

Harvard University Extension School: Conservation Biology and Sustainable Management of Forested Landscapes (ENVR E142 Instructor: Mark Leighton)

Are the Republic of Georgia's Vast Forest Resources a Model for Sustainable Forestry Management in Armenia? (Final: 05/22/08)

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(Photo courtesy of Armenia Tree Project)

“Deforestation was a or the major factor in all the collapses of past societies described in this book.”

-- Jared Diamond, “Collapse: How Societies Choose to Fail or Succeed”

Abstract: This paper compares and contrasts the forests of the former Soviet republics of Armenia and Georgia, with a focus on Armenia and prospects for the future of its endangered forests and associated ecosystems. The entire Caucasus is a biodiversity hotspot, but these two countries are highlighted because they are immediate neighbors with similar conditions and potential for collaboration in the forestry sector. The comparison is of interest because the levels of forest cover differ so dramatically--with less than 8 percent forest cover in Armenia and up to 40 percent in Georgia--so the paper explores historical, economic, and other factors and the potential for improved forest management. A conclusion drawn is that there is room for mutual learning among both countries, despite a common view that Georgia is further advanced because of factors such as its orientation with NATO. In fact, Georgia faces the same forestry challenges as Armenia even while its forest cover is five times that of Armenia.

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Introduction

Objective

This paper provides an overview of forest management and uses in the former Soviet republics of Armenia and Georgia, with a focus on Armenia and prospects for the future of its endangered forests and associated ecosystems. Presently, Armenia has a forest cover of 7.7 percent (232,000 ha) and Georgia has a forest cover of 38 percent (2,641,000 ha), and this paper examines historical, economic, and other factors that have impacted the forests.

This comparison was of interest because the levels of forest cover differ so dramatically--so the paper explores the experiences and the potential for improved forest management. I was especially interested in learning why Georgia has such a high forest cover in relation to neighboring Armenia and to determine whether the forestry practices in that country could be a model for sustainable forestry management in Armenia. My goal was to test this thesis since Georgia is often held up as a model in the region because of its aspirations to join NATO, and it has been included in many lucrative transport projects such as BP's Baku-Ceyhan oil pipeline from the Caspian Sea.

Motivation

The issue in this paper is particularly urgent because Armenia--with a forest cover below 10 percent--is at risk of desertification and faces loss of biodiversity and endemic species. In fact, experts have identified several environmental challenges in Armenia, many of which are related to forest issues. These include soil erosion, water shortages, increased deforestation, and biodiversity loss (Moreno-Sanchez 2005, p. 114). "The mitigation of some of the most critical environmental problems the country is facing today (erosion and water supplies depletion) is directly linked to the conservation and recuperation of the forest cover," wrote Rafael Moreno-Sanchez and Hovik Sayadyan in a 2005 article in *International Forestry Review*.

Country Selection

The entire Caucasus region has been identified by the Critical Ecosystem Partnership Fund as a biodiversity hotspot, but these two countries are highlighted because they are immediate neighbors with similar climate and geological conditions so there is a more realistic comparison and opportunity for learning than one between Armenia and Russia with its vast resources, or between Armenia and Europe with so many different social, economic, historic, and political factors. For example, the Russian case would have been interesting because of its vast reserves of temperate forests and well developed forestry sector, but the difference in geographic and economic scales between the two countries make the comparison less relevant.

In addition, there is a realistic potential for collaboration in the forestry sector because Armenia has more amicable relations with Georgia than with most other neighbors in the

region. Turkey and Azerbaijan have no diplomatic relations with Armenia and have imposed economic blockades against Armenia, both related to conflicts dating back to the Armenian Genocide of 1915 and the Nagorno Karabakh war that erupted just before the breakup of the Soviet Union. Although Turkey has a well developed forestry sector, it is unlikely that there would be practical collaboration or mutual trust between representatives of these two countries in the near future.

Country Overviews

Armenia

Present day Armenia is a fraction the size of ancient Armenia, according to a Time Almanac profile posted on the website of the Armenian Embassy in Washington. Bounded by Georgia on the north, Azerbaijan on the east, Iran on the south, and Turkey on the west, Armenia (**Figure 1**) is the smallest of the former Soviet republics with a total area of 29,800 sq km (comparable to the size of Maryland).



Figure 1: Map of the Caucasus Region

This 1991 Soviet map of the South Caucasus shows Georgia in the center, and land-locked Armenia to the south (Map source: <http://en.wikipedia.org/wiki/Caucasus>)

One of the world's oldest civilizations, Armenia once included Mount Ararat, which biblical tradition identifies as the mountain where Noah's Ark rested after the flood. It

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was the first country in the world to adopt Christianity as its religion in 301 AD. A land of rugged mountains and extinct volcanoes, the lowest elevation is 400 m along the Debed River in northern Armenia, and its highest peak is Mount Aragats at 4,095 m now that Mount Ararat is across the border in Turkey.

Over the centuries, Armenia was conquered by Greeks, Romans, Persians, Byzantines, Mongols, Arabs, Ottoman Turks, and Russians. By the 16th century major portions of Armenia were controlled by the Ottoman Turks, under whom they experienced discrimination, religious persecution, heavy taxation, and armed attacks, which culminated in the genocide of 1.5 million Armenians beginning in 1915.

After the Turkish defeat in World War I, an independent Republic of Armenia was established in 1918 but survived only until 1920, when it was annexed by the Soviet Army. After enduring 70 years of Soviet totalitarianism, Armenia declared its independence from the collapsing Soviet Union in 1991 and in the years that followed, Armenia successfully fought Azerbaijan for control of the Armenian-populated region of Nagorno Karabagh.

