

# **Country Study on Biodiversity of the Republic of Azerbaijan**

## **First National Report to the Convention on Biological Diversity**

**Baku - 2004**

The current document, which represents the first National Report to the Convention on Biological Diversity, represents a status review of the current situation facing biodiversity and its conservation in Azerbaijan, taking on board input from a range of national specialists and feedback from wide consultations. This document provides information sources for the planning of the national Biodiversity Strategy and Action plan, a process which is now underway for completion in 2004.

It has to be noted, that the government of the Republic of Azerbaijan, UNDP in Azerbaijan, Secretariat of the Convention on Biological Diversity, Global Environment Facility and Fauna and Flora International took an active part in development of the Biodiversity Strategy, Action Plan and National Report. We would like to express them our thankfulness and are hoping for sustainable and constant support from their side.

Pages 136, tables 25, pictures 32, appendixes 7

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# Foreword

Biological diversity is a key, integral part of a country's natural resources. In Azerbaijan, geological history and climatic conditions have combined to create an abundant and complex wealth of biodiversity, which has not yet been fully assessed. The rich history and culture of the country is directly linked with the diversity of its natural resources.

Across the world, the pressures of various human activities have resulted in a decline in biodiversity. The dramatic decline in global biodiversity, and the need to arrest this trend, was recognised as a priority issue towards the end of the 20<sup>th</sup> century, and as we enter the 21<sup>st</sup> century it is time to ensure that activities that threaten biodiversity are significantly reduced. International cooperation is recognised as essential in order to promote effective and global approaches to conservation and the sustainable use of natural resources.

International cooperation is based on the concept of 'sustainable development', whereby natural resources are used rationally, to ensure their availability for future generations. Taking into consideration the global opportunities for biodiversity conservation through international cooperation, the parliament of Azerbaijan ratified the Convention on Biological Diversity, which was adopted in Rio de Janeiro in 1992.

The socio-economic dynamics of a country are closely connected with its biodiversity and natural resources, and can therefore be directly and indirectly affected by changes in these resources. During recent years, environmental issues (including those linked to biodiversity) have become a priority in Azerbaijan, and measures are now being taken to improve the status of the environment. Within the last six years, the Government has implemented a number of projects promoting environmental protection, including the National Action Plan on Environment Protection, and the State Program on Ecologically Sustainable Socio-economic Development.

The preparation of this National Report is a critical step towards implementing the requirements of the Convention on Biological Diversity. This report describes the current condition of biodiversity, its use and the existing conservation activities in Azerbaijan. The document will provide a source of information for State and non-governmental organisations in Azerbaijan, and international audiences. This report includes perspectives and information from across key sectors of society, and will be used to support the goal of sustainable social and economic development for the country.

I would like to express my thanks to the Global Environment Facility and the United Nations Development Programme, which provided the financial and organisational support to implement this project. In addition, I would like to thank Fauna & Flora International, the relevant Ministries and Institutes of the National Academy of Sciences and of the Republic, and non-governmental organisations for actively participating in the preparation of the First National Report.



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## Abbreviations

<b>AIOC</b>	Azerbaijan International Operating Company
<b>ANAS</b>	Azerbaijan National Academy of Sciences
<b>BP</b>	British Petroleum
<b>BTC</b>	Baku-Tbilisi-Ceyhan Pipeline Route
<b>CBD</b>	The Convention on Biological Diversity
<b>CIS</b>	Commonwealth of Independent States
<b>CITES</b>	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
<b>GDP</b>	Gross Domestic Product
<b>GEF</b>	Global Environment Facility
<b>IUCN</b>	International Union for Conservation of Nature - The World Conservation Union
<b>NGO</b>	Non-Government Organization
<b>SOCAR</b>	State Oil Company of the Azerbaijan Republic
<b>TRACECA</b>	Transport Corridor Europe-Caucasus-Asia
<b>UN</b>	United Nations
<b>UNDP</b>	United Nations Development Programme
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization

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# **Chapter 1. Country Context**

## Chapter 1. Country Context

### 1.1 Geographic location, borders and land area

The Republic of Azerbaijan is an ancient country, situated between the continents of Europe and Asia in the southeast of the Caucasus region. It is located on the western shores of the Caspian, to the northwest of the Persian Plateau. It has an area of 86,600 km<sup>2</sup>, located between 38'24" and 41'54" latitude North, and between 50'51" 44'46" longitude East. It is in a favourable geo-political location, bordering five countries; the Dagestan Republic of the Russian Federation in the north (289 km of border length), Georgia in the north-west (340 km), the Republic of Armenia (766 km) and Turkey (11 km) in the west, and the Islamic Republic of Iran (432 km) in the south. There is approximately 800 km of coastline along the Caspian shore in the east. The capital city of Azerbaijan is Baku, a port city, located on the Absheron peninsula on the shores of the Caspian Sea.

A separate, physically isolated, area of land- the Autonomous Republic of Nachichevan - is situated in the southwest of the Lesser Caucasus, in a typically mountainous area. It has borders with Iran (163 km, some of which lies along the Araz River), Turkey (11 km) and Armenia (224 km). Nachichevan covers some 5,362 km<sup>2</sup> and at its widest the territory stretches 158 km (from north-east to south-west).

Figure 1.1 -Topography of the Republic of Azerbaijan



### 1.2 Physical geography and topography

The Republic of Azerbaijan is situated in the Alp-Himalayan mountain belt. The three mountain ranges are the Greater and Lesser Caucasus, and the Talysh Mountains, together

covering approximately 40% of the country. The highest point in the country is on Mount Bazarduzu (4,485 m above sea level) situated in the Greater Caucasus. Lowlands and plains make up the other 60% of the country. The average height of the country is 657 m above sea level, however 18% of the country is below sea level (see Map 1). Azerbaijan is located in an active seismic zone, with particularly high activity in the southern part of the Greater Caucasus, the Ganja region in the Lesser Caucasus, and in the Autonomous Republic of Nakhichevan.

Azerbaijan does not extend over a large geographical area, and much of the differentiation of landscapes is due to the variation of altitude. Landscapes are influenced by climate, soil, and habitats that change with increasing altitude. Landscapes replace each other with height, graduating from lowland plains, semi desert, steppe, forest, alpine meadow to subnival communities at the greatest heights of the mountains, creating landscape zones at different altitudes. This altitudinal zonation is naturally disordered in the Lankoran region as a result of the Talysh mountains where semi arid landscapes replace the forest landscapes normal in the mountains. In Nakhichevan, forests develop in islands due to local climatic conditions.

The highest point in Nakhichevan Autonomous Republic is Gapijig mountain (3,906 m). Other important mountain ranges include the Zangazur and Daralayaz ranges in the north-east of the region, where there are a number of peaks over 3,000 m. A third of the territory of Nakhichevan is covered by grassland/steppe, totalling some 172 km<sup>2</sup>, of which some 10,000 ha is salinated.

### **1.3 Water resources**

The main sources of water in Azerbaijan are the surface waters. However, only 24 of the 8350 rivers are greater than 100 km in length. All the rivers drain into the Caspian in the east of the country, through three main river basins - the Caspian Basin, (rivers draining directly into the Caspian), the Kura basin (in western and central Azerbaijan) and the Araz basin. The average density of river networks is 0.39 km per km<sup>2</sup>, with most of the rivers occurring in the Kura basin.

Of the 300 natural lakes in Azerbaijan, only six cover more than 10km<sup>2</sup> of land area. The total area of these six lakes makes up 83 % (250 km<sup>2</sup>) of the total lake area. The lakes of the Kura and Araz basins (in the lowlands) are affected by upstream water management, causing an increase in salinity (5000-13000 mg/L), and a reduction in fish populations. Lakes on the Absheron Peninsula (on the shores of the Caspian) have become salinated as a result of upstream management and polluted by industrial and domestic waste (especially from oil fields). In addition, the number and size of lakes in this area are being artificially increased. Lakes in the mountainous area tend to be small (the total area of the 90 mountain lakes is 2 km<sup>2</sup>), but face few anthropogenic threats, because of their distance from settlements and industry.

In the last 40-50 years many water reservoirs have increased five-fold, so that they now cover 1070 km<sup>2</sup>. Total volume of these artificial lakes is 22.66 km<sup>3</sup>, but only 11.24 km<sup>3</sup> is usable water. The biggest of these by far is Mingachevir Reservoir, located along the River Kura which has a total volume of 16 km<sup>3</sup> and covers some 625km<sup>2</sup>. The water in reservoirs is used primarily for electricity production and irrigation purposes. A dense network of channels irrigates more than 1300 ha of drought prone land. The channels also carry clean water to a number of settlements, although approximately 40% of fresh water in Azerbaijan is taken from subsoil reserves.

Within the Nakhichevan Autonomous Republic there are around 400 water bodies, all associated with the Araz basin. The larger rivers in the territory are the Araz, Shargi Arpachay, Nakhichevanchay and Gilanchay. The area supports a number of natural lakes (including Batabat, Ganligol, Goy gol, and Salvarti gol) as well as reservoirs (including the Araz reservoir). The area also supported a number of kahrizes (systems of subterranean irrigation canals), although the number has declined significantly from 400 to around 182, and there is a danger that further springs will be lost.

## 1.4 Climate

Azerbaijan is a country of varied climates, although it is predominately subtropical. On average, there are 1900-2900 hours of sunshine annually (approximately 5-8 hours daily sunshine). In the lowlands, summers are hot, and winters are moderate, however in the mountains, the summers are cooler, and temperatures in the mountains can reach negative figures. Recorded temperatures have reached a maximum of +46 °C, and minimum of -32°C.

Humidity tends to be low, although it varies across the country. Annual rainfall on the Absheron peninsular in the west varies between 150-200 mm, whilst in the foothills of the Talysh Mountains, it averages 1600-1700mm per year. There is less than 400 mm of rainfall each year over 65% of the country. In these semi-desert and dry steppe areas, agriculture is only possible through artificial irrigation.

The Autonomous Republic of Nakhichevan has a particularly continental climate, with over 2800 hours of sunshine annually recorded in the Araz steppes. Rainfall in Nakhichevan varies between 200 and 600 mm, with low humidity throughout. Minimum and maximum recorded temperatures in the region are -30°C and +43°C respectively. The area is characterised by hot dry winds, which blow 50-70 days of the year (above 1,000 m).

## **Chapter 2.**

# **Socio-economic context**

## Chapter 2. Socio-economic context

### 2.1 History of human settlement and archaeology

Azerbaijan has a proud and long history. As an ancient centre of civilization, it has a great cultural heritage created over thousands of years. Prehistoric people inhabited the region,



**Picture 2.1.** Neolithic (Stone-age) rock engravings of human figures and animals at Gobustan

and evidence of their rock paintings and settlements still survives today. Archaeological evidence in caves and at other monuments (notably the Azikh cave) has shown evidence that some of the oldest modern humans inhabited Azerbaijan during the Stone Age.

Evidence of early cities, forts, religious buildings, early farming and a legacy of legends and stories demonstrate the long history of human settlement in the Autonomous Republic of Nakhichevan. Early towns such as Kultapa and Gilan were located in this area, and Kultapa has proved of particular archaeological interest.

Tribes in the region formed in the third millennium BC, and political organisations were created in the first millennium BC. The state of Manna was established during the ninth century BC with a well-developed cultural and economic basis. At this time the people believed in natural phenomena, the sun and the moon. In the first part of the sixth century BC, Manna was conquered by the Midiya state. During this period, the main religion was Zoroastrianism, based around the natural gas and oil sources that ignited as they escaped from the ground. The states of Albania and Atropeana played important roles in restoring the territory as an independent state. Indeed, the word Azerbaijan is a derivation of Atropat, an Atropeanan ruler from this period. From the third to the fifth centuries, the state of Azerbaijan strengthened, and Christianity began to spread widely among Azeris. Islam became the main religion in the country when Arabs conquered Azerbaijan in the eighth century.



**Picture 2.2.** Stone-age rock engravings at Gamigaya, Nakhichevan

During the middle ages, states such as Shirvanshah, Eldagizler, Garagoyunlu, Aggoyunlu, Safaviler were formed within the territory of Azerbaijan. There was a struggle by the neighbouring countries to occupy these territories resulting in the disruption of the stability of Azerbaijan, and in the 18th century, independent and semi-independent states formed, with

the state of Hanliglar also becoming part of Azerbaijan. At the end of the 18<sup>th</sup> and the beginning of the 19<sup>th</sup> centuries the antagonism and struggle amongst Iran, Turkey and Russia for occupation of Azerbaijan increased. As a result, Russia and Iran signed the Treaty of Turkmenchay in 1828, marking the end of fighting between the countries. Azerbaijan and its population were divided into two parts: the northern part was occupied by Russia and southern part by Iran.

In 1917, the fall of the monarchy in Russia meant that conditions became favourable for the establishment of the national liberation movement in Azerbaijan. On the 28<sup>th</sup> May 1918, Azerbaijan gained its independence and the independent Republic of Azerbaijan was declared. It existed for only 23 months, as on the 28<sup>th</sup> April 1920, Azerbaijan lost its independence when the 11<sup>th</sup> Red Army occupied its territories. Azerbaijan only regained its independent status after the collapse of the Soviet empire in 1991.

## 2.2 Current human population and demography

In the thirteen years since independence (in 1991) the Azeri population has increased by almost 13%, with half of the population living in urban environments. There are approximately 4500 settlements in Azerbaijan, 69 of which are considered towns. In 2001 there were 8,141,400 people living in Azerbaijan. Urban population has increased by 7% since 1991, whilst rural population has increased by 19.5%.

The female to male ratio is currently 51:49. During the period 1990-2001, there has been an increase in infant and maternal deaths, causing a decrease in the rate of natural population increase. In 1990, the rate of increase was 2%, but by 2001 it had dropped to 0.7%. Also during this period, there was a decrease in the number of marriages and an increase in the number of children born out of wedlock.

About 12% of the population is made up of refugees and internally displaced people (IDP). Most of these people have a very poor standard of living, and are housed in temporary settlements in unsanitary conditions.

At the end of 2001, 61% of people were recorded as being of working age (men 18-65 years, women 18-60 years), 30% below working age, and 9% above. In the last 10 years there have been signs of an aging population – with an increase in the number of people above working age, and a reduction in the number of those younger. Between 1990-2001 more people were emigrating from Azerbaijan than immigrating, with most migration thought to be economic, with people of working age leaving to seek work in other countries.

The number of people in work in 2001 was estimated at 4,892,900 an increase of 23.2% since 1990. Registered unemployment is at 1.2% but the number of unregistered unemployed capable of work was estimated as 15.8% in 1999.

Within the Autonomous Republic of Nakhichevan the population was recorded as 364,234 at the start of 2003, with an annual increase estimated at 0.6% and an emigration rate of 0.04%. The sex ratio is similar to that in the rest of Azerbaijan (49 men to 51 women). The population is predominantly rural (70%), with an average population density in the Republic of 71 persons km<sup>2</sup>. The population includes nearly 5,000 refugees and displaced persons (1327 families), mainly living in Nakhichevan city, Sadarak, Julfa and other districts.

## 2.3 Social and economic situation

At the beginning of the 1990s, the social and economic state of Azerbaijan was characterised by a high level of inflation, and economic reform was prevented by internal political instability. The decline in the country's economic state contributed to the lowering of living standards of the population.

Economic reforms occurred in 1995 as a result of political stabilisation, and positive economic changes were achieved. By 2001 the Gross Domestic Product (GDP) was nearly 26,620 billion manats (national currency), a total of 3.3 million manats per person. This is an increase of 70% since 1990. This increase has had a positive result on the standard of living of the population, although reforms still need to be implemented to continue this improvement.

As a result of economic and other state reforms, there has been an increase in private sector investment in the country, through the privatisation of state companies, and the encouragement of investment by private companies. In 2002, 73% of the GDP was through private companies. The main goal of the current government is to increase development of the country, thereby increasing the general standard of living, and reducing poverty. GDP is expected to continue to rise in the coming years, reaching 50,000 billion manats in 2006, due to increased oil production by international consortiums from 2005. In 2002, 6.3 million tonnes of crude oil were produced by AIOC, and this is expected to increase to 21 million tonnes by 2006.

In the next four years, there is expected to be US\$2.5 billion invested in the country from internal sources, and US\$ 8.9 billion from foreign sources. The oil sector will contribute 86% to foreign investments. Forecasts predict US\$11 billion of trade goods will be imported in the period 2003-2006, and US \$7 billion of trade goods exported during this time.

In Azerbaijan, there are two systems of social support: social aid, and social insurance. Compulsory contributions to social insurance enable the State to support citizens in times of employment difficulties, such as after disablement, and to ensure pension provision. In 2001 the contributions from social insurance were 3.1 % of the GDP.

