present level of water, taking into account outflow and evaporation. According to specialists, several centuries are needed to return the lake to its original biosystem, and only after raising the minimum level by six meters and ceasing to throw toxic substances into the waters that feed into it. It has been proposed to construct another 21 kilometer tunnel to divert water from the Vorotan River.

By declaring Lake Sevan and the surrounding area a 150,000 hectare national park, some amount of anthropocentric stress on the region has subsided. However, other legislative actions aimed at establishing a protective regime for using the natural resources of the lake and its basin exist only on paper.

Air pollution. In 1988, stationary sources emitted approximately 250,000 tons of polluting substances into the air basin, including sulfuric anhydride, nitric oxides, hydrocarbons, chloroprene, and others. This total dropped to 150,000 tons in 1989 as a consequence of the damage caused by the 1988 earthquake. The majority of emissions were caused by the following industries: energy production (35% of the total volume of industrial emissions), non-ferrous metallurgy (19%), construction materials for industry (10%), and chemicals (9%). Automotive emissions accounted for about 490,000 tons, or over 60% of the total volume of atmospheric pollutants.

Those enterprises contributing the most to air pollution are the Yerevan factories "Nairit", "Polivinilatsetat", and "Kanaz", as well as the Vanadzor chemical plant, Ararat cement-slate, and Razdan cement factories. The "Nairit" plant has been particularly controversial (Peterson, 1993, pp. 244-7). The
republic’s most polluted cities, Yerevan, Vanadzor (Kirovakan), Razdan, and Ararat, are located in intermontane basins where, because of the extremely high potential for atmospheric pollution (aggravated by frequent calms and temperature inversions), the atmosphere’s ability to purify itself is impeded.

The yearly average concentration for many substances is significantly higher than standard norms: particulates at 7 times the maximum permitted concentration (MPC) in Razdan and Ararat, sulphur gas at 8 MPC in Vanadzor and Razdan, nitrogen dioxide at 7 MPC in Yerevan and Vanadzor, ammonia at 10 MPC in Vanadzor, ozone at 1.1 MPC, and also chloroprene, in Yerevan. It is not uncommon that for discreet periods, the concentration level of polluting substances may surpass the MPC by a factor of 10, or even occasionally by 100. As of the year 1988, Armenia was cited as having the lowest percentage in the USSR of air pollution sources equipped with emission control devices, only 24.3% (Mnatsakanian 1992, p. 66).

It might be noted that one option for reducing Armenia’s air pollution, the Armenian nuclear power station near Oktemberyan, has been shut down for several years due to both internal and earthquake-related safety concerns. However, economic necessity, aggravated by fossil fuel shortages, forced the announcement in 1992 that its two 440 MW reactors would be started up again. If this were not to happen, other types of power plants would have to be built, but as noted earlier, Armenia has very few fossil fuels. Restarting the nuclear reactors will be very controversial.

**Mineral Resources.** In general, the exploitation of mineral resources in Armenia is complicated and inefficient. In spite of enormous volumes of waste produced by mineral extraction and processing, an overall average of only 0.014% of the disturbed subsurface material is actually used. A number of valuable substances are thrown away, especially those associated with the extraction and processing of the copper and copper-molybdenum deposits. In all over 400 million cubic meters of tailings and waste products are produced by non-ferrous metallurgy, storage occupies 300 hectares of land, and 2,300 hectares have been degraded by mining. Likewise, the non-metallic mineral industry produces 45 million cubic meters of waste products and occupies 1500 hectares.

**Plants and Animals.** There are 400 species included in the list of rare and threatened plants in the republic’s Red Book of endangered vegetation. Furthermore, almost twenty species are already extinct, including ezhovnik, Tetradiici, halophilous gladiola, yellow water lily, and others. Several species of bog vegetation also face threat of extinction. The republic’s fauna has suffered in the face of anthropogenic pressure as well. The leopard, snow leopard, porcupine, hyena, manul, and both steppe and forest wildcat have almost totally disappeared. Indeed, southern
Armenia has the highest density of endangered species of any region within the former Soviet Union (Pryde, 1987, p. 27).

In response to these biotic problems, a number of protected territories have been created in the republic. Aside from the above mentioned Sevan National Park, they include four zapovedniki, and 16 zakazniki (Table 14.3).

Khosrov zapovednik is the largest in the republic and is located in the upper basin of the Khosrov and Azat Rivers, tributaries of the Araks River. It represents a unique combination of the flora and fauna of the arid sparse forest. There are more than 80 endemic species of plants; rare animal species include Armenian moufflon, wild goat, leopard and the Mediterranean turtle. The avian population is extremely rich: golden eagle, bearded vulture, peregrine falcon, Caspian snowcock, and stone partridge are among the more noteworthy species.

Over 80% of Dilizhan zapovednik is located in the upper and middle reaches of the Agstev River. Mostly comprised of beech and oak-hornbeam forests, the relict yew groves found within them are of special interest. Among other fauna, the noble deer, European roe deer, wild boar, and southern golden eagle are found here.