According to the UNDP's Human Development Report for 2007-2008, Armenia has a Human Development Index ranking of 83rd out of 177 countries, which places it in the category of "medium human development." Armenia has a GDP per capita of \$4,945 (PPP 2005) and a population of 3 million, according to the international database of the US Census Bureau. By way of comparison, Georgia has a Human Development Index ranking of 96th out of 177 countries, a GDP per capita of \$3,365 (PPP 2005), and a current population of 4.6 million.

Georgia

The history of Georgia also dates back several thousand years, according to a profile on the Foreign Ministry website. Like Armenia, Georgia adopted Christianity in the 4th century, which provided a strong national identity despite repeated periods of foreign occupation and attempted assimilation.

The last conqueror, Russia, started annexation of Georgia in 1801. Georgia spent almost 200 years of its recent history as a part of the Russian Empire--first as Russia's province and then as a Soviet republic. Independent from 1918-1921 following the Russian Revolution, it was part of the Soviet Union until 1991.

With a total area of 69,700 sq km, Georgia is strategically located east of the Black Sea and it controls much of the Caucasus Mountains and the routes through them, notes the Foreign Ministry. The land is mostly mountainous with the Great Caucasus Mountains in the north and Lesser Caucasus Mountains in the south, and the Kolkhida Lowland opening to the Black Sea in the west. Elevations range from the Black Sea to the highest point of 5,201 m at the peak of Mountain Shkhara.

Overview of Forests

Armenia

Armenia is situated in a dry subtropical climatic zone, with annual precipitation ranging from 250-300 mm in the Ararat plain to 1,000 mm on Mount Aragats (Moreno-Sanchez 2005, p. 115). The country's complex topography creates several microclimates and these give rise to a large diversity of vegetation types from a semi-desert in the Ararat plain to sub-alpine and alpine zones at the top of Mount Aragats.

The Armenian forest cover contains 110 tree and 152 shrub species, and the dominant tree species are broadleaf deciduous trees. Today a mix of oak, beech, and hornbeam comprise 81.3 percent of the forest cover. Pines--mostly in plantations--represent 5.3 percent, juniper 2.5 percent, and other broadleaf deciduous trees including hornbeam, lime, ash, and maple make up 10.9 percent of the forest cover.

The northeastern and southeastern parts of the country and the eastern bank of Lake Sevan have the most favorable climatic and environmental conditions for the growth of forests. Therefore, 62 percent of the forest cover is found in the northeast, 36 percent in the southeast, and only 2 percent in the central region of the country. Studies of quaternary volcanism and geological developments have concluded that large areas of Armenia have not supported forests since the end of the tertiary period 1.8 million years ago (Moreno-Sanchez 2005, p. 116).

According to studies by Rafael Moreno-Sanchez and Hovik Sayadyan, Armenia's forest cover was 18 percent in the 17th and 18th centuries. A period of widespread forest cutting for industrial and farming uses brought the forest cover to less than 10 percent, followed by timber imports and reforestation during the Soviet period that brought the forest cover back up to 11 percent (Hergnyan 2007, p. 7).

However, Landsat satellite image data has revealed that Armenia's forest cover reached a dangerously low level of 7.7 percent by 2006. A major feature of the deforestation has been the accelerated rate of forest fragmentation, with most of the losses occurring around Lake Sevan and in the northern part of the country (Hergnyan 2007, p. 6).

In recent years, old high quality mixed oak and beech forests are being replaced by young low quality hornbeam forests, because of high grade cuttings for illegal timber exports to Europe, Turkey, and Iran (Moreno-Sanchez 2005, p. 123).

During the Soviet period, forest management was directed from Moscow or Georgia, so the country did not develop accurate inventory or monitoring techniques. There was also an official view that the forests were an inexhaustible resource that needed to be fully used, which led to a lack of interest in silvicultural practices such as species composition management or intermediate cuttings which were required for the type of forest conditions in Armenia (Sayadyan 2006, p. 5).

Highly protectionist forest policies in more recent decades also prevented the development and implementation of these silvicultural practices, which led to the growth of overstocked and over-mature forests with low density, low annual growth rates, and very poor regeneration.

Therefore, all of the forests in the country today have characteristics that make them susceptible to pests and diseases and have a reduced capacity to recuperate from disturbances. This situation is of concern because the maintenance of biodiversity requires having a balanced age-class distribution with uneven aged forests, landscapes with many different even aged forests, or a combination of these (Hunter 2007, p. 253-256).

Georgia

In contrast with Armenia, forest ecosystems cover about 38 percent of the territory of Georgia and are found throughout the country, with the exception of Javakhk, Khevi, and Tusheti (Georgian Centre for the Conservation of Wildlife 2006, p. 2-4). In eastern Georgia, floodplain forests along the Mtkvari, Alazani, Iori, and Ktsia rivers are dominated by oak and poplar and are rich in creepers. The poplar forests along the Iori River are noteworthy in terms of plant diversity. Floodplain forests in west Georgia are dominated by alder, although there are other tree species such as wingnut, oak, and willow.

Arid light woodlands are found in the semi-desert and steppe belt of eastern Georgia. This biome consists of hemi-xerophyte trees and drought tolerant grass species. The best example of arid woodlands is represented in the 5,000 ha Vashlovani Reserve. Arid light woodlands are found on grey-yellow soils where the climate is dry subtropical in Vashlovani or temperate warm in Mtskheta.

Juniper woodlands are found on northern slopes of the foothills at Mtskheta and Vashlovani, often occupying previously deforested areas. Semi-xerophyte scrub occurs on the southern foothills of east Georgia at altitudes of 600-800 m in areas formerly occupied by Georgian oak. Xeromorphic shrubs, semi-shrubs, and ephemerals dominate this habitat type.