Social aid is paid from through a separate State budget. It supports citizens in times of extreme crisis, such as poverty stricken families, and for childcare. At present, 1,622,000 children each receive 9,000 manats a month.

The State schools run eleven years of which nine years are compulsory. The level of education is high, with 98.8% of the population receiving education. However there is a decline in the level of attendance in the last three years of education. There is also a good teacher to pupil ratio of 1:10. At the age of 13, pupils can attend vocational schools to gain relevant work skills. The number of these schools has been declining in the last ten years, from 176 in 1990 to 109 in 2001.

In the early 1990s the quality of the State health service in Azerbaijan was declining. With low financial resources, immunisation programmes were not carried out, and infectious diseases subsequently increased. In 1995 some services were privatised. In 1998, a State Commission was established to implement reform to the State health service. These reforms are currently focused on primary healthcare issues, improving the general state of the population, reducing cases of infectious diseases, diarrhoea and respiratory infections. The

reforms are also directed at implementing efficient low cost measures to improve health, such as childhood immunisation programmes, and education campaigns.

In spite of the serious economic difficulties facing the Autonomous Republic of Nakhichevan, measures taken since 1996 for the improvement of social-economic conditions have started to achieve results. By 2000, the total economic production of Nakhichevan was 430 billion manats (62% from agricultural production, 14% from industrial output, 15% from construction activities and 9% from transport, communication, trade and social activities). Private sector production represented nearly 80% of total economic turnover, and overall production was over 130% greater in 2000 compared to the previous year. Credit allocation, financial turnover and privatisation of State properties have contributed to the significant improvement of social-economic conditions of Nakhichevan. In 2001 the average monthly salary of the employees was over 150,000 manats, an estimated increase of 11% compared to 2000.

## 2.4 Political Structure and Situation

Azerbaijan existed as an independent republic between 1918- 1920 and in April 1920 it became part of the Soviet Union as the Azerbaijan Soviet Socialist Republic. In 1989 Azerbaijan was one of the first Soviet Republics after the Baltic States to declare its national sovereignty. Azerbaijan gained its formal independence from the former Soviet Union on the 18th October 1991.

Azerbaijan is a legal, democratic, secular republic. Its constitution came into force in 1995, defining three divisions of power, legislative, executive, and judicial:

- The National Assembly (Milli Majlis) holds legislative power, and consists of 125 members elected through a national election.
- The President (elected through a national ballot to stand for 5 years) holds executive powers. He appoints a Prime Minister and a Cabinet of Ministers. The Cabinet of Ministers was reappointed after the Presidential election of October 2003.
- The judicial power is vested in the independent courts, of which the Constitution Court, Supreme Court, and Economic Court are the highest level.

Heydar Aliyev was elected as President in 1993, and re-elected in 1998. His return to power<sup>1</sup> ended much of the separatism and instability in the country, and ceasefire was achieved with Armenia in the conflict in and around Nagorno Karabakh. However, the conflict between the two countries remains unresolved. The region of Nagorno Karabakh was occupied by Armenian forces in 1992, and 20% of the territory of Azerbaijan is considered still under occupation. This conflict has led to close to one million refugees and internally displaced people. The policy of Heydar Aliyev is continued by his son, Ilham Aliyev, as the new president who was elected on the 15<sup>th</sup> October 2003. Currently the ruling political party is the Yeni Azerbaijan Party (New Azerbaijan Party), among others major parties are: Ana Vatan, Democratic Entrepreneurs, Democratic Party, Milli Istiglal, Musavat, Popular Front, Social Democrat, and Yurddash parties. In 1999 some political power was transferred to municipal administrations, as elections were held and nearly 2700 municipalities were set up.

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<sup>1</sup> Aliyev Heydar Alirza oglu was in power previously in 1969-1982

Azerbaijan is a member of a number of international organisations, including the United Nations (1992), Organisation of Security and Cooperation in Europe (1992), Council of Europe (2001) and the Commonwealth of Independent States (1995).

Azerbaijan has joined a total of 21 international environmental conventions. It is a signatory to the Convention on Climate Change (ratified 1995), the Vienna Convention for the Protection of the Ozone Layer (ratified 1996), the Convention on Biological Diversity (ratified 2000), and the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (ratified in 2000).

Nakhichevan is a democratic, legal and secular Autonomous Republic within the Republic of Azerbaijan. It prepares its own constitution which is approved by the President of The Republic of Azerbaijan, but the Autonomous Republic is free to settle its own affairs, and the division of powers with regard to the State authority is defined. The highest authority within the Autonomous Republic is the speaker of the Ali Majlis (Parliament) who is elected for a five-year term, and legislative power is vested in the Ali Majlis which consists of 45 elected deputies.

## 2.5 Infrastructure and Development

The formation of new market relations, and the increase in demand for oil at the world market, stimulated the development of the oil industry on the Absheron peninsula in the late nineteenth century, subsequently attracting foreign investment. New technologies were developed and tested for accessing, processing, refining and storing oil. The developments in the oil industry had a positive impact on the development of other industries at this time, such as engineering, mining (copper production in Gadabay and salt production in Nakhichevan), navigation, construction, and light industries (silk treatment, cotton and food). The current level of infrastructure in Azerbaijan is summarized in Table 2.1.

Table 2.1 Infrastructure in Azerbaijan

Infrastructure	Total measure
Railways	2000 km total length
Roads	32,000 km total length
Long distance oil and gas pipelines	5000 km total length
Electricity supply network	Distribution network of 100,000 km

Baku, the capital of Azerbaijan is the main port of the Caspian Sea, and is connected with the ports of Kazakhstan and Turkmenistan by ship and ferry routes. The communication network of Azerbaijan is well connected to international systems.

Foreign investment into infrastructure has included reconstruction works on part of the TRACECA - international transport corridor (connecting Europe and Asia through the Caucasus), construction of the Baku-Tbilisi-Ceyhan oil export pipeline, and the Baku Arzurum gas export pipeline.

Gas, electricity and water supply systems, which are maintained as part of the state infrastructure, are not in good condition. Further reconstruction measures need to be increased.

Under an economic blockade by Armenia, the Autonomous Republic of Nakhichevan has suffered limited access to ground transport, communication connections and energy. In line with improving economic conditions since the late 1990s, the Republic has provided finances

for the development and restoration of infrastructure. Investment in industry, transport, construction, energy, education, health, agriculture and social needs has resulted in improvement of conditions for the wider population.

## 2.6 Land property rights and tenure

In 1995, a law was passed to reform land in Azerbaijan of two land types, Sovkhoz (Government collectives) and Kolхозes (village cooperatives). The process of implementing land reforms began with the adoption of further legislation facilitating the legal privatization of state land. The process of land reform has now been completed. Types of land ownership present in Azerbaijan in 2003 are shown in Table 2.2. In all, 858,142 families have benefited from this act, and now are the owners of land. This is approximately 4.1 ha of land for each person, but the actual distribution between people depends on the provisions of the different regions.

Table 2.2 Current land ownership in Azerbaijan

Type of land ownership	Percentage of total territory under ownership type
Remained state owned	57.0 % (4.93 million ha)
Municipal ownership	23.7 % (2.05 million ha)
Privately owned	19.3% (1.67 million ha)

A series of laws has defined the 'Land Market' describing purchase, mortgage and other rights of the landowners. Land belonging to private individuals, organisations, or municipalities can be bought and sold, but only to Azeri citizens or organisations.

Private ownership has been made possible in the Autonomous Republic of Nakhichevan under new economic conditions, and this has been aligned with agrarian reforms. Land associated with villages have been returned to private ownership under the decree "On land reforms" (N 155-1 Q, June 16, 1996), and land restitution has nearly been completed for land previously used by kolkhozes and sovkhozes (government and village collectives). Land reform has been completed for 198 of the 205 villages and 42,969 ha of land have been distributed to date. A quarter of the territory (9,635 ha) will remain in State ownership, 34% (303985 ha) will be provided to municipalities as common land, 40% (56461 ha) will be divided among the population.

## 2.7 Land Use

Just over half the area of Azerbaijan is suitable for agriculture (Table 2.3). The rest of the land comprises marsh, wetlands, forest, and settlements. The land that is suitable for agriculture is in the arid zone of the country, and often requires irrigation in order to reach international standards of quality and quantity.

Table 2.3 Distribution of land in Azerbaijan

Land area	Quantity in ha	
	2001	2002
Total area of Azerbaijan	8,641,506	8,641,506
Total area fit for agriculture	4,516,955	4,515,847
Area with crops	1,621,855	1,629,165
Area with long term crops	160,030	158,586
Lots rested	59,850	54,099
Haymaking	108,300	109,028
Pastures	2,566,920	2,564,969
Gardens	253,058	253,462

The total territory within the Autonomous Republic of Nakhichevan 526,300 ha, of which 147,600 ha (28%) is suitable for some form of agriculture<sup>2</sup>. Forests cover 2,500 ha, the rest of the land being dominated cliffs and brackish/saline land (such as 10,000 ha of salinated lands along Araz River). In total, over 10% of the territory (56,100 ha) is irrigated.

## 2.8 Human pressures on the environment

The Republic of Azerbaijan has a great wealth of natural resources, however in recent decades, human activities have caused several ecological problems in the environment, such as the loss of biodiversity.



**Picture 2.3.** Pollution and dumped rubbish on the Absheron Peninsula near Baku

The population in Azerbaijan has increased by nearly one million since 1990. This has been due in part to the 250,000 refugees that have settled in the country from Armenia, and the 700,000 people that have been internally displaced due to occupation of Azeri territory. This increase in people has caused an increase in pressure on the natural environment from human activities.

Although the decline in the socio-economic situation in the last 10 years has led to a decrease in the impact on the environment from industry, many of the environmental problems of the previous era remain unsolved, and the legacy of large-scale heavy industry continues to impact on the environment. Industrial and toxic wastes remain the main issue. At present there are eight million tonnes of toxic waste in various sites.

The extraction and refinement of oil greatly influences the environment and its biodiversity. Terrestrial and marine ecosystems have been damaged due to amongst other things: poorly maintained equipment, methods of storage, open channels to collect and transport the oil. Environmental regulations relating to standards of extraction are not always adhered to, and similarly, measures to protect the environment are not implemented. Tens of thousands of hectares of land have been biologically destroyed because of the extraction of construction materials and ore.

Within agricultural lands, the negative impacts on biodiversity have decreased in recent years. However, some agricultural methods continue to negatively affect biodiversity, such as the continued application of low quality fertilizers and pesticides, irrigation systems, and intensive grazing regimes. In particular, the proper use of pesticides plays an important role in the health of the environment. The level of use and methods of application during Soviet

<sup>2</sup> Of this 24,100 ha is cultivated for crops and 4,000 ha is under long-term crops. Gardens represent some 967 ha, vineyards cover 2,518 ha, hay meadows 3,200 ha and pastures 91,400 ha.

times were dangerous to both humans and animals, and damaged the environment. Today however, the use of pesticides must be approved and registered with the State Commission within the Ministry of Agriculture. Currently hundred types are registered, however unregistered and prohibited types are imported and used illegally.

The construction of dams on the River Kura has affected the reproductive potential of sturgeon species, and has reduced the water flow into lakes that maintain and help restore fish populations.

In many villages, wood remains the main fuel type. The unsustainable harvest of wood for this purpose is leading to the reduction and fragmentation of forest cover, and changes in community structure. Fragmentation of these and other habitats is also occurring due to the increasing density of infrastructure, such as roads, and pipelines.

Anthropogenic impacts on nature have increased within the Autonomous Republic of Nakhichevan. Since the conflict that started in the early 1990s, there has been an increase in the use of timber for fuel, and charcoal created from forest trees has resulted in destruction of rare and scarce and endemic plant species. Waste and pollution is a problem in many areas, with over 2,000,000 m<sup>3</sup> of polluted water being released every day into the Nakhichevan River and then into the Araz River in a day. Improper use of the land has caused evidence of ongoing degradation including salination, erosion, and desertification. The anthropogenic impacts to the nature are recognized as a significant ecological danger in Nakhichevan, as elsewhere in the world, requiring co-ordinated efforts to prevent further damage occurring.

## **Chapter 3. Status of Biodiversity and Ecosystems**

## Chapter 3. Status of Biodiversity and Ecosystems

### 3.1 Status and quality of research on ecosystems and species

Research into biodiversity has been conducted in Azerbaijan over a number of years. Research into ecosystem classification, structure and function is relatively new and poorly developed, however much has been learnt about the country's species and ecosystems. A range of research institutes of the Azerbaijan National Academy of Sciences are involved in this, including: the Institute of Microbiology (focusing on the distribution and applied use of microorganisms); the Institute of Botany (focusing on the distribution and ecology of lower and higher plants, including description of new species of algae from the Caspian Sea); the Institute of Zoology (focusing on the distribution, ecology, evolution and protection of animal species and species composition of zoogeographical complexes, including the description of 200 new species); and, the Institute of Genetic Resources (focusing on assessments of the genetic bank, agrobiodiversity and wild relatives, assessments for sustainable use of biodiversity). The Genetic Resources Institute co-ordinates the activities of other institutions towards a national inventory and database for genetic resources (and biodiversity) of the country.

Research on the ecology and introduction of useful, rare and disappearing plants is conducted by the Botanical Garden, which also hosts collections of a number of important taxa. Furthermore, at the Mardakan Arboretum on the Absheron Peninsula, research is conducted into protection of trees under natural conditions.

The Ministry of Agriculture operates a number of scientific institutes which conduct research relevant to agrobiodiversity (both in terms of selection and plant preservation). These scientific research centres include: the Institute of Vegetable-Growing (focusing on vegetables and melons) the Institute of Horticulture and Subtropical Plants (focusing on fruits, nuts and tea plants); the Scientific Institute of Viticulture and Wine-Making (focusing on grapes and vines); the Institute of Fodder, Meadows and Pastures (focusing on fodder production and methods for sustainable use of pastures); and the Institute of Cotton-Growing (cotton production).

In addition, applied research on fish biodiversity has been conducted by the Institute of Fish Culture, of the Ministry of Ecology and Natural Resources.

Since the early 1970s research on species and ecosystems has been carried out in Nakhichevan Autonomous Republic. The Nakhichevan Regional Scientific Institute (since 2003 known as the Bio-resources Institute) and the Nakhichevan State University have both conducted research into species distribution and diversity. Although studies into a number of taxa are incomplete (including microorganisms, fungi, lower plants, protozoa and invertebrates), a wide range of species have already been documented and further studies to complete the inventory commenced in 2003. Higher plants and animals are much better studied in Nakhichevan. The "Herbarium Fund" was created in 1977 and now stores almost 600,000 herbarium specimens.

### 3.2 Biogeography

Azerbaijan can be divided into a number of biogeographical regions, although the number and location of these regions is dependant on the method of classification. Classification

using floral and topographical distinctions defines 20 distinct regions. The country is dominated by Mediterranean plant communities (50%), boreal plant communities (30%), and Caucasus plant communities (5%).

In general, the fauna of the country represent a number of different biogeographical zones – reflecting the position of the country at the junction of a number of distinct biogeographical areas (the Middle East, Asia Minor, the Mediterranean, Europe, and the Palaeartic). The Fish of six distinct geographical regions are represented in the country, with the majority belonging to the Ponto-Caspian region<sup>3</sup> (69 species). Amphibians from all five adjoining areas are represented, while reptile from eight distinct biogeographical regions is represented (including species with origins in Iran, the Middle East, Asia Minor, the Mediterranean, Europe, Caucasus, the Eastern Palaeartic, and Turan). The birds of Azerbaijan (those that over-winter and breed) include trans-Palaeartic species (242 species), European species (57 species), and Mediterranean species (43 species). There are 48 species unique to this region<sup>4</sup>.

The mammals of Azerbaijan represent six biogeographical complexes. The most dominant of these are the species originating in the Caucasus (44 species), followed by species from the Middle East (30 species), European forest species (10 species), species from southern Asia (7 species) and desert species of Turan (5 species). In addition, there are three introduced species.

Of the 20 biogeographical regions represented within Azerbaijan, three are found in the Autonomous Republic of Nakhichevan (Nakhichevan plain, Nakhichevan mountain and Nakhichevan high mountain zones). Nakhichevan AR is considered to be unique botanical-geographical district in Small Caucasus, differing from surrounding areas by its floristic composition, which is dominated by xerophytes (65% of the flora), and is most similar to Middle Asia, north Iranian and Mediterranean floras. Xerophytes geographical type organizes 65.36% (1889 species) of the total species. Nakhichevan supports a range of plant communities, and most of the zoological groups present in Azerbaijan.