Forests also dominate in the Shikahogh zapovednik located in the upper basins of the Tsav and Shikahogh Rivers. There is a relict plane tree grove here, as well as mountain goat, wolf, marten, partridge, hawks, and Caspian snowcock.

In the smaller Erebun zapovednik, situated just west of the capital, rare species of wild wheat are preserved.

Since zapovedniki are not a united or continuous territory, it is difficult for them to maintain their protected populations. There are various parcels of settlements and farms wedged in among them. Conflicts constantly arise over hay mowing which destroys nests, burrows, lairs and wild plants; hay fields and cattle pastures represent human subsidized competition to wild animals.

The border area between Armenia and Azerbaijan illustrates an especially serious ecological situation, because of the armed conflict there in the early 1990s. Forest fires are a frequent by-product of the systematic shelling; they kill wild birds and animals, or force them out of their habitats. A relict plane tree grove, located 6 km from the Azerbaijani border, has been destroyed. The risk of epidemics in this zone has already increased dramatically as it is impossible to properly maintain purification facilities, water supply and sewage systems.
Table 14.3. Preserved Areas in Armenia

<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 (c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature reserves (zapovedniki)</td>
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<td>720.12</td>
<td>180.03</td>
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<td>National Parks</td>
<td>1</td>
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<td>Preserves (zakazniki)</td>
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<td>851.00</td>
<td>53.19</td>
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<td>Hunting preserves</td>
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<td>0.00</td>
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<tr>
<td>Total</td>
<td>21</td>
<td>3071.12</td>
<td>146.24</td>
<td>10.31</td>
</tr>
</tbody>
</table>

Zapovedniki (date created) Hectares

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<thead>
<tr>
<th>Zapovedniki</th>
<th>Hectares</th>
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<tr>
<td>Dilizhan (1958)</td>
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<tr>
<td>Erebun (1981)</td>
<td>100</td>
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<td>Khosrov (1958)</td>
<td>29680</td>
</tr>
<tr>
<td>Shikahogh (1975)</td>
<td>18000</td>
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<td>Total</td>
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</tbody>
</table>

National Parks Hectares

| Sevan (1978)                        | 150000   |

(a) For the definition of each type of preserve, see Appendix 2 to Chapter 1.
(b) In square kilometers.
(c) Area of Armenia is 29,800 sq. kilometers.

Governmental Actions and Future Prospects

The following are among the more significant environmental improvement measures taken in Armenia within the last few years: 1) the new Yerevan wastewater treatment plan is a bio-purification facility with a capacity of 220 million cubic meters per year; 2) the Armenian nuclear energy plant at Oktemberyan has closed down; 3) a production line of primary aluminum refining at the Kanaz factory in Yerevan was shut down, eliminating fluoride wastes and resinous compounds; 4) production of cyanamide, melamines, nitric acids and ammonia compounds was stopped at the Vanadzor chemical factory; 5) production was cut at the Kauchuk-I and Nairit plants in Yerevan; and 6) the Alaverdi mining and metallurgical combine has been restructured by eliminating sulfurous acid and certain operations including ore firings and fusion.

The Ministry for the Conservation of Nature and the Environment provides general guidelines and coordinates the republic’s conservation and rehabilitation measures. There are executive departments for land use strategy and international cooperation, as well as the following subdivisions: atmospheric protection; protection and conservation of water resources; protection of plant and animal life and their habitats; protection of soil and subsurface features; and state environmental impact assessments. The Ministry also operates interregional territorial inspection stations. The Ecological Commission is a standing committee of the republic’s Supreme Soviet.

The Armenia Green Party and the Society for the Conservation of Nature in Armenia are the largest public organizations with an ecological agenda.

Obviously, Armenia’s future environmental and social well-being will depend heavily on the course of events in the political and economic arenas. The cessation of the military conflict with Azerbaijan is paramount; as noted earlier, some hopeful signs appeared in early 1994. Also needed are mutually profitable cooperation with its neighbors, the creation of reliable and diversified ties with the global community, internal political stability, and the development of democratic institutions represent the most difficult stumbling blocks. If they are not resolved, one cannot expect any improvements in the quality of the republic’s environment.

Many of the stumbling blocks in the economic arena fall into the category of building a foundation for a market economy. Above all, it is necessary to reform the various types of land use so that they can help improve socio-economic conditions, through the widespread adoption of non-intensive resource technologies, the development of alternative forms of energy, tourism and recreation, and other innovative projects.

And of course, the organization of environmental education for a population whose environmental consciousness is extremely low is especially important; as well as the establishment of an open and effective monitoring system for environmental quality. Much will depend on the
extent to which Armenia is drawn into the international environmental arena. In particular, President Levon TerPetrosian's idea of turning Armenia into a research region for ecological-human environment experiments merits attention. The concept, which was suggested at the 1992 Rio conference for conservation and development, is to develop an effective environmental program which could then be applied to other small countries as well. This idea is of course dependent on peace being achieved; still, in ways such as these, this small republic with serious environmental problems is nevertheless looking to the future with hope.
BIBLIOGRAPHY