Forests are the most common habitat type in Georgia. Oriental beech is the dominant species, although there are many other tree species in the forests. Georgian oak forest occurs at 600-700 m in eastern Georgia, beech forests are found in the middle and upper zones of the forest belt, and pine forests often develop on the edges of mountain steppes or steppe-meadows in southern Georgia between 1,700-2,400 m.

Pine and oak woodland can be found in eastern Georgia at 800-1,100 m, but in Achara in western Georgia it is found from 300-1,200 m. Fragments of a relic yew forest are preserved in the Batsara Reserve in east Georgia, while the zelcova forest in Babaneuri in east Georgia is noteworthy due to its relict nature and distribution. Maples are found only in the Alazani Valley, and this species does not occur above 1,000 m.

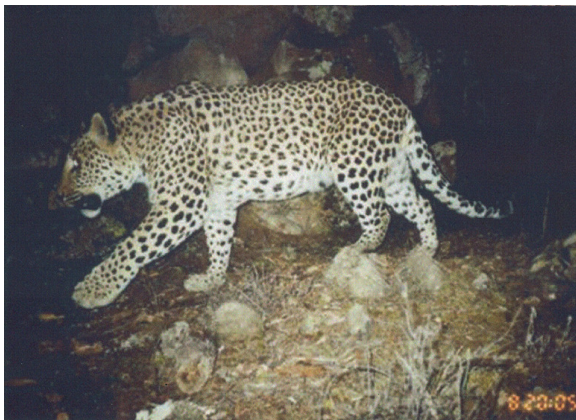
The unique colchic forests in the Kolkheti Lowlands in west Georgia are temperate deciduous forests rich in creepers, endemic pine forests are found on the Abkhazian coastline, and chestnut forests are found in east and west Georgia. In west Georgia they occur at 100-1,000 m and in east Georgia they are found as high as 1,400-1,450 m.

The high mountain flora of the sub-alpine zone is generally very diverse. The flora of the upper tree line at 2,400-2,750 m is especially diverse in terms of species composition and community structure, and it is rich in rare endemic and relic species. Major plant community types include light woodlands, crook-stem forests, lying shrubs, high grasslands, and broadleaf meadows. At about 1,800-1,900 m, sparse park-like forests replace closed canopy forests.

Wildlife Ecology and Reserves

Armenia

Forests provide habitat for wildlife, so forest management is an essential element of wildlife conservation. In Armenia, there are 500 vertebrate animal species, with 99 on the IUCN Red List for Armenia, and there are 3,500 species of vascular plants, of which 387 are included on the Red List. The system of protected areas in Armenia includes 3 reserves, 2 national parks, and 23 state sanctuaries, all of which cover 10 percent of the surface area of the country (Manvelyan 2007, p. 8-9).



Figures 2-3: Caucasian Leopard and the Shikahogh Reserve

The endangered Caucasian Leopard finds refuge in Armenia's Shikahogh Reserve (Photo courtesy of World Wildlife Fund Armenia); activists and experts convinced the government to reroute a road in southern Armenia that was slated to go right through the reserve (Photo courtesy of Armenia Tree Project)

In 2005, World Wildlife Fund Armenia documented the existence of the critically endangered Caucasian Leopard (*Panthera pardus tulliana*) living in the habitat of the Shikahogh Nature Reserve in southern Armenia (**Figures 2-3**). Later that year the government announced a plan to build a new road to Iran right through the middle of the reserve. After widespread protests by activists and experts, the government decided to reroute the road around the reserve, which was a victory for Armenia's environmental movement and for this rare and endangered species living in Armenia's forests (Ettling 2006, p. 8).

Georgia

The Republic of Georgia has 12 species of amphibians and 52 species of reptiles, of which 3 snakes and 12 lizards are endemic to the Caucasus. There are 79 species of small mammals and more than 300 species of birds in Georgia, a significant number of which are migratory, and 3 of which are endemic. There are 35 bird species on the IUCN Red List for Georgia and 33 mammals, from which 4 are extinct on the national level, 5 are critically endangered, and 6 are endangered (FAO Wildlife Policy 2006, p. 6-7).

According to a 2006 report on the conservation of wildlife resources, habitat destruction including forest felling, elimination of biological corridors, and hunting have posed serious threats to wildlife in Georgia, especially forest and game species, and large mammals have been most affected because of their low reproductive rates and naturally low densities (FAO Wildlife Policy 2006, p. 2-3).

The system of protected areas in Georgia includes 22 nature reserves, 4 national parks, 11 managed reserves, and 1 protected landscape, all of which is 6.7 percent of the total area of the country.