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<sup>3</sup> The Ponto-Caspian region is a vast territory, encompassing the basins of the Black, the Azov, and the Caspian Seas.

<sup>4</sup> According to B. C. Stegmann 1938

### 3.3 Status review of ecosystems

#### 3.3.1 Description of the key ecosystems

Figure 3.1 The main ecosystem types of Azerbaijan



1. Scarps with glaciers, subnival and nival zones
2. Plateaus and high altitude meadows
3. Meadow/steppe in the mid altitude zone,
4. Steppe with xerophytic scrub
5. Mid altitude mountain forest zone, and broadleaved foothills
6. Xerophytic scrub, arid steppe, and arid forest in the low altitude mountain zones
7. Low altitude mountain steppe
8. Low altitude semi-deserts
9. Forest meadow landscapes of lowlands and plains
10. Arid plains and steppe
11. Lowland and plain semi desert.

The main ecosystems present in the Autonomous Republic of Nakhichevan include desert, semi-desert, mountain with xerophytic scrub, frigana (dry mountain vegetation), gariga (scrub), forest (including arid forest systems), scrub, sub-alpine meadow, alpine meadow, alpine tundra, subnival and nival zones, high mountain zones and wetlands.

#### 3.3.2 Description of key ecosystems

##### Forest Ecosystems

Forests cover 11 % of the total land area of Azerbaijan. The main forest ecosystems are found in the Lesser and Greater Caucasus mountains and in the Talysh mountain range. The upper limit of the forests is between 1800-2000m above sea level. The lower limit is

Picture 3.2. Mountainous woodland

The upper limit of the forests is between 1800-2000m above sea level. The lower limit is

largely dependent on the level of human impact on the forest, which can be intensive at low altitudes. In the past, forests covered much of the lowland plateaus and foothills outside the arid areas, however only fragments now remain in these areas. Areas currently well forested, such as the Tugai forests and the forests on the Garabag plain are now being lost.

A diversity of tree species is found in the forests of Azerbaijan, however beech (*Fagus spp.*) represents the dominant species in 32% of the forests. It is found in all the mountainous regions, except for most of the south escarpment area of the Lesser Caucasus and Nakhichevan Autonomous Republic. Overall 14% of the total forest area is covered by oak (*Quercus spp.*) forest, with the majority (40%) of these being in the Greater Caucasus, with 35% in the Lesser Caucasus, and 25% in the Talysh Mountains. The third most abundant type of forest is that dominated by hornbeam (*Carpinus spp.*). Of the 15 species of hornbeam described globally, five are found in Azerbaijan<sup>5</sup>. Other tree species are summarised in the Table 3.1 below.

Table 3.1 Tree species present in the forests of Azerbaijan

Tree species	Latin name	Notes
Walnut	<i>Juglans spp.</i>	Grows along river gorges and escarpments, in the southern aspect of the Greater Caucasus and in the Ganikh- Haftaran valley
Lime	<i>Tilia spp.</i>	There are three species of endemic lime in Azerbaijan, found in the mid-altitudinal zones of the mountain ranges.
Date	<i>Diospyros lotus</i>	Found in the Talysh Mountains southern Caucasus, at altitudes between 300-1000m
Birch	<i>Betula spp.</i>	Grows in upland regions, where found in the foothills up to sub-alpine altitudes, and on the Absheron Peninsular; covers less than 3,000 km
Iron tree	<i>Parrotia persica</i>	This relict species grows at altitudes of 200-300m. These species have been reduced by human encroachment into forests
Pine species	<i>Pinus spp.</i>	Only covers 0.5 % of the area of Azerbaijan. Found in Kapaz, Goy-gol, Zayamchay, and Asrikchay.
Oriental plane tree	<i>Platanus orientalis</i>	This species is protected in Basitchay Strict Nature Reserve
Juniper	<i>Juniperis spp.</i>	Found from 100-2500m, and is found in parts of Nakhichevan , and in the Caucasus
Eldar pine	<i>Pinus eldarica</i>	An endemic tree only found on Ellar Oyugu mountain.
Plants of Tugai <sup>6</sup> forests	-	Forests are found on the river Kura, and cover only 0.8% of the area of Azerbaijan

The forest cover in Nakhichevan Autonomous Republic has declined dramatically over the last century, from some 30,000 ha of forest recorded in 1917, to around 2,500 ha today. Most of the remaining forests are within the high mountain zone (1800 – 2600m), in contrast to the situation within the rest of Azerbaijan. The dominant tree species in these forests is the Oriental oak (*Quercus macranthera*; 84%). Other trees in these forests include ash (*Fraxinus spp*; 20%), maple (*Acer spp.*), juniper (*Juniperus foetidissima*, *J. excelsa polycarpus*), pear (*Pyrus*

<sup>5</sup> *Carpinus x. grosseserrata* H. Winkl. (*C. oxycarpa* H. Winkl.), *C. arpinus schuschaënsis* H. Winkl. (*C. geoktschaica* Radde-Fomin), *C. orientalis* Mill., *C. orientalis subsp. macrocarpa* (Willk.) H. Winkl., and *C. betulus* L. (*C. caucasica* Grossh.).

<sup>6</sup> Tugai forests – flood-lands forests in Caucasus and Middle Asia.

*salicifolia*) and mountain ash (*Sorbus greaca*). The forests in Nakhichevan Autonomous Republic regulate natural processes, and provide an important source of timber, fuel, medicinal plants, nuts and fruits. Forests have been damaged not only by over-exploitation, but also by natural events such as fires and floods (in 2003 over 25 ha were destroyed by flooding). As well as the main forests at Batabat and Bichanak, a range of other smaller forest areas remain<sup>7</sup>, although many are now fragmented and isolated. Measures to protect and restore natural regeneration in clearings and meadows may help contiguous forest to be re-established in Nakhichevan.

### Grassland and Desert Ecosystems

Semi-desert ecosystems cover 32% of Azerbaijan's territory, and are found from 27 m above sea level (the height of the Caspian Sea) to 1300m (in the Orta Araz gorge). Grassland ecosystems are found in this semi-desert zone, where annual precipitation is 200-400mm.

**Picture 3.3.** Annual poppies *Papaver macrostomum* in grassland.

They are found around the Kura and Caspian Basin, and in the Nakhichevan Autonomous Republic. Semi-deserts also occur over the arid foothills of the Greater Caucasus and at the lower altitudes of other mountains such as Ajinohur, and Jeyranchol.

Some damage of grassland and semi-desert habitats has occurred, for example as a result of long-term irrigation the soil structure has changed in the Kura-Araz lowlands, and soils have become salinised due to the rising level of the Kura river.

Grassland ecosystems cover 33% of the territory of the Autonomous Republic of Nakhichevan, mainly occurring along the Araz River. In addition, fragments of different

<sup>7</sup> Khazina Dara forest in Julfa district; Kola and Duman forests around Gavik, Sadara, Kalbaoruj, Vanli and Lakatag villages; Sakkarsu forest in the Bayahmad Pass; Talalar forest near Ayrichay; Palidlig, Aznamer and Hadrut oak forests near Yukhari Jalil, Ashagi Jalil, Bist, Tivi, and Nasirvaz.

desert ecosystems occur, including saline semi-desert systems. These areas appear to be expanding through desertification and associated salinisation is occurring due to over-use of lands, the arid climate, intensive irrigation and inappropriate drainage or irrigation systems. Saline deserts support a diverse and unique flora (around 256 species), including some halophyte species characteristic of such environments<sup>8</sup>. The animals associated with these ecosystems are mainly nocturnal or crepuscular (including lagomorphs and rodents), although birds such as desert partridge (*Ammoperdix griseogularis*) and vultures may be seen during the day. Semi-desert ecosystems are also present in Nakhichevan plains, in less saline areas at altitudes of 1100-1300m (and sometimes up to 1500m). Many of these semi-desert systems are dominated by wormwoods (*Artemisia spp.*, such as *A. fragrans.*), although a range of other plants occur. Some of these semi-desert areas provide important winter pastures.

### Mountain Ecosystems

Mountain meadow ecosystems cover 10% of the territory of Azerbaijan. Alpine meadow is found between 2000-4500 m above sea level, and has similar communities throughout the altitudinal zone. Many of the escarpments do not have soil, and few plant communities exist on them. The subalpine meadows of the north-east Greater Caucasus, the Garabag volcanic plateau and ranges, Shahdag, and Murovdag are covered with grain crops, along with meadow-steppe plants. Forest ecosystems also occur in mountainous regions, but are addressed in more detail above.

Picture 3.4. Mountain landscape

Mountain ecosystems are characteristic of Nakhichevan Autonomous Republic, and include a range of communities including xerophytic scrub (including scrubby, rocky areas (gariga)), steppe-meadows (friganoid), as well as scrubby xerophyte forests, bushes, oak forests, high mountain meadows and cliff communities. One of the dominant plant communities is friganoid steppe-meadow vegetation, a complex system that supports a diversity of plants, including aromatic herbs, such as clary sage (*Salvia sclerea*), lamb's ears (*Stachys spp.*) and thyme (*Thymus collinus*), which are important economically and medically. Vetches (such as *Astragalus spp.*) are often characteristic in these areas, and a number of rare and endemic plants are also present, including alliums (*Allium leonidi* and *A. mariae*) and tulips (*Tulipa florenski*).

Alpine and sub-alpine meadows in Nakhichevan are highly diverse, supporting over 890 plant species. There is a greater area of alpine meadows, which are dominated by grasses such as *Agrostis alba*, *Phleum alpinum*, *Carex canescens*, and *Nardus stricta*, and the low productivity of these areas restricts grazing potential (although cattle are still grazed on such pastures in some numbers). High mountain meadows and pastures (at 2000-3000m altitude) have been affected by over-grazing, leading to invasion by non-palatable plants. At higher altitudes (3200-3700m) the vegetation becomes shorter and more patchy, dominated by

<sup>8</sup> For example *Halocnemum strobilaceum*, *Halostachis caspica*, *Salicornia europaea*, *Zejdilitsia florida*, *Salsola crassa*, *Frangenia hirsute*, and *Anabasis aphylla*

lady's mantle (*Alchemilla sericea* and *A. caucasica*), with grass (*Poa alpina*), clover (*Trifolium ambiguum*), speedwell (*Veronica gentianoides*), and plantain (*Plantago atrata*).

### Wetland Ecosystems

The wetland ecosystems of Azerbaijan are of particular biological importance. The wetlands and lakes provide an important stopover for migrants, and over-wintering birds, and are estimated to support between 20,000 – 100,000 birds during the annual migrations. The lakes also support a diversity of plant species. Some of the key lakes and wetlands important for biodiversity are described below:

- Lake Agzibir on the Caspian coast has no protection status, but has a high diversity of zooplankton (38 species) and macrobenthic organisms (130 species, as well as 181 bird species, including 77 species of waders. Studies have shown that migrating and over-wintering wader numbers can reach up to 200,000 birds on this lake alone.
- Lake Gush in the Salyan region, fed by the Shirvan River, also has no protection status, although 79 species of wader and nine raptor species have been found. Migrating and over-wintering bird numbers can reach over 31,000 birds.
- The Kura Delta on the Caspian shore consists of a number of channels and marsh areas, stretching out into the Caspian Sea, 20 km to the south-east. Reed beds dominate the wetland ecosystem. This site is of great importance for migrating birds, supporting numbers in the region of 75,000 waders. Although the Delta has no protection status, it is State owned.
- Mahmudchala and Agchala Lakes to the south of Baku cover 23,000 ha, much of which is covered with reed beds. Although important for wintering birds, the area is not protected but hunting revenue helps protect the area.
- Hajigabul Lake (904 ha) belongs to the State. Although there are few reed beds this lake provides habitat for some 54 wader species, including a number of rare waders. Five species of birds<sup>9</sup> found on this lake are globally threatened, and 15 have European threat status. In addition, the lake's communities of algae, macrophytic plants, plankton and macrobenthos have been found to be highly diverse.
- Sarisu Lake is situated on the bank of the Kura River, in the Imishli region, and belongs to the State. This lake supports a notably high diversity of zooplankton and phytoplankton. It has a rich reed bed community that provides ideal nesting sites for birds. Studies in 1998 showed 29 bird species breeding here, including some globally threatened species. Aggol Lake, also on the right bank of the Kura (in Agjabadi) also has a high diversity, including 87 species of breeding birds.

Picture 3.5. Waterbirds at Gizilagaj Strict Nature Reserve

<sup>9</sup> Dalmatian pelican (*Pelecanus crispus*), pygmy cormorant (*Phalacrocorax pygmeus*), marbled teal (*Marmaronetta angustirostris*), ferruginous duck (*Aythya nyroca*) and white-headed duck (*Oxyura leucocephala*)

- State-owned Varvara reservoir is situated on the Kura River, to the south-east of Mingachevir and covers 2,140 ha. The reservoir supports a high diversity of zooplankton, algae, phytoplankton, and higher plants. Of the 34 species of fish found in the lake, 16 are considered economically important.
- Jhandargol Lake is situated on the border with Georgia and covers 1,250 ha. Its water is used for irrigation, and the lake supports an important fishing industry. The lake is rich in biodiversity, including four globally threatened bird species<sup>10</sup>, and an important reed bed community.

There are many wetlands and water bodies in Nakhichevan Autonomous Republic, which support varied hydrophytic vegetation (nearly 210 species of water, wetland or marshland plants have been recorded). Although water plants have not been well described in the Republic, they include duckweeds (*Lemna spp.*) and pondweeds (*Potamogeton spp.*). Other species are more associated with water margins and marshes<sup>11</sup>. In general cover and productivity in these wetland and marshland systems is low.

### Coastal and Marine Ecosystems

The Caspian Sea is the largest enclosed body of water in the world, covering 436,000 km<sup>2</sup>,

#### Picture 3.6. Rocky shore on the Absheron Peninsula

with borders on five countries<sup>12</sup>. The surface of the Caspian is at 27 m below the level of the world's oceans, although historically the level fluctuates. The deepest point is 1,023 m (the Lenkoran hollow), but the average depth is just 184 m.

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<sup>10</sup> Lesser white-fronted goose (*Anser erythropus*), pygmy cormorant (*Phalacrocorax pygmaeus*), Dalmatian pelican (*Pelecanus crispis*) and imperial eagle (*Aquila heliaca*).

<sup>11</sup> For example, *Convolvulus persicus*, *Heliotropium ellipticum*, *Halacnemum strabilaceum*, *Salicornia europaea*, *Puccinellia qiqanteae*, and *Chenopodium rubrum*

<sup>12</sup> Russian Federation, Republic of Kazakhstan, Republic of Azerbaijan, Republic of Turkmenistan and Islamic Republic of Iran.

In general the water of the sea is not fresh, but brackish, (three times less concentrated than the oceans). The Caspian Sea is not a homogenous water body due to the influx of water with different compositions in different areas. In general the north Caspian is less salty (due to the influx of water from the Volga and Ural rivers), and more species diverse than the middle or southern areas. However, nearly all of the indigenous species are found in the middle of the Caspian where the water composition is stable.

The Caspian provides a characteristic ecosystem that differs from the major oceans of the world. The sea is of global importance due to the high biodiversity, large number of endemic species (see Table 3.2), and the presence of globally threatened bird and fish species, including the economically important sturgeon. The region is also a migration route for millions of birds moving from Africa and the Mediterranean to Central Asia and India. To date 446 bird species have been recorded in the Caspian, of which 120 species breed, 62 species over-winter, and 278 species migrate through.

Table 3.2 Number of endemic species found in the Caspian<sup>13</sup>

Phylum	Subphylum	Class	Subclass	Order	Number of endemics	
<i>Porifera</i>	-	-	-	-	4	
<i>Coelenterata</i>	-	-	-	-	2	
<i>Nematoda</i>	-	-	-	-	3	
<i>Platyhelminthes</i>	-	<i>Turbellaria</i>	-	-	29	
<i>Rotifera</i>	-	-	-	-	2	
<i>Annelida</i>	-	<i>Oligochaeta</i>	-	-	4	
		<i>Polychaeta</i>	-	-	4	
		<i>Branchipoda</i>	<i>Diplostraca</i>	<i>Cladocera</i>	19	
<i>Arthropoda</i>	<i>Crustacea</i>	<i>Maxillopoda</i>	<i>Ostracoda</i>	-	3	
			<i>Copepoda</i>	-	23	
		<i>Malacostraca</i>	<i>Eumalacostraca</i>	<i>Mysida</i>		20
				<i>Isopoda</i>		1
				<i>Amphipoda</i>		68
				<i>Cumacea</i>		19
				<i>Decapoda</i>		1
		<i>Chelicerata</i>	<i>Arachnida</i>	<i>Acari</i>	<i>Acariformes</i>	2
<i>Mollusca</i>	-	-	-	-	53	
<i>Vertebrata</i>	-	-	-	-	55 <sup>14</sup>	

In total some 450 species of plankton have been recorded from the Caspian, 140 of which are found in the territories of Azerbaijan. There are 87 species of algae, some of which entered the Caspian from the Black Sea after the construction of the Volga-Don channel in 1954. In addition, 380 species of zoobenthos have been recorded from 13 different animal groups, with the majority of species occurring in the middle and south of the Caspian Sea.