Adequacy of Reserves

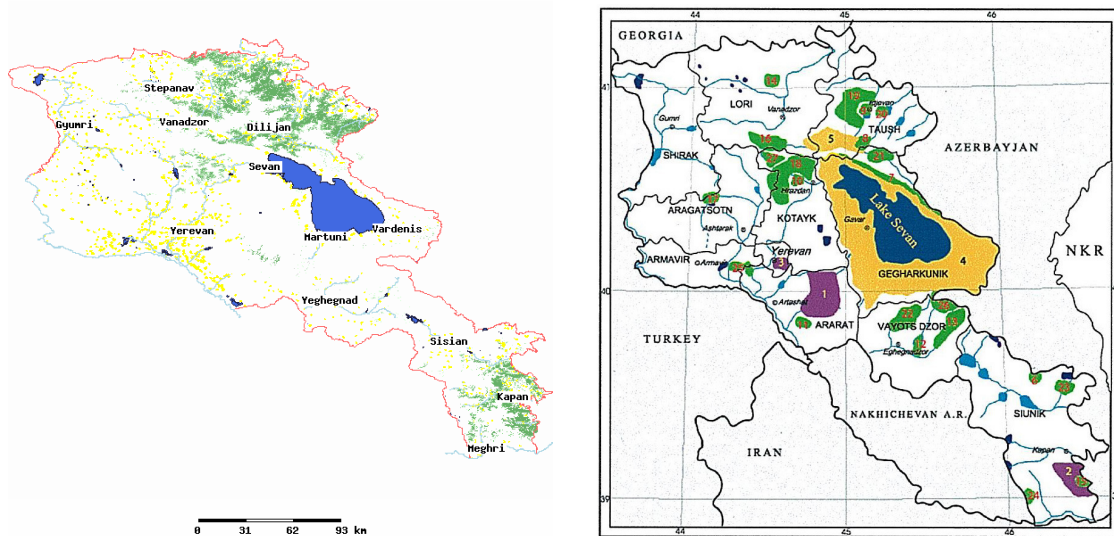
According to the Plants and Genetic Resources in Central Asia and the Caucasus website, Armenia has seven distinct landscape zones: desert, semi-desert, dry steppes, steppes, woodlands, sub-alpine, and alpine lands. In the sphere of conservation land, Georgia has allocated 6.7 percent of its territory or 465,650 ha to protected areas, while Armenia has allocated 10 percent or 298,000 ha to protected areas.

Because Armenia is less than half the size of Georgia, the total area of these reserve areas is more comparable in scale between the two countries, which leads one to infer that Armenia has made conservation more of a priority, perhaps out of environmental necessity. World Wildlife Fund Armenia has noted in a 2007 report, however, that 60 percent of Armenian species are represented within the protected area network, while many important habitat types are not yet represented in the network of protected areas (Manvelyan 2007, p. 9).

Forest is found throughout Georgia and is the most common type of habitat, but in Armenia nearly all of the forest cover is found in the northeast and the southeast (**Figure**

4). A comparison with a map of Armenia's 27 protected areas (**Figure 5**) illustrates that these forest areas are not represented in reserves, which is a concern for the protection of biodiversity and forest types since the level of forest cover is so critically low.

This would be best shown, however, by comparing the distribution of specific forest species in Armenia using vegetation maps, although those resources were not located for this study. It is possible that such information is available in some of the historical forestry literature published in the Russian language, which would be of interest in a more detailed study.



Figures 4-5: Armenia's Forest Cover and Protected Areas

Armenia's rivers and limited forest cover distribution (left) using available data from 2000 (Map source: <http://osweb.cudenver.edu/armenia/Index.php>); Armenia's 27 protected areas (right) include 3 reserves (shown in purple), 2 national parks (shown in yellow), and 22 state protected areas (shown in green) (Map source: World Wildlife Fund Armenia)

It is likely that the adaptive and temperate species such as oak, beech, and hornbeam that predominate would be able to recover from the deforestation occurring in Armenia. In general, however, countries with a low percentage of unprotected forest are considered to be a high priority for conservation (Hunter 2007, p. 376), and World Wildlife Fund and other NGOs are working in countries such as Armenia to expand protected areas networks to include more of the endangered habitat types.

Uses of Forests and Other Factors

Although they differ in size, with 2,641,000 ha of forests in Georgia compared with only 232,000 ha in Armenia, the factors related to the uses and management of the forests in these two former Soviet republics are remarkably very similar.

Forests have been exploited for many uses in both countries, especially for timber and fuelwood. The use of fuelwood has been driven by many factors historically, with political, social, and economic issues playing interrelated roles that can influence the use and exploitation of forests.

In addition to the need for affordable sources of energy, political corruption in the region has enabled illegal logging to emerge as a significant threat to the forests in Armenia and Georgia. While the use of fuelwood is related to the availability of alternate fuels such as natural gas and also to poverty and the ability to afford such alternatives, illegal logging has been driven by the shadow economies that have emerged in these countries after the breakup of the Soviet Union.

Armenia

According to a household survey about how people use forests in Armenia, 30 percent of the respondents reported using wood as fuel for heating or cooking, with more rural residents using wood than urban residents. In addition, 30 percent of the respondents living in rural areas graze animals on forest land (Danielian 2007, p. 20-21).

Historically, Armenia's forested areas were cleared for agriculture, construction materials, and fuelwood, and the population in the Armenian highlands was occupied with horticulture, animal husbandry, and the cultivation of fruits. Armenia's forests were also impacted by the waves of invasion by the Romans, Byzantines, Persians, Arabs, Mongols, and Seljuk-Turks, when the conquering armies cut and exported high quality timber from Armenia (Moreno-Sanchez 2005, p. 117-118).

In more recent centuries, deforestation for agricultural land at low elevations and animal husbandry in mountain meadows changed to overexploitation of the forests for industrial uses. From 1763-1917, 75,000 tons of copper were processed in 20 small metallurgical factories. This had a major environmental impact and resulted in the loss of approximately half of Armenia's forests since large volumes of wood were used for the smelting of raw copper ore, and wood was converted to charcoal for further smelting and other mining processes.

According to a 2005 article by Rafael Moreno-Sanchez and Hovik Sayadyan in *International Forestry Review*, the copper mining industry was established by French missionaries in accordance with a license agreement with the Tsar government. The first visual forest inventory activities were conducted in 1887 by these missionaries in the northern and southeastern parts of the country around the copper mines, in order to estimate the volume of timber that could be converted to charcoal for the copper industry and the availability of timber to support the construction of the associated railway.

Therefore, the industrial exploitation of the Armenia's forests started when the country joined the Russian Empire in 1828. After the establishment of Soviet authority in Armenia in 1920, the country switched from an extensive agrarian economy to a highly industrialized economy with great impact on its natural resources and the environment.

New settlements and their associated road networks had an impact on forest cover at lower elevations, while extensive animal husbandry (sheep, goats, and cattle) at higher elevations impacted the areas next to sub-alpine and alpine meadow pastures (Moreno-Sanchez 2005, p. 119-120).

Armenia never had a large forest industry, and the main forest industries are small particle board and furniture factories and wood crafts. Starting in the 1960s, timber imports from Russia grew exponentially and reached approximately 90 percent of the demand for forest products in Armenia. These timber imports in addition to forest plantations established from the 1950s to the 1980s increased the forest cover of Armenia to 11.2 percent during the Soviet period (Moreno-Sanchez 2005, p. 120-121).

In recent years, the transportation, economic, and energy blockades imposed against Armenia by Turkey and Azerbaijan after the breakup of the Soviet Union have placed tremendous pressure on the forests as source of fuelwood. During the 1990s, nearly 50 percent of the energy consumed by households near forested areas came from fuelwood.

Also during this period, many rural residents became dependent on sheep and cattle for subsistence after the privatization of the large collective farms, and these animals usually forage in an unregulated manner in the meadows and grassland of state-owned forests. And finally, as timber imports from Russia ceased, Armenia's forest industry depended on raw materials obtained from illegal forest cuts, all of which reduced the country's forest cover to 7.7 percent by 2006 (Moreno-Sanchez 2005, p. 122-123).

According to a recent economic analysis of Armenia's forest industry, household consumption of fuelwood is driven primarily by poverty, which suggests that the demand for fuelwood will decrease when adequately priced energy alternatives are available in combination with effective policies to reduce poverty (Hergnyan 2007, p. 9). This study by the Economy and Values Research Center indicates that 55 percent of heating energy is provided by natural gas, 36 percent is provided by electricity, and 9 percent is provided by fuelwood.

The study does reveal a paradox of development, however, which is related to forests. Although fuelwood consumption tends to decrease with an increase in GDP, wood processing is expected to increase with economic growth since wood is used in building, flooring, and furniture that are consumed in greater volumes as the economy improves. "Based on Armenia's economic growth rates, consumption and production of forest products is expected to show a stable growth in the long term," notes the report, which later acknowledges that a wealthier society also places greater emphasis on forest services such as conservation and recreation (Hergnyan 2007, p. 16-17).

An analysis of wood exports reveals that timber and logs are the largest in volume, while wooden crafts may be more well-known but are almost negligible in volume. In 2005, 92 percent of this volume was registered as unprocessed or primary processed wood. The export of unprocessed wood results in significant lost income for Armenia, and the main

export destination is Iran, where industrial roundwood goes through additional processing or is transported to other countries. Other export destinations in recent years in order of volume are Czech Republic, Russia, the United States, Spain, France, Georgia, and even Turkey which is not an official trading partner (Hergnyan 2007, p. 22-23).

Georgia

The European Union-funded Association Green Alternative has identified similar challenges facing Georgia's forests, notably corruption and illegal logging, lack of public participation and law enforcement, and unsustainable use of fuelwood (Association Green Alternative 2006, p. 3). The World Wildlife Fund has indicated that the situation in Georgia is different than in Armenia, and that illegal logging for industrial use is a substantial proportion of the total harvest (World Wildlife Fund 2005, p. 4).

According to a country report prepared for the Countdown 2010 biodiversity conservation program supported by the IUCN World Conservation Union, extensive logging was particularly noticeable in the first half of the 20th century in Georgia. By the 1970s, mass woodcuts were limited due to the import of comparatively cheaper timber from Russia, which is why mountain forests remained more or less untouched.

However, fuel shortages and the energy crisis of the 1990s led to an increase in cutting to obtain fuelwood. The lack of efficient control has led to the illegal harvest of large volumes of timber for commercial purposes, and large amounts of wood are being exported to Turkey, 92 percent of which is beech timber (Georgian Centre for the Conservation of Wildlife 2006, p. 9).

Illegal logging, fuelwood harvesting, and the timber trade threaten the biodiversity of the forests and lead to habitat degradation, notes the C2010 report. Forests are being destroyed and streambeds and banks damaged by the transport of logs by trailing the brushwood. Uncontrolled grazing in forest areas is also a common practice at present, and the area of high density forests have been considerably reduced (Georgian Centre for the Conservation of Wildlife 2006, p. 18).

Other Dynamics Impacting Forests

Desertification

In a search to understand why there is such a vast difference in forest cover among two small neighboring countries, studies reported that timber imports from Russia during the Soviet period reduced pressure on forests in both countries. But a look at a satellite photo of the South Caucasus (**Figure 6**) reveals that the desert is encroaching upon Armenia from the south where Iran and western Turkey are seen as brown patches while Georgia in the north appears green.

This is consistent with the data here that 62 percent of Armenia's forest cover is found in the northeast and only 36 percent is in the southeast, while in Georgia forest is found

throughout the country and is the most common type of habitat. International organizations have warned that Armenia is at risk of desertification and climate change projections make this even more of a concern, which is why forest conservation and sustainable management is such an urgent issue for the country.