### 3.4 Status review of plant communities and habitats

#### 3.4.1 Description of key plant communities

Distinctive plant communities are associated with particular habitat types:

- **Xerophytes** can tolerate dry and arid habitats and are found in areas of:

<sup>13</sup> Systematic taxons *Species 2000* used from <http://www.sp2000.org/>.

<sup>14</sup> 54 fish and 1 mammalian species

- **Steppes:** (e.g. *Festuca silcata*, *Stipa lessingiana*, *Onobrychis cornuta* and *Medicago coerulea*);
- **Deserts and semi-desert:** (e.g. *Astragalus tribuloides*, *Glycyrrhiza glabra*);
- **Halophytes** (e.g. *Halocnemum strobilaceum*, *Halostachys caspica*, and *Sasola crassa*) develop in salty places;
- **Psammophytes** (e.g. *Ceratocarpus arenarius*, *Convolvulus persica* and *Elymus gigantea*) develop in sandy areas;
- **Hydrophytes** (e.g. *Polygonum hydropiper*, *P. amphibium* and *Eleocharis meridionalis*) grow around water bodies and in wetland areas;
- **Hydrophiles** (e.g. *Batrachium divaricatum*, *Potamogeton perfoliatum* and *Zannichellia palustris*) develop in water bodies;
- **Mesophytes** are the dominant form of vegetation, and can be further characterised in relation to specific habitats:
  - **Forests:** The most widespread forest communities are dominated by hornbeam (*Carpinus caucasica*), Eastern oak (*Quercus macranthera*) and ash (*Fraxinus excelsior*);
  - **Humid lowland meadows:** (e.g. *Heraecleum trachyloma*, *Aconitum nasutum* and *Doronicum macrophyllum*);
  - **Alpine meadows:** (e.g. *Festuca pratensis*, *F. violacea* and *Carum caucasicum*).

### 3.4.2 Rare, endemic or threatened plant communities and habitats

In Azerbaijan, a number of specific habitats or plant communities are rare or threatened, for example:

1. Psammophytic coastal plant community (*Astragalus bakuensis*, *Melilotus caspicus*, *Calligonum bakuensis*, *Nitrardia schoberi*);



**Picture 3.7.** *Convolvulus persicus*, a rare psammophytic community

2. Xerophytic plant communities in Nakchivan Autonomous Republic near the village of Badanli and in Shabuz region (*Dorema glabrum*, *Iris lycotis*, *Astragalus badamlensis*, *Thymus collinus*);
3. Wetland communities around Akushchay and Sarisu Lakes (*Trapa hyrcana*, *Nelumbo caspica*, *N. alba*, *N. peltata*);
4. Dry forest communities in Azerbaijan and Nakchivan (*Pistacia mutica*, *Celtis caucasica*, *Punica granatum*, *Rhus coriaria*, *Juniperus oblonga*, *J. polycarpus*, *J. sabina*, *J. depressa*, *J. foetidissima*);
5. Eldar pine (*Pinus eldarica*) forest is only found on the Eldar plain in the Samukh region, and the oak forests (*Quercus longipes*) around the Nabran region are threatened;
6. Humid, sub-tropical forest, supporting the rare and threatened iron tree (*Parrotia persica*), is unique to the Hyrcan forest of Lenkoran region in Talysh province;
7. Rare and threatened alpine meadows around the lakes of Gey-gol and Matal-gol are typified by the lily *Lilium ledebourii*.

Steppe communities dominated by *Ferula oopoda* and by *Colutea comarovii* are globally unique for the Nakhichevan Autonomous Republic. In the mountain pastures of the Shahbuz region a rare and unique plant community is dominated by the endemic species *Rheum ribes*.

## 3.5 Status review of species

### 3.5.1 Microorganisms

Although there is little information on the diversity of micro-organisms in Azerbaijan, there are estimated to be between 1,200 and 1,250 species, but to date no endemic micro-organisms have been described. No specific measures are in place for the protection of micro-organisms.

As in the rest of Azerbaijan, there is a lack of knowledge about the diversity of microorganisms present in the Autonomous Republic of Nakhichevan. The presence of bacteria (*Monera*) is clear, particularly from their impacts through diseases in humans, animals and plants, and in their use in food production and processing (such as *Lactobacillus* etc.), and in healthcare (e. g. *Penicillium*). Microorganism cultures are kept in a number of institutes and epidemiological stations in the region.

### 3.5.2 Protozoa

Protozoa are cellular organisms that live either independently, or as part of a larger organism. Protozoa provide many varied and essential roles in an ecosystem, for example providing food for fish larvae and fry, and increasing soil fertility. They are also the pathogens of human and animal diseases. The protozoa described in Azerbaijan are distributed from the following groups:

- Over 300 species of *Sarcomastigofora* (flagella and amoebae). Specifically 12 plant and 17 animal flagella and free-living amoebae have been found in the soils of the Lenkoran area, the Shirvan steppe, and Karabakh Mountain. Over 100 species of amoebae have been found in the soils of the Sheki-Zakatala area, and in the reservoirs of the Absheron region.
- *Foraminiferida* principally inhabit the marine benthos, attached to stones, algae and hydroids and in planktonic forms. Most forms live in salty water, but some can cope with significantly fresher water. To date 18 species have been found in the Caspian, 15 of which are believed to be endemic.
- One species of *Pheodarea* has been found in the harbour of Baku<sup>15</sup>. Two marine species of *Heliozoa* and eight fresh water forms have been recorded either as plankton, or living on substrates.
- A total of 268 species of *Apicomplexa* have been found in Azerbaijan, and all are internal parasites of vertebrates. In addition, 29 species of *Microspora* have been found in Azerbaijan (27 of which parasitise invertebrates) and 42 species of *Myxozoa* (fish parasites) have been recorded.
- There are over 1,000 free-living and parasitic species of *Infusoria* and *Ciliphora* in Azerbaijan. Of these 464 species are found in the Caspian, 300 species in lakes and reservoirs, and 126 species in soil. Parasitic *Infusoria* are widespread, 26 species are external parasites on fresh water and marine fish, and species within this group can be useful indicators of organic water pollution<sup>16</sup>.

<sup>15</sup>*Cannosphaera haekelli*, found in the late 19<sup>th</sup> century

<sup>16</sup> Species of the genera *Apiosoma*, *Epistylus*, and *Trichodina*

### 3.5.3 Fungi

The fungi of Azerbaijan have been widely studied by a number of mycologists (see Table 3.3). The structure, ecology, biology or habitat of approximately 5,020 species has been studied. The majority of fungi studied to date are parasitic on plants, causing a variety of diseases, which cause particular problems in agriculture. Approximately 400 myxomycetes (slime moulds) have been described. This widespread group is found in both aquatic and terrestrial ecosystems, and is also airborne. In addition, approximately 400 basidiomycetes (club fungi) have been recorded in the country. Of particular note is the species *Terfesia transcaucasica*, which is endemic to Azerbaijan and is considered to be at risk of extinction. It is found in the regions of Araz, Absheron, the Lesser Caucasus, and Karaback.

Table 3.3 The number of genera and species of fungi described in Azerbaijan and Nakhichevan AR.

Class	Azerbaijan		Nakhichevan
	Number of genera	Number of species	Number of species
<i>Myxomycota</i> (slime moulds)	18	40	-
<i>Phycomycota</i>	45	240	47
<i>Ascomycota</i> (yeasts, moulds, morels and truffles)	210	1,020	67
<i>Basidiomycota</i> (smuts, rusts, jellies, mushrooms and bracket fungi)	260	2,600	35
<i>Deuteromycota</i> (fungi imperfecti)	130	1,120	22
<b>Total</b>	<b>763</b>	<b>5,020</b>	<b>171</b>

A total of 171 species of fungi have been described from Nakhichevan Autonomous Republic, some of which (notably *Phylostica* and *Septoria spp.*) cause agricultural diseases (affecting tobacco, tea, apple and pear plants, as well as natural vegetation). Further details are shown in Table 3.3.

### 3.5.4 Flora

#### Lower plants

Among the lower plants recorded from Azerbaijan, some 249 species of algae have been described from the Caspian Sea, and of these 197 are microscopic (phytoplankton; see Table 3.4). In addition, a high diversity in mosses is recorded from Azerbaijan, with 774 species described from 44 different orders.

Table 3.4 The number of species within the main algal classifications found from the Azeri area of the Caspian Sea

Group of algae	Number of species
Red algae ( <i>Rhodophyta</i> )	20
Brown algae ( <i>Phaeophyta</i> )	5
Green algae ( <i>Chlorophyta</i> )	25
Microscopic species:	
Diatoms ( <i>Bacillariopyta</i> )	197
Blue-green algae ( <i>Cyanophyta</i> )	80
Dinophyte ( <i>Dinophyta</i> )	16
Golden algae ( <i>Chrysophyta</i> )	1

In Nakhichevan Autonomous Republic a range of blue-green algae (approximately 25 species) were recently discovered associated with mineral springs, and many of these are newly described in Azerbaijan, being previously only found in other countries. Diatoms

have also been found in these same mineral springs, from which 46 species have now been identified. Nakhichevan also supports 24 species of mosses.

### Higher plants

Approximately 4,500 species of higher plants are recorded in Azerbaijan (Table 3.5) , which represents around 65% of the floral diversity of the Caucasus region, and 11% of the world's flora. The main areas of plant diversity in Azerbaijan are the highlands of Nakhichevan (60% of the species occur here), the Kura-Araz plain (40%), the Devechi-Kuba region east of the Greater Caucasus (38%), the centre of the Lesser Caucasus (29%), Gobustan (26.6%), the Lenkoran region in the Talysh Mountains (27%), and the Absheron region (22%).

Table 3.5 Number of plant species in different groups

Group	Azerbaijan	Nakhichevan
	Number of species	
<i>Briophyta</i> (mosses)	346	39
<i>Sporophyta</i> (ferns and horse tails)	63	14
<i>Gymnosperms</i> (non flowering plants)	24	18
<i>Angiosperms</i> (flowering plants)	4,413 <sup>17</sup>	2887 <sup>18</sup>
<b>Total</b>	4,846	2958

Over 2958 species of higher plants have been recorded from the Autonomous Republic of Nakhichevan (see Table 3.5). Over half of the plants in the country are xerophytes, but hydrophytes and halophytes are also represented. The majority of the plants described are perennials (65%) and biannuals (27%), along with bushes (6%) and trees (2%).

### Endemism

There are over 400 species of plants endemic to Azerbaijan. These include around 210 endemic lower plant species (including ten endemic species of lichen). Around 16 species of algae are endemic to the Caspian Sea<sup>19</sup>. In addition, 210 higher plant species are considered endemic to Azerbaijan, including species from 98 genera and 32 families. The centres of both higher and lower plant endemism are in the regions of Nakhichevan, the Talysh Mountains, and east of the Greater Caucasus.

**Picture 3.8.** Iron tree *Parrotia persica* in the Hyrcan forest of Lenkoran region in Talysh province

The Autonomous Republic of Nakhichevan is an important centre of plant endemism and supports over 50% of the endemic plants found in Azerbaijan. Endemism is particularly high within a

<sup>17</sup> Including 910 monocotyledons, and 3,503 dicotyledons

<sup>18</sup> Including 627 monocotyledons and 2260 dicotyledons

<sup>19</sup> Four species of red algae, one species of brown algae (an endemic genus), one species of blue-green algae and ten diatom species.

number of botanical families, including legumes and peas, roses and wild cherries, asters and wormwoods and grasses (*Gramineae*)<sup>20</sup>. Recent re-evaluations suggest the territory has 112 country endemics, and 219 regional (Caucasian) endemics, and an additional 73 plants are locally distributed within Iran and Turkey. Approximately 65 endemic species and subspecies are found only in Nakhichevan, including *Scrophularia nachiczevanica*, *Stipa isajevi*, *S. karjagini* and *Pyrethrum ordubadica*.

### Conservation status

Overall 10% of plant species are considered to be threatened in Azerbaijan, with 415 species now being classified as either rare or threatened and recommended for inclusion in an updated National Red List<sup>21</sup> (although only 140 of them are mentioned in the current Red Book of Azerbaijan<sup>22</sup>) and three species are listed as globally threatened in 1989 - *Iris acutiloba*, *Calligonum bakuense* and *Astragalus bakuenses*. In 1982 the government recognised that 2,124 plant species in Azerbaijan are rare, endemic, threatened, or of economic importance (Government Order number 167).

Just under 2% of the flora of Nakhichevan Autonomous Republic is listed in the Azerbaijan Red Data Book (54 species or subspecies are listed<sup>23</sup>). In addition, some species have not been found in the territory for a number of years and may have become locally extinct<sup>24</sup>.

### 3.5.5 Fauna

#### Invertebrates

Approximately 20,000 species of invertebrates have been recorded in Azerbaijan, of which 90% are within the phylum Arthropoda (invertebrates with jointed legs), of which a further 90% are insects (sub-phylum Insecta; see Table 3.6). The arachnids (spiders and mites) represent the second largest group of arthropods in Azerbaijan, with 1,870 species recorded within the three main orders (*Araneae*, *Acariformes* and *Parasitiformes*, each represented by 700 – 800 species). Fewer crustaceans (order *Crustacea*) have been recorded, with a total of 324 described from Azerbaijan. In addition, it is notable that the phylum *Nematoda* (nematode worms) is very numerous in Azerbaijan (with 1,084 recorded species).

Table 3.6 The six most diverse orders of insects in terms of the number of species recorded in Azerbaijan

Order	Number of species
<i>Lepidoptera</i> (Butterflies)	4500
<i>Coleoptera</i> (Beetles)	4000
<i>Hymenoptera</i> (Ants, bees, wasps and sawflies)	2500
<i>Diptera</i> (Flies, mosquitoes and gnats)	2000
<i>Hemiptera</i> (True bugs)	874
<i>Homoptera</i> (Plant bugs)	739

<sup>20</sup> Endemism is high in *Fabaceae*, *Rosaceae*, *Asteraceae* and *Poaceae*.

<sup>21</sup> Hajiyev, V.J. and Musayev, S.H. (1996) Plants and the structure of the plants recommended to Azerbaijanians red and green books.

<sup>22</sup> Red Book of Azerbaijan SSR, Published: Ishig, (1989). This classifies species by threat (0-4): extinct, endangered, rare, vulnerable or data deficient.

<sup>23</sup> Of particular note are *Nectaroscordum tripedale*, *Ferula oopoda*, *Stenotaenia daralaghezica*, *Campanula radula* and *Salsola tamamschjana*

<sup>24</sup> For example, *Aristolochia bottae*, *Paeonia tenuifolia*, *Camranula minesterana* and *Triticum monococcum*

## Vertebrates

Azerbaijan supports 623 species of vertebrates (Table 3.7), across the main taxonomic groups.