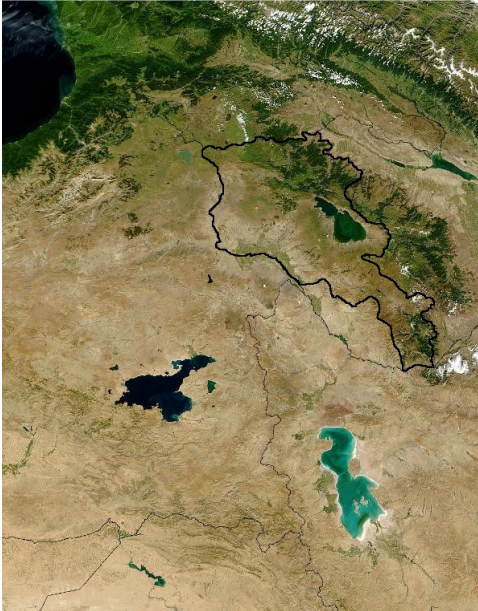


Figure 6: Satellite Map of South Caucasus
This 2004 satellite map of Armenia (borders delineated in black) shows desertification in the south and west, while the northern areas into Georgia are more heavily forested (Map courtesy of Armenia Tree Project)

Mining

The 2005 study by Rafael Moreno-Sanchez and Hovik Sayadyan in International Forestry Review about the historical impact of the copper mining industry on Armenia's forests was particularly instructive. This is because even today the mining industry is threatening more of Armenia's forests and ecosystems with extinction. In 2007, Armenia Tree Project and Friends of the Earth issued action alerts in response to a plan to clear cut a 600 ha forest in northern Armenia to create a tailing dump for a new copper mine. According to ATP and experts at WWF Armenia, this forest provides habitat to hundreds of species of birds, mammals, reptiles, and plants, including many that are registered in the IUCN Red Book, so there has been strong opposition from conservationists to this new copper mining project.

Although foresters and other experts may argue that Armenia could benefit economically from a timber industry that is managed sustainably (Sayadyan 2006, p. 8), there are a number of significant constraints that make this unlikely, from unfavorable climate to difficulty of transport. The arid climate and extreme temperature variation in the region are unfavorable to tree growth, so the direct economic significance of forests and forestry through the production of wood and wood products will be insignificant, noted an FAO study of the region (FAO Forestry Department 2006, p. 1).

Sustainability

In outlining a sustainable management approach to Armenia's forests, Rafael Moreno-Sanchez of the University of Colorado noted that multiple objectives and uses of the forest must be integrated in a manner and rate which will make the resource available to future generations, which will promote continuous economic benefit, social acceptability, sound environmental conditions for human development, and the subsistence of other species. It was also acknowledged that a broader management concept is required to include areas beyond the borders of the forest.

Finally, given that most of the value of Armenian forests resides in non-marketable goods and services such as the protection of other resources, water production, and recreation, studies are required to assign monetary values to these goods and services that can benefit the national and local economies (Moreno-Sanchez 2007, p. 7-9).

Considering the environmental situation in the region--arid conditions, high level of desertification, declining agricultural and range productivity caused by land degradation, loss of biodiversity, and increasing water stress--the provision of environmental services will be an important concern (FAO Forestry Department 2006, p. 116).

Forest Policy and Management

The legislation regulating the forestry sectors in Armenia and Georgia include their respective constitutions, international agreements and conventions, and national laws. In the international sphere, as of January 2007, Armenia and Georgia have ratified the following international conventions and agreements related to forests and the environment: Convention on Biological Diversity, UN Framework Convention on Climate Change, Kyoto Protocol, Convention to Combat Desertification, Ramsar Convention, and the World Heritage Convention (FAO 2007, p. 138).

Armenia

In Armenia, there are several sections of the Constitution related to environmental protection: "The state shall ensure the protection and reproduction of the environment and the reasonable utilization of natural resources" (Article 10), "Everyone shall have the right to live in an environment favorable to his/her health and well-being and shall be obliged to protect and improve it in person or jointly with others" (Article 33.2), "The basic tasks of the state in the economic, social, and cultural spheres are...to pursue environmental security for present and future generations" (Article 48).

The forest sector was addressed as part of the World Bank's poverty reduction strategy that has been supported by \$85 million in loans to Armenia since 2004. In a November 27, 2007 press release, the World Bank announced that its fourth loan installment to Armenia would assist in the fight against illegal logging. "The credit [supports] adequate monitoring and combating of illegal logging in order to ensure that Armenia's forests are

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protected. The conservation of Armenia's forests will help the poor as they will benefit from more investment opportunities in rural and mountainous areas," notes the release.

While environmental protection has been a legal priority, illegal logging and the unsustainable use of the forests has still persisted and both countries have been grappling with new forestry laws, although with limited success to date and for similar reasons.

The new Forest Code for Armenia was written with the support of the World Bank and the Swiss Agency for Development and Cooperation and it was adopted in 2005, although it was recognized that it was incomplete and would require additional legislation. At the time and during my research, there was no indication that there was much public input or discussion about the proposed set of laws aside from a few articles written by the head of the Armenian Forests NGO.

"For import of wood--something that Armenia needs in order to protect the remaining forests--there are both taxes and customs fees that make it prohibitively more expensive. Adding to the imbalance, exports of wood are charged neither taxes nor customs fees. This increases the incentive to cut more forests for export. At the very least, this must be reversed to allow more incentives for import and disincentives for export," wrote Jeffrey Tufenkian in 2005.

"Many officials point to the poor economic situation of villagers and point to villagers as the ones to blame for cutting the forests. In fact, villagers pulling branches and small trees from the forest by hand or donkey--although certainly a factor--are a fairly small fraction of the whole problem. In this case, the real culprits are the businessmen who bribe local officials to look the other way while they take out large, valuable trees by the truckloads for sale in and out of Armenia. In some cases they are even making new roads to access the more remote forests," added Tufenkian.

"The new Forest Code is not well-accepted by many foresters and as far as I know the authors of law also feel that essential amendments are required," wrote Hovik Sayadyan of the Armenian State Agrarian University in an email interview for this paper. "The forest law should be discussed and evaluated several times and on different levels. In reality the forest law was discussed only two or three times within a very limited framework. Even so, many valuable remarks and comments were not taken into account. To put it simply, if you ask a forest ranger about the forest law you will never get proper answer. This means that only a limited number of people were very keen to have it passed by the National Assembly."

"The Forest Code was adopted in 2005, however some of the provisions are not fully implemented, particularly in relation to community forest management and forest enterprises. The government is working on the specific regulations related to these points," wrote Anna Jenderedjian of the Armenia Tree Project NGO in an email interview for this paper.

(Disclosure: I have worked in the US development office of the Armenia Tree Project since 2004, with primary responsibilities in public relations and fundraising for the program among the US-Armenian diaspora.)

“The law was adopted before any evaluation was accomplished and it was mainly based on Soviet [forestry] data. Until now there are contradictions related to the forest cover, tree composition and distribution, and the economic evaluation [of the forests]. So in my opinion the code is still ‘raw’ and its effectiveness depends greatly on the elaboration of the right regulations that are compatible with Armenia’s political, environmental, and socio-economic conditions,” added Ms. Jenderedjian.

“At the same time there is a jurisdictional overlap between different agencies. The Forest Code states that forest management is to be implemented by the Ministry of Agriculture and monitoring by the Ministry of Nature Protection. At the same time a new Forest Monitoring Center under the Ministry of Agriculture was opened in 2007 and it is not yet clear what are the specific differences in relation to their responsibilities, as both bodies are responsible for forest monitoring,” continued Ms. Jenderedjian.

Georgia

The basis of environmental legislation is set in Article 37 of the Constitution of Georgia, which reads: “Everybody is entitled to live in a safe for health environment (sic all), and benefit from natural and cultural environment. Everybody is obliged to take care of natural and cultural environment. In order to provide safe for the human health environment in accordance with ecological and economical needs of society, in consideration of interests of current and future generations, State ensures protection of the environment and rational utilization of natural resources” (Association Green Alternative 2006, p. 41).

The Republic of Georgia faced similar challenges in the drafting of its forestry laws, although their NGO sector appears to have taken a more proactive role in the issue. For example, the Caucasus Environmental NGO Network kept the public informed and issued a series of email appeals during 2006 and 2007 in response to the forest code being considered in Georgia. Since 2002, the World Bank has also been funding a Forests Development Project (FDP) “to establish sound forest management systems that maximize the contribution of Georgia’s forests to economic development and rural poverty reduction in an environmentally sustainable basis.”

According to the CEE Bankwatch Network, the Georgian government agreed that forestry would become a priority for the country, and they agreed with the World Bank that illegal logging and corruption were obstacles to sustainable forest management, but the NGO raised several concerns about the FDP program. First, the FDP plan was written before the creation of a National Forest Policy, which has been an ongoing project of the FAO National Forest Program Facility since 2003. Second, the government did not carry out an independent baseline study on the illegal use of state forests. And third, the Forest Code contradicts the Convention on Biological Diversity because it allows the

introduction of new species at the cost of eradicating less economically valuable local species.

In summary, CEE Bankwatch recommends an inventory and total economic valuation of Georgia's forests, a National Forestry Policy that is implemented on the basis of an "ecosystem approach," and that corruption in the forestry sector is addressed by strengthening governance and reducing illegal logging.

"According to my discussions with different agencies in Georgia after independence in 1991, as was the case in Armenia, no nationwide forest inventory took place in Georgia," wrote Prof. Sayadyan in an email interview. "Within the large World Bank [Forests Development Project] only 15-20 percent of the national forests were inventoried, despite the fact that in Georgia there are many skilled foresters and professionals at the Institute of Mountain Forestry and Agrarian University. In fact, in Soviet times they had the primary responsibility for the forest inventories in Armenia and in Azerbaijan. By the way, various sources report the forest cover in Georgia as being between 30-40 percent, but I believe it could be less than 30 percent as their forests have also been cut irregularly and in many cases in an illegal way."

Conservation Arguments

Biodiversity Hotspot

The South Caucasus including Armenia and Georgia has been identified by the Critical Ecosystem Partnership Fund (CEPF) as one of the most biologically rich regions on Earth and among the planet's 25 most diverse and endangered hotspots. The entire Caucasus is one of World Wildlife Fund's Global 200 Ecoregions, which are identified as globally outstanding for biodiversity. The Caucasus has also been named a hotspot by WWF's Large Herbivore Initiative, where 11 species of large herbivores and 5 large carnivores are found over a relatively small area.

The IUCN Red List identified 50 species of globally threatened animals and one plant in the Caucasus in 2002, 18 of which have restricted ranges or are endemics. The Caucasus Mountains also harbor a wealth of highly sought-after medicinal and decorative plants, as well as unique relic and endemic plant communities. Because of these unique assemblages of plant and animal communities and rare and endemic species, the Caucasus is considered "globally important for conserving representative areas of the Earth's biodiversity, making it worthy of international attention" (Critical Ecosystem Partnership Fund 2004, p. 4).

These facts are highlighted to emphasize the importance of protecting the forests of Armenia and Georgia. Given the strategic importance of this issue, CEPF highlighted the major threats that have been identified and need to be addressed, some of which include issues outlined in this paper such as overgrazing, illegal logging, fuelwood harvesting, and the timber trade (Critical Ecosystem Partnership Fund 2004, p. 27-31).