Table 3.7 Number of species found within the different vertebrate classes in Azerbaijan and Nakhichevan AR

Class	Number of species	
	Azerbaijan	Nakhichevan
Fish	98	24
Amphibians	10	4
Reptiles	52	24
Birds	363	136
Mammals	106	37

- **Fish.** In total there are 89 species of fish in Azerbaijan, of which eight introduced and seven of these have become widespread<sup>25</sup>. Representatives of ten orders of bony fish (Class *Osteichthyes*) have been recorded from within the Azeri territory of the Caspian Sea, and of 13 orders are found in the inland waters of Azerbaijan. There is one species of lamprey (group *Petromyzontiformes*), which is found in the Caspian Sea (*Caspiomyzon wagneri*).
- **Amphibians.** Ten species of amphibians from five families are recorded in Azerbaijan<sup>26</sup>. These amphibian species live in a variety of landscapes, depending on their ability to adapt to harsh environments, and their different nutrient needs. They are commonly found in plains, semi desert habitats and the mountain foothills, where six species occur. Few species are found in deserts, high mountains or alpine meadows.
- **Reptiles.** There are 52 species of reptiles found in Azerbaijan<sup>27</sup>. Most of these species are found in semi-desert areas. Few are found in other lowlands or mountainous areas.
- **Birds.** Azerbaijan is very rich in avifauna. There are 363 species of birds recorded from 60 families. Around 40% of these species are native to Azerbaijan, however 27% of these species over-winter here, and 10% pass through on migration. Azerbaijan is a major route for birds migrating from Asia to Europe, and millions of birds pass through the country from Eastern Europe and western Siberia to South and West Africa each year. Approximately 1.5 million birds use the wetlands of Azerbaijan to rest and feed.
- **Mammals.** Some 106 species of mammals have been recorded in Azerbaijan, three of which are introduced species<sup>28</sup>. Mammals from seven orders are represented: Insectivores (13 species in three families), *Chiroptera* (bats; 27 species), *Lagomorpha* (rabbits

<sup>25</sup> Salmon (*Salmo gardneri*), trout (*S. iridus*), goycha salmon (*Salmo iscgan*), chum salmon (*Oncorhynchus keta*), leaping grey mullet (*Liza saliens*), grey mullet (*L. risso*), gambusia (*Gambusia affinis*)

<sup>26</sup> Common newt (*Triturus vulgaris*), warty newt (*T. cristatus*), eastern spadefoot (*Pelobates syriacus*), Caucasian spadefoot (*P. caasicus*), green toad (*Bufo viridis*), common toad (*Bufo bufo*) common tree frog (*Hyla arborea*), *H. arborea savignii*, marsh frog (*Rana ridibunda*), *R. macrocnemis*.

<sup>27</sup> Mediterranean spur-thighed tortoise (*Testudo graeca*), Caspian gecko (*Tenuidactylus caspius*), horn-scaled agama (*Trapelus nuderatus*), Caucasian laudakia (*Laudakia caucasia*), toadhead agama (*Phrynocephalus helioscopus*), *Ermias* species (*Eremias trauchi*, *E. velox*, *E. arguta* and *E. pleskei*), European glass lizard (*Pseudopus apodus*), greenbelly lizard (*Lacerta chlorogaster*), Caucasus emerald lizard (*Lacerta strigata*), Eurasian blind snake (*Typhlops vermicularis*), *Eryx jaculus*, Dahl's whip snake (*Coluber najadum*), spotted whip snake (*C. ravergeri*), Transcaucasian rat snake (*Elaphe hohenackeri*), *Eirenis collaris*, *E. punctatolineatus*, *E. modestus*.

<sup>28</sup> Wild island hare (*Oryctolagus cuniculus*), marsh beaver (*Myocastor coypus*), and American racoon (*Procyon lotor*)

and hares; 2 species), *Rodentia* (rodents; 36 species), *Carnivora* (carnivores; 19 species, including one species from the suborder *Pinnipeda*). The most widespread species of mammal in Azerbaijan include the water rat (*Arvicola terrestris*), gray rat (*Rattus norvegicus*), wolf (*Canis lupus*), jackal (*C. aureus*), fox (*Vulpes vulpes*), stone martin (*Martes foina*), badger (*Meles meles*) and wild boar (*Sus scrofa*).



**Picture 3.9.** Goitred gazelle *Gazella subgutturosa* fawn in Shirvan National Park

The aquatic fauna is particularly notable in the Nakhichevan Autonomous Republic, with the rivers Nakhichevanchay and Arpachay showing the highest faunal diversities – mainly constituted by invertebrates, of which a number are newly recorded in the region<sup>29</sup>. Around 225 vertebrate species are described from Nakhichevan, and 45 of these are considered rare or have a restricted range. Fish species richness is high, and many of these fish are important economically, aesthetically or scientifically. The fish (including sturgeon species) are dependent on the rich invertebrate and zooplankton fauna of these rivers as a key food source. One fish species is endemic to the Saggarsu River.

### Endemism

It is difficult to accurately estimate endemism among invertebrate groups, as the geographical distribution of many species has not been investigated fully. Known endemics are listed in Table 3.8. Furthermore, it is difficult to determine where the centres of endemism are amongst terrestrial invertebrates in the region due to the lack of studies, and difficulties undertaking this research. However, the endemism of spiders (*Aranae*) is known to be higher in the Greater Caucasus than in Talysh region, and other endemic spiders are

<sup>29</sup> For example, *Eucalamis lyra*, *Macrotrix rosea*, *Bosmina crassicornis*, *Strularia lacustris*, *Herpobdella testacea* and *Hudroporus palustris*

known from the Lesser Caucasus. Invertebrate endemism from the Hyrcan region are frequently recorded in the literature.

The greatest number of aquatic invertebrates is found in the Caspian Sea, which is not surprising given how the isolation of this water body may have contributed to speciation.

A number of bee species are found in restricted ranges in Nakhichevan and may be unique to the Caucasus.

Group	Number of endemic species
Porifera (sponges)	3
Coelenterata (jellyfish, corals etc)	1
Platyhelminthes (flat worms)	3
Acanthocephales	8
Annelida	17
Mollusca	126
Anthropoda	738

Among vertebrates, the knowledge of endemism is much higher.

- **Fish.** A number of fish species endemic to the Caspian Sea, mainly species from the orders *Clupeiformes* (herrings) and *Perciformes* (perch). Fifteen species, and six sub-species of *Gobiidae* (order *Perciformes*) in Azerbaijan are endemic, while most of the endemic freshwater fish are from the order *Cypriniformes*.
- **Amphibians.** One species is found in Azerbaijan as Caucasian endemics (*Pelodytes caucasicus*).
- **Reptiles.** Some species, related to Caucasian zoogeographical complex may be considered as Caucasian endemics.
- **Birds.** Three regional (Caucasian) endemics are found in Azerbaijan.
  - The Caucasian black grouse (*Tetrao mlokosiewiczzi*) is found in high mountain forests at altitudes of 1,700–3000m, in both winter and summer. It is considered Data Deficient by the IUCN Red List of Threatened Species, 2000).
  - The Caucasian snowcock (*Tetraogallus caucasicus*) occurs in high mountains and meadows (at altitudes of 2,200-4,000m) and is listed in the Azerbaijan Red List.
  - The green warbler (*Phylloscopus nitidus*) is found in pine and mixed forests and in sub-alpine scrub at altitudes of 1,200-2,600m.
- **Mammals.** Although there are no strictly endemic mammals in Azerbaijan, there are around 15 regional endemics present in the country. The Caspian white-toothed shrew (*Crocidura caspica*), Hyrcan forest mouse (*Syloaemus hyrcanicus*) and Shelkovnikov's vole (*Microtis schelkovnikovii*) have been found in the Lenkoran district, but are also likely to be found in the adjacent territory of Iran. The long-tailed hamster (*Calomyscus urartensis*) is found in a small area in the mid-Araz valley of the southern Caucasus, and also in Iran. Vinogradov's jird (*Meriones vinogradovi*) is found in the arid territory of Nakhichevan, and also in adjacent countries. However, Nazarov's vole (*Terricola nazarovi*) has only been found in the Murovdag Range of the Lesser Caucasus. The status of the Caucasian leopard (*Panthera pardus ciscaucasica*) is unclear.

Species endemic to the Caucasus region and Asia Minor include the Levant mole (*Talpa levantis*), Rade's shrew (*Sorex raddei*), Shelkovnikov's water shrew (*Neomys schelkovnikovii*), and the Caucasian snow vole (*Chionomys gud*). In addition, the Dagestan vole (*Terricola dagestanicus*) and Robert's snow vole (*Chionomys roberti*) are endemic to the Caucasian

Range and the Lesser Caucasus, although the former has also been found in Asia Minor. The Dagestan tur (*Capra cylindricornis*) lives only in the Greater Caucasus. It is also thought that the Caucasian forest mouse (*Sylvaemus ponticus*) is the endemic of the Caucasus. The Caspian seal (*Phoca caspica*) is endemic to the Caspian Sea.

### Conservation status

Forty species of invertebrates are listed in the Red Book of Azerbaijan as being threatened with extinction. These are all insects (from the orders *Coleoptera*, *Lepidoptera*, and *Hymenoptera*). In many cases, the insects under threat are large and attractive, and have been over collected. There are however, more species that are considered threatened by specialists, but are not included on this list. For example, there are 15 species of invertebrates that are found in Azerbaijan, that were included on the Red List of the former USSR<sup>30</sup>, but are not on the Azeri Red List.

Among vertebrates, five species of fish are considered endangered in Azerbaijan due to anthropogenic activities. The species of sturgeon (*Acipenser nudiventris*) was included in the Red book of Azerbaijan in 1995, however six species of sturgeon found in Azerbaijan are on the IUCN red list of endangered species, and the status of sturgeons remains an issue of ongoing concern. These species are fished in Azerbaijan according to the rules of CITES<sup>31</sup>. A species of herring (*Clupeonella cultriventris*) is also on the IUCN red list. There are a further seven species of fish that are recommended for inclusion in the Azeri red book<sup>32</sup>.

Five of the ten species of amphibians found in Azerbaijan are listed in the Red Data Book of Azerbaijan (see Appendix 1). A number of these species (*Triturus vulgaris vulgaris*, *T. cristatus*, *Bufo bufo*, *Pelobates syriacus*, and *Pelodytes caucasicus*) have all been successfully bred in ex-situ conditions. Nine species of reptiles are listed in the Red Data Book of Azerbaijan (see Appendix 1). Of the bird species found in Azerbaijan, 21 are either considered globally or nationally threatened. These include the Critically Endangered long-billed curlew (*Numenius tenuirostris*), and the Endangered white-headed duck (*Oxyura leucocphala*). Six other species are classified as Vulnerable<sup>33</sup>, the other 13 are listed as Lower Risk or Data Deficient. A number of bird species are also considered to be of European importance.

Around 33% of the mammals in Azerbaijan are included on either the Azerbaijan Red Data Book or as globally threatened in the IUCN Red List. In the Azeri Red Data Book, five species are listed as extinct, nine have limited distribution. Another ten species are recommended for inclusion in the second edition of the Azerbaijan Red Data Book. Of particular note are the carnivores, as a number of carnivore species are thought to be locally extinct due to hunting and habitat change (for example striped hyena, Caucasian leopard and wild cat) all rare from Nakhichevan during the last century. Nearly a quarter of mammal species occurring in Azerbaijan have naturally restricted ranges, as a result of the

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<sup>30</sup> Insects: *Coenagrion mercuriale*, *Cordulegaster insignis*, *Epallage fatime*, *Bolivaria brachyptera*, *Haploembia solieri*, *Bradyporus multituberculatus*, *Saga pedo*, *Porphyrophora hamelii*, *Homoptera*, *Olivierina extensa*, *Xylocopa valga*, *Scolia maculata*, *Satanas gigas*. Molluscs *Pantastacus pylzovi*, *Eisenia muganiensis*.

<sup>31</sup> CITES - The Convention on International Trade in Endangered Species of Wild Fauna and Flora..

<sup>32</sup> European Chub (*Leuciscus cephalus orientalis*), Transcaucasian barb (*Varicorhinus capoeta*), Caspian barbel (*Barbus brachycephalus caspius*), Bulatmai barbel (*Barbus capito capito*), Mursa *Barbus mursa*), Danube bleak (*Chalcalburnus calcoides longissimus*), Blackbrow bleak (*Acanthalburnus microlepis*).

<sup>33</sup> Lesser white fronted goose (*Anser erythropus*), imperial eagle (*Aquila heliaca*), red-breasted goose (*Branta ruficollis*), corn crake (*Crex crex*), lesser kestrel (*falco naumanni*), marbled duck (*Marmaronetta angustirostris*)

relic nature of the populations, specific habitat requirements, or the species being at the edge of their range.

Of the diverse fauna in the Nakhichevan Autonomous Republic, 49 species or sub-species are listed in the Azerbaijan Red Data Book, many of which are showing population declines or range restrictions<sup>34</sup>, including the bezoar or cliff goat (*Capra aegagrus*), mouflon (*Ovis orientalis*), leopard (*Panthera pardus*), and a number of amphibian species. The Nakhichevan fauna faces a number of direct threats, including the impacts of increased use of natural resources, poor land management, pollution and consequent ecological change since 1989. As a result species such as Caucasian leopard, wild cat and wild boar are no longer seen. Ecological change is particularly evident around the Araz River, where pollution affected invertebrate numbers and has reduced fish species richness from 21 to 16. (Rare plant and animal lists for the Nakhichevan Autonomous Republic are included in Appendices 5, 6 and 7).

## 3.6 Key threats to biodiversity

### 3.6.1 Habitat loss and modification

#### Land Conversion

The major cause of biodiversity loss in Azerbaijan is the decrease in natural environments. This decrease has been due to human (anthropogenic) activities changing or destroying natural habitats. Industry and construction has had an extensive impact on natural habitats. For example, construction on the Absheron Peninsula has reduced the area of natural and unspoilt habitats, and as a result has caused a decrease in the biological diversity on the peninsula.

As a result of political events, about 250,000 people fled from Armenia to Azerbaijan, and more than 700,000 people were displaced from the land occupied by Armenia. These people were settled in towns, temporary camps, hostels and incomplete buildings. New settlements have been constructed in order to improve the way of life for these people, but not all people could be

**Picture3.10.** Habitat conversion to agricultural land near Shamakhi

resettled. Lack of public amenities is causing both health and environmental problems in these areas.

#### Land degradation

A major ecological problem in Azerbaijan is the gradual degradation of agricultural land. At present 3.6 million ha of land are subject to erosion. The soil of large areas of land is also becoming salinated. At present 1.5 million ha of land has been salinated to the extent that it is no longer suitable for agriculture. Salination and erosion of soils tend to be a result of poor

<sup>34</sup> This number includes six amphibians, eight reptiles, 18 bird species and 17 mammals.

irrigation and drainage systems, ground water extraction and wood cutting. In addition, the location of refugee and displaced persons settlements near river-banks and canals can degrade the integrity of the channels.

Grazing by cattle has affected large areas of natural grassland habitats, and has contributed to soil erosion. Overgrazing by cattle reduces the amounts of plant matter available to other natural herbivores in the environment, thus decreasing their numbers and changing the dynamics of the community. Overgrazing can also cause the local extinction of plants in some areas.

Loss of forests is also contributing to soil erosion and land degradation. Forest cover provides a protective function to surrounding lands, without it the soils become exposed and erode, and flooding onto neighbouring lands contributes to further soil erosion.

Land is also affected by the uncontrolled use of fertilizers, herbicides, and pesticides on a large scale, and such habitat modification may reduce biodiversity. In recent years there has been an increase in uncontrolled import of these chemicals into the Republic. There is also little awareness among farmers on the correct use of these chemicals. Overuse can cause a number of negative effects in natural communities and can threaten key species, especially those at the top of food chains. Over recent years, due to the decentralisation and privatisation of companies, and an increase in prices, the level of fertilizer use has decreased (Table 3.9). At present 90-95 % of fertilizers used are nitrogenous, as other types are too expensive.

Table 3.9 Trends in fertilizer use in the The Republic of Azerbaijan since 1987

Year	Tonnes of fertilizer used
1987	301,000
1990	140,000
2000	13,400
2001	10,500

### Habitat Fragmentation

The fragmentation of ecosystems in Azerbaijan is prevalent in several ecosystems:

- **Forests.** The unavailability of natural gas, and other fuels has meant that some communities are using wood as their major source of fuel. Wood is taken from surrounding forests, and as well as destabilising soil complexes this unsustainable cutting fragments the forest ecosystems. In other parts of the country forests are being fragmented as economically valuable timber species (such as nut and oak) are illegally harvested at an unsustainable level.
- **Grasslands.** Converting lowland grassy ecosystems into agricultural land, through ploughing and scrub removal is fragmenting the remaining area of natural steppes. This is also having a significant impact on the population of birds that rely on these unique ecosystems. Many of the steppe ecosystems are also fragmented by irrigation channels and associated constructions (particularly the Kura-Araz plain).
- **Rivers.** The construction of hydrological dams on the major rivers flowing into the Caspian Sea, has created obstacles that effectively fragment the riverine habitat for some species (for example, as a result of the construction of the Mingachevir and Bahramtapa reservoirs on the Kura and Araz rivers). This has reduced the breeding areas for sturgeons because they are unable to pass the dams to reach breeding areas upstream and has resulted in a decrease in their population.

The arid climate of the Nakhichevan Autonomous Republic, characterized by extreme temperatures and low rainfall, makes the land increasingly fragile with respect to anthropogenic impacts (from agricultural and industrial uses), and water management (including irrigation) has had particular impacts on the territory. Misuse of pastures, forests and agricultural lands has reduced their productivity.

Some areas of land have been significantly degraded, including wide areas of grassland habitat along the Araz River, water bodies, forests, scrub and pasturelands. Salination has affected large areas of grassland in Nakhichevan (up to 10,000 ha), particularly in the districts of Sadarak and Julfa. Little efforts have been made to restore these lands over recent years, and as a result these lands are no longer suitable for agriculture and are reverting to marshes. Modern irrigation techniques would need needed in order to recover these lands.

### 3.6.2 Over-use of biological and natural resources

#### Overgrazing of grasslands and pastures

During Soviet times, land was owned by the State, and as such, the people did not view the land as theirs to protect. This resulted in the overgrazing of grasslands and plains in many regions. Furthermore, due to the recent economic decline in the country, many people have attempted to increase their income from natural resources. This has been reflected by an increase in the area and intensity of land now grazed by cattle. The intensive use of pastures, such as in the Absheron and Gobustan area has accelerated the erosion of the soil, and the desertification of the land. Some refugee families and displaced persons have settled and now breed stock in several regions of the country. Unfortunately, because there is no summer pasture for their stock, they remain on the winter pasture all year, which leads to overgrazing to the extent that the pasture can no longer be used.

#### Over use of forest resources

There are many areas in the country where the local populations do not have access to



Picture 3.11. Felled oak tree *Quercus longipes* in Nabran forest

energy sources such as electricity, gas and coal, and imports of wood and coal from Russia has almost stopped. The wood in the surrounding environment has therefore been cut for use as fuel. In many places wood has been cut at an unsustainable rate, and some of the forests that are being destroyed include those that are internationally important habitats. Refugees or internally displaced people represent 12% of the population of Azerbaijan, and live in poor conditions, and

thus rely on wood resources surrounding them to provide fuel to cope with the lack of electricity and the severe winters. They also clear forest to provide land to sow crops. Forests in the occupied territories are also used unsustainably, and the volume of timber extracted from such forests by Armenians continues to increase.

### **Over hunting and persecution**

Uncontrolled hunting of large charismatic animals (and indeed insects) is reducing the populations of a number of species, resulting in some species being at risk of extinction. Existing legislation has set limits in order to regulate the level of hunting. Nevertheless, mechanisms controlling the quotas of fish and animals are not effective, and these limits are often exceeded. The weakness of the structures to regulate the industries means that there is also little information on the actual levels of hunting and fishing. The awareness of local populations is often very poor, in respect to the importance of their local habitats and biodiversity. An example of how this impacts natural populations can be seen with reptiles and amphibians when people destroy the animals, seeing no difference between poisonous and non-poisonous animals.

### **Trade in wildlife**

There is evidence that there is an export trade in rare animals and plants from Azerbaijan. Both the Saker falcon (*Falco cherrug*), and peregrine falcon (*Falco peregrinus*) are hunted and illegally sold abroad.

### **Water extraction**

Azerbaijan is rich in natural resources, and industrial development provides many opportunities for the country. Nevertheless, ecological problems have occurred because of the unsystematic use of these natural resources, and because modern technologies are not always applied to prevent these problems. The extraction of water resources is a particular issue. Of the 35 milliard m<sup>3</sup> of water resources in the country, 5 milliard m<sup>3</sup> of is ground water, and 21,4 milliard m<sup>3</sup> is in the 38 reservoirs, and 900 million m<sup>3</sup> in 450 lakes. According to State sources, approximately 10 milliard m<sup>3</sup> of water is used each year, and just under 3 milliard m<sup>3</sup> of this water is lost due to poor transportation systems. Of the water used, 70% is from neighbouring countries, and there is an annual water deficiency of 4 milliard m<sup>3</sup>.

In Nakhichevan Autonomous Republic over-grazing has affected the productivity of pasturelands, and many areas are suffering from erosion and other indications of degradation. For example, grass is scarce and unproductive in the Araz plains, which act as the winter pastures. These lands would now sustainably support up to ten cows/ha, but densities of up to 300 cows/ha are still recorded. The most productive lands remain within Sharur district, and in some parts of Sadarak district. Nakhichevan's forests have also been over-used as a source of fuel, charcoal and construction materials.

Hunting is prevalent in Nakhichevan, and hunting quotas appear to be generally exceeded. Range of animal rare species is hunted. Fishing is popular for sport, recreation, subsistence and commerce. However, the fish catch exceeds official quotas, and in addition a range of illegal fishing methods are used and fish are illegally hunted during the spawning season. Fish populations are also affected by other factors such as: lack of regulation of water levels; lack of fish protection equipment in reservoirs; and pollution. Trade in a number of wild species is reported from Nakhichevan. These include wild boar, mouflon, mountain goat (bezoar), quail, venomous snakes, and wild plants such as tulips and orchids.

Water extraction is an important issue in Nakhichevan, given its abundance of water bodies and underground water sources. The breakdown, inefficiency and leakage from irrigation systems and reservoirs result in losses of up to 40% of water due to be used for irrigation.

### **3.6.3. Pollution**

#### **Water pollution**

The protection of water resources is important for the sustainable use of resources in Azerbaijan. However there are currently many problems associated with the water

resources in the country (over and above problems of water extraction described above). Polluted industrial waters are entering the Caspian Sea, which is likely to affect biodiversity, and changing water levels of the Caspian Sea damage infrastructure and result in desertification of the shoreline.

The reservoirs of the cities in Azerbaijan are often polluted due to the lack of sewage systems, and purification plants. Of the 75 cities, only 35 have mechanical purification plants. In Baku, only 50% of waste water is purified. Untreated water from domestic and industrial use is often pumped into the Caspian Sea, contributing to the ecological crisis of the sea. Lack of finance prevents much being done, although there are some small local projects that are providing local purification in different regions.

The pollution in the waters is not just from Azeri sources, but also rivers flowing in from other countries. Pollutants (including heavy metals, phenols and petroleum) are carried in water from Armenia (350 million m<sup>3</sup>) and Georgia (330 million m<sup>3</sup>), whilst only 25 million m<sup>3</sup> from Azerbaijan enters the Kura River. The territories occupied by Armenian forces have few ecological controls and there is little sustainable use of water resources there. The Kura River is seriously polluted in these areas, although it also provides Azerbaijan with 75% of its water for drinking and agricultural use.

### **Terrestrial and soil pollution**

In the large cities and industrial zones of Azerbaijan, the lack of regulations has resulted in significant legacies of pollution. On the Absheron peninsula, 10,000 ha of land is polluted with oil. Sumgait city is an extreme case of terrestrial pollution, and in 1992 the Azeri State Committee of Ecology declared it an “ecological disaster zone” as a result of the heavy pollution resulting from industrial activities.

### **Air pollution**

Many of the industrial centres of Azerbaijan suffer greatly from air pollution. In particular, some areas suffer from smog where the polluting compounds (steam, gas, sulphur, nitric oxide etc) mix with the rain. Even now, with many of the industries no longer working, the mix of weather and pollution remains a problem. In Baku, scientists have recorded the presence of many airborne pollutants<sup>35</sup>, and recently a relatively high pollution load has been recorded from the city's atmosphere. Air pollution is also high in the cities of Sumgait, Ganja and Mingechevir (see Table 3.10). In contrast, air pollution is less of a problem in the areas of

**Picture 3.12.** Air pollution

Nakhichevan, Sheki, Alibayramli and Lankaran, although low levels of some pollutants have been recorded.

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<sup>35</sup> Sulphur, steam, smoke, nitric oxide, nitrogen dioxide, hydrate sulphate, soot, chlorine, ammonia, sulphuric acid, phenol, and heavy metals.

Table 3.10 Atmospheric pollutants (number of times above normal levels) in four major cities in Azerbaijan.

Pollutant	Baku	Sumgait	Ganja	Mingechaur
Carbon (soot)	1.4 -3.4	1-1.2	1.2-2.0	1.2-2.0
Phosphorus	2.2-2.5	-	-	-
Chlorine	1-2	1-1.2	-	-
Carbon monoxide	5	5	1.2-1.9	2.0-2.9

The Autonomous Republic of Nakhichevan faces a particular threat from water and soil pollution. At present the area lacks any modern facilities to clean water, and each day 2.4 million m<sup>3</sup> of polluted water from Nakhichevan city is released into the Nakhichevan River, which in turn flows into the Araz River. This contributed to the increasing pollution levels in this river, which also receives 4-5 million m<sup>3</sup> of untreated water from Armenia every day, from both residential and industrial sources (including chemical factories). Sediment loads in the river have increased dramatically, heavy metals may be as much a five times greater than recommended safe levels, and nitrates are particularly high. Salination of land and associated pollution, as a result of poor irrigation practices, is also a major problem in Nakhichevan.

Air pollution is less of a problem in Nakhichevan than in some of the larger cities of Azerbaijan, however concerns are increasing over the impact of vehicle emissions in the territory, particularly from trucks transporting goods over the mountain passes to Iran and Turkey. Lime and cement works in Nakhichevan may also contribute to air pollution. There is an increasing problem in relation to waste disposal from residential, industrial, market and office sources.

#### 3.6.4. Introduced and invasive species

There are several notable species that are considered to be invasive in Azerbaijan. One of the most notable is the comb jelly *Mnemiopsis leidyi* - an introduced species that invaded the Caspian through the Volga Don channel. Its population has now multiplied to the extent that the biomass of the population has exceeded the general productive biomass of the sea. There are no predators for this jelly in the Caspian, and climatic conditions favour its growth and reproduction. It feeds on animal plankton, including the planktonic larvae of fish, and as such, it is capable of seriously undermining economically and biologically important fish populations. This could also impact the rest of the food chain, as top predators, such as the Caspian seal and sturgeon species, are reliant on healthy fish populations.

Of the 21 introduced samples of the invasive species American racoon (*Procyon lotor*), ten males and eleven females were released in the Ismayilli region in 1941 from where they have spread to other regions of the Republic. They are now widely spread throughout the forest ecosystems of Azerbaijan, and hunting of this species is encouraged throughout the year.

#### 3.6.5. Natural pathogens

In Azerbaijan there are many natural pathogenic viruses and bacteria that affect livestock and other animals. Their impact on the animal can be varied, however a high load of parasites weakens an animal and can reduce its immune response. Some of these pathogens are naturally occurring (such as rabies, a highly infectious virus that damages the central nervous system of animals). Viruses and parasitic fungi can affect plants, and many have a damaging effect on crop plants. Pathogenic parasitic protozoa are not great in number. However some are present that infect animal species.

A great number of parasitic worms have been recorded in Azerbaijan, including over 4,000 species of Platyhelminthes (flatworms) and 789 Nematelminthes (nematodes) (of the 24 species to animals and 318 species to plants cause diseases). Diseases caused by parasitic nematodes include a disease in foxes (particularly worrying because of the close links between the habitations of humans and foxes), a fatal disease found in populations of wild and domestic pigs, and other diseases that are found in domestic and wild animal populations. The impact of such disease on populations of wild animals is not fully understood.

Introduced pests (such as the Colorado beetle) have affected a number of agricultural systems in the Nakhichevan Autonomous Republic, as a result of lack of quarantine controls on imports. An agreement of trade and plant quarantine restrictions was reached between Azerbaijan and Iran in 2002, allowing for new regulations on transfer of seeds and other agricultural products, and avoids accidental transfer of key species likely to pose a threat to agriculture (including bacteria, fungi, nematodes, insect pests and weeds).

### **3.6.6. Climate change**

Climate change is an ecological problem on a global scale that poses a recognized threat to all ecosystems and associated biodiversity. Predictions suggest that climate change is likely to have a negative impact on ecosystems in Azerbaijan and may result in increased flooding and desertification, fragmentation of habitats, and species extinction. Over the last century the air temperature in Azerbaijan has increased on average by around half a degree Celsius, with the highest changes in temperature recorded from the Greater Caucasus and the Kura-Araz lowland (0.5 - 0.6°C) and lowest changes recorded in Minor Caucasus and along Caspian shoreline.

Based on global models of climate change, experts estimate that average temperatures in Azerbaijan could increase by as much as 2°C. Associated with this it is expected the incidence of temperature extremes will increase, as will extreme weather events. Particularly important, is a predicted decrease in humidity for much of Azerbaijan.

Such increases could affect the availability of water (particularly in arid regions), which could in turn impact on irrigation, drinking water, and power production. Biological systems would also be affected under this scenario, with predictions of changed ecosystem dynamics and degradation of forest zones. The predictions suggest that the area of deciduous forest will decrease by 20%, while coniferous woodland will increase by 12%, and scrub coverage could increase by as much as 70%. The area of oak forest could reduce by 2-3%, although areas of beech would increase by 15% and hornbeam by 19%.

The warmer climate could increase productivity for a number of plants, and this would favour increased agriculture (including vineyards, cotton and fodder production). However, the increase in evapo-transpiration from the soil could result in increased salination and erosion, ultimately leading to desertification.

### **3.6.7. Natural Disasters**

#### **Floods**

Storms and intensive snow melt can lead to serious flooding in Azerbaijan, most often in the river basins of the south and north-eastern slopes of the Greater Caucasus, and south-west, and north-eastern slopes of the Lesser Caucasus. The flooding is exacerbated by the reduction in plant cover (due to over grazing, and forest clearing). Floods during the period

1994-2003 caused economic damage, and also affected biodiversity, especially in the areas around the mountain rivers of Kishchay, Shinchay, Talachay, Katekhchay, and Kurmukchay. In 1996 there was severe flooding on rivers in the Autonomous Region of Nakhichevan. A flood on the River Kura in 2003 damaged more than 50,000 hectares of arable land. The annual damage is estimated at up to US\$80 million.

Changes of water flow into the Caspian Sea also have a negative impact on the biodiversity of marine and coastal communities. Between 1978 and 1995, 485km<sup>2</sup> of the Caspian Sea underwent a 2.5m increase in sea level. This is thought to have caused economic damage of US\$ 20 million, and also affected coastal communities, and caused oil products from terrestrial oil extraction to mix with the seawater, polluting the marine environment. Future changes of the level of the Caspian Sea could affect many species, such as the threatened species of sturgeon, that rely on moving between unpolluted freshwater and marine environments to breed.

### **Strong winds**

The mountain environment in Azerbaijan can act to intensify the westerly winds on the Caspian coast, in the Kura Basin, and the easterly winds in Nakhichevan. In the last ten years, records show that windy days (with winds more than 25 m/second) have increased in the Republic. During the last three years, rainstorms associated with strong winds have seriously damaged plant growth and productivity.

### **Avalanches**

Although there are avalanches in the mountain regions of Azerbaijan, they have little effect on fauna and flora. Only when the avalanches become too frequent are populations negatively affected. Conversely, herbivores in the regions of Ajhinohur and Kobustan have suffered due to reduced browsing because the snow has been too stable in some years.

### **Temperature extremes**

Extremes in temperature are thought to have a negative effect on biodiversity, and fluctuations in extreme temperatures cause concern. In 2002 the most severe frost on record was measured in the Nakhichevan region and some other highlands. Long-term droughts also affect biodiversity, especially in marshy areas and dry areas where droughts can accelerate the desertification process.

### **Fire**

Fire is not a characteristic of forests in Azerbaijan, and fires started by human activity can have a disastrous impact on biodiversity. In 2002, seven forest fires were started affecting around 46 ha of land, and in 2001 there were 30 fires, affecting 300 ha of land. Uncontrolled fires are normally started in cornfields that are burnt after periods of drought. However in the Talysh mountain meadows and forests do often catch fire in the spring and summer seasons.

### **Fluctuation of level of the Caspian Sea**

Beginning from 1978 up to 1995 485 km<sup>2</sup> coast line of Azerbaijan remained under water at the result of the growth of sea level 2.5 m in the Caspian Sea. At the result of the growth of the level in the Caspian Sea the sea is re-polluted with the oil products. Biogenic elements, organic substance, and heavy metals amounts increase at the result of washing the areas under water or water pressure. Also there were changes in the estuary of the Kura; so in comparison with 1979 the thickness of the sludge grew 1.2-1.4 m. According to the modern research results high humidity will be kept in the Caspian Sea basin as the result of climate heating. If the level grows 150 centimeter, in the Caspian Sea 87,7 thousand ha will remain

under water and it will occupy 1,6% of Azerbaijan area. At the result of expected growth at the Caspian Sea level is one of the important factors to influence the multiply of mine fish. The multiply of mine fish in the river will decrease; the quality of the water on the coastline will deteriorate and the places for spawning will get to worth in shallow coastal areas because of the growth in the sea level.