Ecosystem Services

In addition to their contribution to biodiversity conservation, there are a number of other reasons that forests have value that require their protection. Prominent among these are the ecosystem services provided by forests, such as climate regulation, erosion control, nutrient storage and water cycling, as well as recreation and the production of non-wood forest products.

In a landmark article published in *Nature* in 1997, Robert Costanza et al estimated that the annual value of ecosystem services provided by forests is \$969 US per ha. If using this widely cited estimate as an example, Armenia's current forests would have an annual valuation of \$224.8 million US, which is significant given that the current total annual budget of the country is \$2.5 billion US.

The figure is also substantial when compared with the total value of wood exports from Armenia, which were estimated at \$2.6 million US in 2005 according to UN Comtrade data (Hergnyan 2007, p. 23). Even if Costanza's valuation is considered very high and the annual value of the intact forests is not a full 84 times the annual value of the wood exports from Armenia, there is clearly a sizeable difference that requires full examination as indicated by other experts in this sphere. When examined in this context, the value of Armenia's forests is substantially higher in terms of strategic environmental services that serve the public benefit than as timber or log exports (Hunter 2007, p. 72).

Finally, the cost of land remediation is more than 70 percent greater than other forms of environmental restoration, so the insurmountable cost of desertification caused by deforestation can be a major incentive to improve forest management practices in these countries (Rogers 2006, p. 125-126). Soils that took centuries to form can be eroded very quickly as a result of unsustainable land use, to the point that Lester Brown noted that society can survive the exhaustion of oil reserves, but not the continuing loss of topsoil (Hunter 2007, p. 162-170).

Conclusions

The work in the forestry sectors of both countries indicate a clear understanding of the problems and solutions required to ensure sustainability, with Georgia even in talks with the Forest Stewardship Council to eventually certify their timber harvests.

The Economy and Values Research Center has identified a practical and strategic set of 14 recommendations to address the problem of deforestation in Armenia, most of which are also relevant to Georgia because they face similar forestry challenges. Some of the more interesting and urgent priorities include easing access to natural gas supplies, exempting industrial timber imports from value added taxes, imposing an export ban on industrial timber, enhancing ecotourism and the forest service sectors, and implementing forest certification and chain of custody tracking procedures (Hergnyan 2007, p. 28-38).

Finally, it is clear that there is room for mutual learning in the forestry sector among both countries, despite a common view that Georgia maybe further advanced because of factors such as its orientation with NATO. In fact, its forestry sector faces the very same challenges as Armenia even while its forest cover is five times that of Armenia.

Hope for Change

While the prognosis for Armenia's environment seems dire with a critically low level of 7.7 percent forest cover, and Georgia's more plentiful reserves are also endangered by illegal logging and similar challenges, the story of New England's forests provides a necessary message of hope. After more than 200 years of near total exploitation for agriculture, grazing, timber, and other uses, the decimated forests of New England regenerated naturally and the area is now one of the most heavily forested regions in the US (Foster and Aber 2004, p. 72-74).

This regeneration was possible because of changes in land use patterns, away from those mentioned above that degraded forests. If Armenia's economic development continues and rural residents become less dependent on subsistence farming and livestock, then perhaps its temperate forests could experience a natural succession as witnessed in New England beginning in the 1850s.

Although for this to happen, adaptation of cultural practices and the long-term views of citizens and government might be required, and that is no small order. In Armenia, for example, a heavily meat-based diet is a valued cultural tradition, and yet the widespread grazing of livestock is a major threat to the regeneration of forests. As Jared Diamond illustrated in his book "Collapse: How Societies Choose to Fail or Succeed," civilizations can cling to unsustainable practices, even to the point that their very existence is endangered.

In one chapter about the downfall of Easter Island, Diamond points out that grazing leads to soil erosion and eliminates most of what remains of native vegetation. He notes that the island's inhabitants had the misfortune of living in one of the most fragile environments at the highest risk of deforestation. The area ended up with no tree species standing and with about 90 percent of the former population gone, in a clear example of a society that destroyed itself by overexploiting its own resources (Diamond 2005, p. 112-118).

If people are not concerned with the future and environmental sustainability because of a sense of hopelessness induced by corruption and poverty--or because many of the younger population have emigrated--many residents may not be as firmly tied to the land and the future of their community. By contrast, when Japan reversed its tide of severe deforestation by the 1800s, political stability and confidence in their future encouraged leaders to invest and plan for the long-term future. There was also a hope among the poor that their land would pass eventually to their heirs, so the control of Japan's forests fell into the hands of people with a vested long-term interest (Diamond 2005, p. 298-305).

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Experts at the Harvard Forest have identified a vision for Massachusetts that would expand the area of the state's protected land base from 1 million acres to 2.5 million acres, which is an area equivalent to half of the state (Foster Vision 2005, p. 5). Given Armenia's harsh historical realities and present day challenges, it could be argued that the area of protected forests and ecosystems should be expanded to conserve biodiversity and endemic species, as well as the environmental services necessary to sustain the small fragment of Armenia that remains in a land-locked and hostile region of the world.

Additional Research

This research focused on studies available in the English language, although these references cited earlier work that was published primarily in Russian, so it is likely that more comprehensive analysis will require use of those sources.

This paper also identified a lack of studies and analysis with specifics about the emerging forestry laws in these countries, although such information may be available in the native languages. As a result, the details here relied on interviews with experts in the field who made reference to the shortcomings in this area.

Finally, because of the nature of the problem, there was also a lack of specific details and historical data on illegal logging in these countries, although this research relied on recent studies by Association Green Alternative in Georgia and the Economy and Values Research Center in Armenia that address this issue possibly for the first time.

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