# **Chapter 4**

## **Use and values of biodiversity**

## Chapter 4. Use and values of biodiversity

Biodiversity has significance to mankind in a range of ways, which may be economic or intrinsic. Biodiversity in Azerbaijan is used directly in a large number of ways, and in addition a range of cultural and aesthetic values are placed on species and ecosystems in the country.

### 4.1. Agrobiodiversity

In general, the Caucasus region is recognized as an important centre of origin for

**Picture 4.1.** Experimental wheat plots at Garabakh Experimental Station, Ter-ter region

agrobiodiversity. Within this context Azerbaijan supports a number of wild relatives and varieties important for agriculture. The cereals and livestock varieties are particularly significant.

#### 4.1.1. Crops under cultivation

##### Cereals

Of 454 species of gramineous plants (*Poaceae*) in Azerbaijan, 25 are cultivated. Azerbaijan is one of the centres of origin for cereal crops, and shows particular variety in the forms of wheat described. Some species of wheat are particularly important for agriculture, including so-called 'tough wheat' (*Triticum durum*) of which 43 varieties are described from Azerbaijan, and 'soft wheat' (*T. aestivum*), which is represented by at least 87 varieties, including a range of hybrid types. Although a range of native varieties of wheat have been developed over time, more recently a number of forms have been introduced associated with more intensive agricultural systems.

Other forms of cereals found in Azerbaijan include barley (*Hordeum spp.*), rye (*Secale spp.*), triticale (*Triticale spp.*), maize (*Zea spp.*) and rice (*Oryza spp.*). Ten species of barley have been recorded from Azerbaijan, of which two are cultivated (of which 500 genetic varieties, including a number of native forms, have been described) while five species of rye occur, although only one of these (*Secale cereale*) is cultivated. Only one species of maize is widely grown in Azerbaijan (*Zea mays*), and 90 distinct genetic varieties are registered. Similarly although only one species of rice is grown in Azerbaijan (*Oryza sativa*), over 80 local varieties have been registered, including a number of traditional cultivars. In the case of triticale (a hybrid of wheat and rye) 326 varieties have been described.

A wide range of other crops are grown in Azerbaijan, including vegetables, potatoes, vines, fruit, tobacco, tea and cotton.

### Horticulture

A range of wild plants are widely cultivated in gardens, with domesticated varieties of fruits and berries having been developed from wild relatives, including apples, pears, walnuts, hazelnuts, blackberries, medlar and others. Over 6000 fruit and berry samples of 150 species are cultivated, many in a range of local forms including notably apricots (*Armeniaca vulgaris*), cherries (*Serasus spp.*), pomegranates (*Punica granatum*) and grapes (*Vitis vinifera*).

Wheat, barley and sweetcorn are currently the main crops grown in the Nakhichevan Autonomous Republic, with wheat being the most extensive crop (both 'tough' (durum wheat) and 'soft' forms are grown). Although millet

Picture 4.2. Apples in Guba region

and rye were once important crops, they are no longer commercially grown. The extent of land planted with grain increases each year, and ongoing efforts are made to increase productivity. In 2002, 73,658 tonnes of grain was produced in the territory, representing over 12 varieties of wheat and three types of barley.

A range of plants have been grown in gardens in Nakhichevan since ancient times, and fruit from the area (particularly from the Ordubad region) is considered to be of high quality. Currently, nearly 2270 ha of land in Nakhichevan is cultivated in gardens, to grow grapes, a wide range of apricot varieties, peaches, plums, apples, mirabelle, cherries, quince, pear, almond, mulberry, lemon, walnuts, pomegranates, blackberries, strawberries, and dates. In 2002, around 28,755 tonnes of fruit were produced. It is suggested that the Ordubad region may be suitable for increased productivity of certain fruits (particularly lemons) for export to world markets. Natural orchards of wild pomegranates grow around Kilit village in Ordubad.

### 4.1.2. Wild ancestors of crops

#### Cereals

Azerbaijan is significant for being a centre of origin for a number of crops, particularly cereals. Wild relatives of wheat, including single-grain wild wheat (*Triticum boeoticum*) and Ararat wheat (*T. araraticum*), are found in the lowlands and foothills, and to some extent in

more mountainous areas. In addition, six wild barley species are common in Azerbaijan<sup>36</sup> and rye is represented in four wild forms<sup>37</sup>

### Other crops

Unfortunately, although Azerbaijan originally possessed a diversity of wild relatives of corn, beans, vegetables, fruits, berries and grapes, along with a range of traditional local varieties, most of these have since been lost due to poor protection and discontinued selection of these forms. Currently, a number of scientific research institutes within the Ministry of Agriculture, along with the Genetic Resources Institute of National Academy of Sciences, are undertaking collection, study and maintenance of examples of agricultural crops and their wild ancestors, to provide the basis for future selective breeding. Research is being carried out on arable crops (cereals, corn, beans and tobacco), vegetables, berries, grapes, fodder species and cotton. Since 1996 significant efforts have been made to increase the collection of genetic material relating to important crops, under the Republican Crop Genetic Resources Program (see Table 4.1).

Some wild ancestors of wheat (*Triticum monococcum*, *T. araratum*, and *T. urartu* occur in Nakhichevan Autonomous Republic, mainly in the area of Garagush Mountain (2600 m).

Table 4.1 Number of species/forms and number of samples of different crop types collected to date under the Republican Crop Genetic Resources Program

Crop	Number of species/forms	Number of samples
Corn	18	15,900
Grain	20	3,500
Vegetables	64	643
Fodder	50	1,500
Cotton	2	1,000
Tobacco	2	90
Fruit, berry and grape	116	7000

### 4.1.3. Livestock diversity

#### Cattle

Three species of long-horned cattle are found in Azerbaijan - neat, buffalo and zebu. A range of long-horned cow breeds are found in the country, including brown Caucasus (a local breed), black-light, Simmental, Kostroma, Svis, brown Lithuania, Lebedin, red desert, red Eston, Holstin Friz, Aberdeen Angus, Limousine and Hallovey. Buffalo numbers in Azerbaijan are significant (over 300,000) with most being privately owned, and these are an important source of milk and meat.

#### Sheep

Sheep-breeding has been widely developed in Azerbaijan, with a range of breeds specialised for fine fleeces, rough fleeces and meat/milk. Traditional forms include Azerbaijan mountain merinos, Bozakh, "Shirvan", "Garabakh", Mazex, Balbas, Jaro, and Herik, while a number of other breeds (Sovet merinos, Askaniya, Prekos) have been introduced into the country.

#### Goats

Goats have been selectively bred in Azerbaijan since ancient times. Since 1936 these native breeds have been supplemented by Angora goats from Turkey (concentrated in the Ganja-Gazakh and Upper Karabakh regions).

<sup>36</sup> Wild barley (*Hordeum spontaneum*), blue barley (*H. glaucum*), bulbed barley (*H. bulbosum*), violet barley (*H. violaceum*), and rye barley (*H. secalinum*)

<sup>37</sup> Weed-field rye (*Secale segetable*), Transcaucasian rye (*S. vavilovi*), Anatoly rye (*S. anatolicum*), and wild rye (*S. silvestre*)

### **Pigs**

Four breeds of pigs are regularly kept in private farms in Azerbaijan - big white pig, Ukrainian white desert pig, white Lithuanian pig and big black pig.

### **Horses**

Azerbaijan is one of the countries where the horse was first domesticated and bred in ancient times. A number of famous horse breeds originated in Azerbaijan - including the "Karabakh" and "Dilbaz" breeds, and the less well-known "Guba" and "Shirvan" forms. Three key genetic forms of horse are recognised in the country: (i) Lower Caucasus type which originated in the foothills region of little Caucasus; (ii) Large Caucasus type, which are smaller forms originating from the higher mountain areas; and (iii) plain type - a larger workhorse from the Kura-Araz plateau. In addition a range of foreign horse breeds have been imported over the last 50 years (including English, Arab, Terek, Turkman, Budyonni, and Traken races).

### **Poultry**

A number of common domesticated chickens (white rus, Leggorn Red Aylend Nyu-hempshir and Broyley-6) are bred for meat and eggs, alongside more traditional local hen breeds. Local Indian hen breeds are found in Guba-Khachmaz, Upper Karabakh, Shirvan, Ganja-Gazakh regions. Domesticated ducks (Pekin) were introduced in 1956, while a range of different local goose breeds have been developed in the Republic. These forms are adapted to local climatic conditions and do not require supplementary feeding as long as pasture is available.

#### **4.1.4. Wild relatives of domesticated livestock**

##### **Goats**

Two species of wild goat are found in Azerbaijan. Notably, the bezoar or cliff goat (*Capra aegagrus*) is a species dating from prehistoric times, and is smaller than other wild goats, with a body length of 140-160 cm and height of less than 85 cm. The species is also distinguished from other goat species by the shape of its horns and its colouration (reddish-brown). Bezoar goats are distributed in the Lesser Caucasus (including the mountain chains of Shahdag and Murovdag), in the Upper Garabag, in Lachin and Kalbajar rayons, and in Nakhichevan are common in the mountain chains of Zangezour and Nasirvaz.

##### **Sheep**

The Asian mouflon (*Ovis orientalis*) occurs in Azerbaijan. It is a small species (standing up to 83 cm high, with a body length of less than 115 cm), with a short tail and curved horns. The species is found in the southern Caucasus (Alinja, Ilandag, Nasirvaz, Gapijig, Nehramdag and surrounding chains).

##### **Pigs**

Wild boar (*Sus scrofa*) is common throughout the Caucasus where a sub-species has been described. Wild boar are found in all forests and reed thickets in Azerbaijan and are the most common wild hoofed mammals in the Republic, and are a focus for hunting.

A range of local domesticated breeds of buffalo, goat, and sheep are found in the Autonomous Republic of Nakhichevan, along with wild ancestors of livestock such as mouflon and bezoar goat and wild boar live in the territory.

## 4.2. Wild species of economic importance

### 4.2.1. Use of wild plants

#### Food plants

A wide range of Azerbaijan's flora is used as a source of food. Key food species and their uses are listed in Table 4.2 below.

In addition, a number of other wild plants produce fruits and vegetables used in Azerbaijan, including cherries, plums, cornel tree, hawthorn, forest strawberry (*Fagaria vesca*), Russian cherry-plum (*Grossularia reclinata*), sea-buckthorn (*Hippophae rhamnoides*), apple, medlar, cherry-plum, blackthorn (*Prunus spinosa*), raspberry (*Rubus caesius*), dog-rose (*Rosa spp.*), blackberry (different varieties of *Rubus*), garlic (*Allium sativum*), onion (*Allium cepa*), and leeks (*A. porrum*).

Table 4.2 Key food species and their uses

Common name	Botanical name	Use
Chestnut	<i>Castanea sativa</i>	The nut is eaten roasted or raw; chestnut flour is made from the nut, and is combined with wheat flour to bake bread
Hazel-nut	<i>Corylus avellana</i>	Hazel nuts are eaten roasted or raw, and are widely used in bakery and confectionery products
Beech	<i>Fagus orientalis</i>	Fruits are eaten instead of sunflower seeds, and valuable oil is also acquired from its fruit
Linden	<i>Tilia caucasica</i>	Flowers and leaves are used for teas and tisanes, and linden flowers are a source of nectar for honey production
Shepherd's purse	<i>Capsella bursa pastoris</i>	Young leaves are used in making soup and borsch
Millet	<i>Echinochloa oryzoides</i>	Thick roots are pickled and eaten fresh
Ferula	<i>Prongos ferulaceae</i>	Cooked or pickled
Cow-parsnip	<i>Heracleum trachyloma</i>	Leaves and stem are eaten.
Sorrel	<i>Rumex spp.</i>	Leaves and stem are used
Caper	<i>Capparis herlacea</i>	Buds are pickled
Sugar cane	<i>Sorghum saccharatum</i>	Used to produce syrup and doshab (boiled down fruit juice)
Cockspur	<i>Echinochloa crusgalli</i>	Nutritional uses (America)
American Millet	<i>Milium effusum</i>	Seeds are used in baking bread
Chervil	<i>Chaerophyllum aureum</i>	Seeds are used as fodder for domestic animals and poultry

#### Timber

Around 400 species of trees and bushes are recorded in Azerbaijan (representing nearly 10% of the country's flora) and approximately 11% of the land area is forested. Timber provides a source of materials for construction and furniture making. Key timber species include hornbeam (*Caprinus spp.*), Georgian oak (*Quercus iberica*) and beech (*Fagus spp.*).

#### Medicinal plants

Around 800 plant species of medicinal value have been recorded in Azerbaijan, including 150 species used in pharmacology. Key medicinal plants include elecampagne (*Inula*

*helenium*), *origanum* (*Origanum vulgare*), coltsfoot (*Tussilago farfara*), valerian (*Valeriana officinalis*), and *Helychrisum arenarium*, with 33 dried products obtained from these plants, which are mainly traded by "Azerfarm Ltd". In addition a range of oil-based products are developed through cold pressing of various plants (including various nuts and fruits), and a traditional medicine called doshab (a concentrated syrup, usually of mulberry) is produced from a range of wild plants, including mulberries, medlar and rosehips. Currently there is a growing recognition of the importance of extending the cultivation of medicinal plants, and moves towards certification is necessary to broaden the access to European markets.

### Plants in foreign trade

A number of plants from Azerbaijan have attracted foreign businessmen, and some valuable plants are exported abroad, including cultivated liquorice (*Glycyrrhiza glabra*), linden (*Tilia cordata*), cane (*Phragmites australis*), reed (*Arundo donax*) and nettle (*Urtica dioica*).

The population of the Nakhichevan Autonomous Republic use wild plants for medicinal, food, wood, dyes and other purposes. Many of the species collected are rare, endemic or endangered. A great number of plants (up to 750 species) are used in traditional remedies and medicines, and resources of Nakhichevan can be seen as a 'natural pharmacy'. The level of collection of some natural products is relatively extensive.<sup>38</sup> A few of these are currently commercially cultivated (by the "Scientific-Production Co-operative for Medical Plants", and further expansion of cultivation may be an option in future.

Some plants are recognized as important sources of pollen and nectar for honey<sup>39</sup>, and others provide flavourings for natural beverages and teas<sup>40</sup>. A number of plants are used as food, either raw, cooked or preserved<sup>41</sup>. A wide range of plants are recognized as important sources for aromatic and essential oils<sup>42</sup>, camphor<sup>43</sup> and other extracts<sup>44</sup>, and *Carpodium platycarpum* is recognized as a plant of potential medical and economic importance, restricted to Nakhichevan. Commercial production of essential oils from these plants may be possible in Nakhichevan. Other species of note include liquorice (*Glycyrrhiza glabra*), and decorative plants such as tulips and Caucasian oak.

## 4.2.2. Use of wild animals

### Hunting

Traditionally a number of mammals (fox, bear, wild pig, hare) and birds (duck, goose, quail) have been subject to sport and commercial hunting. In recent years there has been a growth in interest in sport hunting in Azerbaijan, focused on large and charismatic species. The local bodies of the Ministry of Ecology license such hunting.

<sup>38</sup> Figures for 1988 indicate production as follows: rose hips (83 tonnes), hawthorn (82 tonnes), wild apples and pears (157 tonnes) and thyme (56 tonnes).

<sup>39</sup> For example *Chamaenerium angustifolium*, *Melilotus officinalis*, *Lamium album*, *Onobrychis transcaucasica* and *Salvia limbata*

<sup>40</sup> For example, *Berberis vulgaris*, *Padus mahaleb*, *Jornus mas*, *Malus orientalis*, *Orchis mascula*, *Origanum vulgare*, *Prinus divaricata*, *Pyrus salicifolia*, *Ribes bibersteini*, and *Rubus iberica*

<sup>41</sup> For example, *Rheum ribes*, *Dorema glabra*, *Prongos ferulaceae*, *Chaerophillum auranta*, *Eremurus spektabilis*, *Falcaria sioides*, *Heracleum trachiloma*, and *Carum caucasicum*

<sup>42</sup> For example, *Caropodium platycarpum*, *Nepeta cataria*, *Thymus transcaucasica*

<sup>43</sup> Extracted from Siberian white pine (in Soviet times)

<sup>44</sup> For example *Betula pendula*, *Conium maculatum*, *Valeriana sisymbriifolia*, *V.tiliifolia*, *Inula helenium*, *Cris sulphure*, *Chenopodium botrys*, *Zizifora spp.*, *Mentha longifolia*, and *Tanacetum millifolium*

## Fishing

Fishing occurs in freshwater internal water systems (Mingachevir reservoir, the Kura and Araz rivers), as well as in the Caspian Sea, utilising the many valuable kinds of fish found in Azerbaijan. Most economically valuable are the sturgeon (Acipenseridae), which is a high fat-content fish and is the source of caviar. Four species of the genus *Acipenser* are considered to have a particularly fine taste: ship sturgeon (*Acipenser nudiiventris*), sterlet (*A. ruthenus*), Russian sturgeon (*A. guldenstadtii*), and Kura sturgeon (*Acipenser stellatus cyrensis*). There are several hatchery programmes that release juvenile fish to support the existing populations (see Table 4.3).

In addition, other species that are fished commercially include a number of Clupeiformes



**Picture 4.3.** Trophy hunting for Dagestan tur *Capra cylindricornis* in Sheki region

(herring). Sprats (*Clupeonella spp.*) are a source of bone meal for use in agriculture (for both poultry and livestock). The local population also uses a number of other species of the family Cypriniformes (carp) which are considered to be good to eat, including: Asp (*Aspius a. taeniatus*), Balic vimba (*Vimba v. persa*), Black Sea roach (*Rutilus frisii kutum*), common carp (*Cyprinus c. carpio*), North Caspian roach (*Rutilus rutilus*), Caspian bream (*Abramis brama orientalis*), Kura bleak (*Chalcalburnus chalcoides guldenstadt*) and Danubian bleak (*Ch. chalcoides longissimus*).

Fish species	1990	1995	1996	1997	1998	1999	2000	2001	2002
Acipenseridae (Sturgeons)	17.52	1.24	4.10	6.10	6.22	20.29	17.85	12.90	15.05
Salmonidae (Salmonids)	0.14	0.01	0.10	0.08	0.09	0.03	0.05	0.03	0.07
Cyprinidae (Minnows/carp)	531.67	315.41	440.37	467.85	455.31	483.60	513.34	510.13	464.50
<b>Total</b>	<b>549.33</b>	<b>316.66</b>	<b>444.57</b>	<b>474.03</b>	<b>461.62</b>	<b>503.92</b>	<b>531.24</b>	<b>523.06</b>	<b>479.62</b>

### Medical use

Leeches (*Hirudinea medicinalis*) are used by the general public for the treatment of different diseases and hirudin<sup>45</sup> from leeches is considered to be a precious medical remedy. In addition, until the mid 1990's a special institution existed to collect venom from the Levantine viper (*Macrovipera lebetine*) populations.

There is a long history of the use of wild animals in Nakhichevan Autonomous Republic, including hunting of birds (such geese, ducks, bustards, quail, and partridge). Among the birds hunted in Nakhichevan are a number of locally endemic sub-species of non-migratory birds, which may be at particular risk from over-exploitation combined with loss of habitats and fires<sup>46</sup>. In addition, other species caught by the general population include mountain goats, mouflon, fox, wolf, jackal, and vipers (including Radde's viper).

A wide range of fish is caught within Nakhichevan's rivers and lakes, particularly from the Araz River and reservoir. There is also fishing on the Iranian bank of the Araz. Fish populations have declined as a result of unsustainable offtake (particularly during the sensitive spawning period), use of illegal fishing devices, and overfishing from the Iranian side of the Araz reservoir) and as a result of pollution, changes in water composition and reduced invertebrate populations in the Araz River.

### 4.2.3. Evaluation of sustainability of use of wild species

The fauna and flora of different areas of Azerbaijan face different anthropogenic threats, resulting in inconsistent patterns of distribution of key biological resources. For example, the biological resources of the Caspian Sea are threatened as a result of its isolation from other oceans, and the intensity of pressure on its resources. In addition, the steppe and semi-deserts of the Kura-Araz and Absheron plains are threatened, as are the forest resources of the Greater and Lesser Caucasus Mountains. The regions with greater resilience to use of resources include the wetter areas in the subtropical regions (such as Astara and Lankaran), where the dry subtropical forests recover well and can be sustainably managed.

## 4.3. Use of biodiversity for biotechnology and genetic collections

Biodiversity is used for scientific and industrial purposes through biotechnology. Genetic material is sourced from wild and cultivated plant species and is maintained *in vitro* for both conservation and scientific goals. Forms of tomato, tobacco, wheat and roses have been developed under laboratory conditions. In industry, genetic material from wild and cultivated plants is used to develop hybrids with specific characteristics.

## 4.4. Indirect uses of biodiversity

Azerbaijan provides suitable conditions for the development of ecotourism, particularly for holidays based on bird-watching. Interesting bird populations can be observed at all times of year (for wintering, migration and breeding), and large colonies of herons, cormorants, gulls and tern can be seen in reed beds and islands. In winter extensive flocks of little

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<sup>45</sup> From the saliva glands of the leech

<sup>46</sup> Quail (*Coturnix coturnix coturnix*), rock partridge (*Alectoris graeca jaujisijus*), grey partridge (*Perdix perdix janesjens*), Caspian snowcock (*Tetraogallus caucasicus taurijus*).

bustards, eagles, and griffon vultures are seen in the lowlands, and large populations of water birds gather are concentrated along the Caspian coast and in inland water systems.

## 4.5 Cultural or traditional values of biodiversity

### 4.5.1 Wildlife and national cuisine

In Azerbaijan, the national cuisine reflects the traditional methods of food preparation, but incorporates the availability of foods and requirements of a modern diet. A range of agrobiodiversity and wild species are traditionally used within the national diet. Most dishes are prepared from veal, mutton and poultry. The region is also rich in fish - the main species consumed are sturgeon caught in the lake, rivers, and the sea. Meals are often prepared with a variety of ingredients to add taste. Ingredients include lemon, olives, vinegar, pomegranate syrup, plums, grapes, cherries, apricots, fruit paste, and sumakh spice.

Meals are accompanied by rice, bread, and a variety of vegetables, predominantly aubergine, tomato, sweet peppers, cabbage, spinach, sorrel, beetroot, turnip, and onion.

Herbs such as saffron, caraway, anise, laurel leaf, coriander, mint, dill, parsley, celery, tarragon, basil

**Picture 4.4.** Azeri cuisine: Starred sturgeon *Acipenser stellatus*

and thyme are also commonly served with, and accompany meals. These ingredients are also combined into salads. Other popular foods include caviar, omelette with vegetables or walnuts, fried beans and walnut, and other snacks. Mixes of garlic, aubergine, and hot pepper, are preserved with salt or vinegar and are served with meat courses.

Meals usually start with strong black tea, to aid digestion, and for social reasons. Tea is often served with fruit preserves made from quince, watermelon, cherry, peach, plum, walnut and mulberry. The tea is sometimes flavoured with herbs and spices, such as thyme, cloves and cardamom to add flavour. In addition, the natural waters of Azerbaijan are rich in minerals and are believed to promote good health.

### 4.5.2 Arts, folklore, and music

Located between the Middle East, Europe and Asia, on the ancient 'Silk Route', Azerbaijan has historically played an important part in the world economy and exchange of culture. This history is reflected in the creative culture existing today through highly skilled musicians, astrologists, sculptures and craftsmen. Azerbaijan has a great artistic history, with craft methods passed down through families. Many types of folklore are depicted through art, music, dance, and in the history of architecture, and much of this folklore is

related to the natural resources of the region and reflect the close relationship between culture and natural history.

The culture is globally renowned for its cultural and spiritual achievements. Ancient customs and traditions remain significant in the spiritual lives of modern Azeris. Families have played a central role in maintaining these traditions through the generations. Religious events are celebrated as national holidays, such as 'Gurban Bayrami' (the day of the sacrificial slaughter of an animal). The 21st of March (the equinox) is 'Novruz Bayramy', a celebration of the coming spring. Rural communities also celebrate the harvest on 'Harvest holiday'. For all these celebrations Azeris prepare food as gifts for friends and relatives.

National crafts reflect the rich biological resources of the country. The main crafts are carpets, silks, jewellery, and wood, stone and metal carvings. The internationally renowned carpet makers are found in Guba, Shamakhi, Ganja, Gazakh, Garabach, and the villages around Baku. Carpets traditionally are made using plant dyes and wool.

**Picture 4.5.** Girls in national Azeri dress at Novruz Bayram (20th/21st March) with bowls of sprouting wheat to celebrate the coming of spring

Azeri literature depicts the many ancient traditions of the country, and many great authors (such as Khagani,

Nizami, Fizuli, Nazimi, Vagif, Sabir, Jalil Mammadguluzadeh, and Husseyn Javid) reveal the close relationship between the culture of the region and its biodiversity.

### **4.5.3 Spiritual values of biodiversity**

One of the unique aspects of Azeri culture is the variety of religions that are currently and historically practiced (see Chapter 2). Many religions teach the importance of biodiversity.

### **4.5.4 Recreation and biodiversity**

Due to the need to house more than one million refugees in Azerbaijan, there is great pressure on recreation sites. The areas traditionally used for recreation and spas are now used for sheltering these people. Of the 12,000 tourist sites, 10,000 are occupied by refugees - despite the fact that these sites are unsuitable as permanent settlements.

The main areas used for tourism and spa use are within the Absheron, Nabran, Kura, and Lenkoran coastal resorts, and tourists visit such resorts over five months of the year. Changes in the level of the Caspian Sea have caused a great number of recreational centres on the coast to be flooded. Other areas in the forested mountain regions of Guba, Shemakha-Ismaili, Belokan-Gabala, Kelbajar, Karabakj, Kedabek, Nakhichevan and Ganja-Naftalan are visited because of the presence of thermal springs and medicinal mud volcanoes. Over 250



**Picture 4.6.** Guest house in hornbeam *Caprinus spp.* woodland Gachresh, Guba region

recreational sites have been identified in these regions, within a total area of 35,000 ha (much of which is forested).

**Chapter 5**  
**Key economic sectors affecting**  
**biodiversity**

## Chapter 5

# Key economic sectors affecting biodiversity

### 5.1 Agriculture

#### 5.1.1. Current situation

In 1995, agriculture contributed 33.4% to the total GDP of the country, however by 2002 this percentage had reduced to 21% of GDP, although agricultural production has grown over this period (Table 5.1). Land reforms set up new privatized farms in the place of the former sovkhoses and kolkhoses. In 2002, 240,000 ha of land were in agricultural use, a decrease of 3.8% since 1995.

**Picture 5.1.** Harvesting wheat in Saatly region

*Table 5.1 Estimated outputs for different agricultural products in 2002, and the percentage increase since 1995*

Product	Production in 2002	Increase since 1995
Grain	2,196,000 tonnes	2.4%
Potatoes	695,000 tonnes	4.5%
Vegetables	975,000 tonnes	2.3%
Horticultural plants	330,000 tonnes	7.9%
Fruits	517,000 tonnes	59.8%
Meat	125,000 tonnes	52.0%
Milk	1,120,000 tonnes	35.5%
Wool	12,000 tonnes	31.1%
Eggs	562 million	5.8%

In the period since 1995 the move to a market economy has impacted both the rural economy and living conditions, with the reforms of State farms and Socialist co-operatives (sovkhoses and kolkhoses) which resulted in the privatization of land and livestock, and the end to State control on production, marketing and prices. New private farms were established, and nearly 100% of production was within the private sector. Private farms have increased employment within local communities; in 2002 just over 40% of Azerbaijan's employment was within agriculture and forestry (together supporting nearly 1.5 million people), compared to 31% employment in these sectors in 1995. There has been a disproportionate move into agricultural jobs compared to other sectors. The profitability of the agricultural sector has also increased, with a reduction in the number of companies operating at a loss (down from 47% in 1995 to 36% in 2001) and profitability across the sector rated as +1.1% (compared to -4.7% in 1995).

In such an arid country, irrigation is an important measure to maximise the area of land suitable for agriculture, and an extensive irrigation system was established in the country between 1970 and 1990, consisting of 49,000km of irrigation channels, 30,000km of drainage

collectors, to help regulate the water system. At present 3,200,000 ha of land are irrigated. However, much of the irrigation system has fallen into disrepair, causing problems where ground waters have increased and land has become salinated. Currently 385,100 ha of irrigated land is in not suitable condition.

### **Livestock breeding and pastures**

The extent of livestock has increased significantly in recent years. In 2002 there were estimated to be 2,153,000 cattle and 6,800,000 sheep and goats in Azerbaijan, an increase since 1993 of 49% and 51% respectively. As a result of land privatization, livestock are now owned by private companies and individuals.

In the last 20 years, out of 80 infection and invasive diseases that are included in the International Epizodic Bureau list A and B, 38 diseases have been found in the livestock of the country. Foot and Mouth Disease has been a problem amongst CIS countries since 2001, and remains the main health problem for livestock in Azerbaijan. Sixteen control points have been established for meat inspection, but disease control is hindered by lack of finances and equipment.

Azerbaijan has the greatest extent of pastureland within the southern Caucasus region, totalling 3,873,800 ha (including 1,548,900 ha of winter pastures, 602,900 ha of summer pastures and 1,722,000 ha around villages). Despite the existence of such large areas of natural pasture, only 43% of winter pasture, and 29% of summer pasture was provided for sheep in 2002, and just 24% of the pasture surrounding the villages was used to graze cattle. However, grazing densities for cattle were high, and were estimated to be over twice recommended grazing norms. Intensive use leads to erosion, changes in the structure of the pasture community and an increase of invasive species. Productivity of pasture lands in some places has reduced by 2-3 times, and the level of fodder has reduced by 50-60%, and it is thought that 70% of pastures are threatened by erosion, and 16-20% had become salinated. Research shows that the area of land suitable for both winter and summer pastures has been significantly reduced. Despite this, there are few measures are being followed to maintain the productivity of the pastures, and some pastures are being used inappropriately (for example for conversion into cropland, which destroys the pasture and increases risks of salinisation and erosion).

As a result of the agricultural land reforms, local executive bodies and municipalities have been given ownership of the pastures. These are then leased to organizations or individuals for 10-15 year terms. According to the Ministry of Agriculture figures for 2003, 785,400 families own the lands in the rural regions of Azerbaijan, to keep a total of 5,969 thousand animals. Out of owned 1,395,100 hectares of winter pastures and 570,000 hectares of summer pastures only 2,946,000 and 1,941,000 of animals accordingly may be kept. However, in some cases there are problems with this system as people wish to avoid the charges associated with leasing land. In addition, the influx of refugees and internally displaced people into rural areas has placed additional pressure on the agricultural environment, as use is intensified around refugee camps and centres.

In Nakhichevan Autonomous Republic, as elsewhere in Azerbaijan, recent land reform has had significant impacts on agriculture, resulting in upturn in this sector. Over 99% of agricultural output is now produced by the private sector. In 2000, agricultural products were worth 269 billion manats, which was 29.6% higher than the previous year. As a result of internal markets, production was increased for almost all products, apart from tobacco for which production fell by 81% between 1999 and 2000. Livestock numbers have also risen.

Despite a drought in 2002 agricultural output remained high<sup>47</sup>. In 2001, 15,724 ha of land were under cultivation (an increase of 46% on 1999), and productivity of this land also increased over this period, particularly in terms of grain production. However, one identified threat to ongoing production is the spread of a number of weed species, and measures are needed to prevent their further expansion. Weeds are also invading a number of pastures and hayfields, associated with their over-use and degradation, and some of these weeds are poisonous to livestock. As elsewhere in Azerbaijan, Nakhichevan relies on irrigation systems to support intensive agriculture, and much of the irrigation infrastructure is in a poor state of repair. Salination contributes to land degradation and the change in grassland communities to more salt-tolerant forms.

Limited access to pastures results in overstocking (with densities of up to 150 head/ha), and privately owned flocks from villages are often pastured freely on communal land, with little awareness of regulated use, resulting in trampling of vegetation, erosion, change in plant communities and destruction of natural habitats.

### **5.1.2 Impacts of agriculture on biodiversity**

- Part of the land has been converted from natural grasslands into agricultural (cultivated) land, reducing the total area of native habitat in the country. The distribution of endemic, rare and threatened plants is not taken into account when land conversion is planned.
- Land degradation as a result of over-use of pastures has significant impacts on grassland biodiversity, as the species composition and productivity of pastures reduces as they become invaded by more tolerant and unpalatable species.
- Irrigation channels result not only in the fragmentation of habitats, but also such structures prevent the free movement of animals and plants, and often prove fatal to animals that fall into them and become trapped.

## **5.2 Forestry**

### **5.2.1. Current situation**

Azerbaijan is a country with few forests, and total forest area represents just 1,178,500 ha or 11% of the territory. 934,500 ha are mainly State owned with only 54,000 ha in private or community ownership. The forests support a significant timber resource (Table 5.2), although the densest forests are found away from human habitation.

Forest area and density is declining as a result of the reliance of local population on timber for fuel. The Ministry of Ecology and Natural Resources is responsible for forest management, and is operating around 40 organisations focusing on forest protection and restoration. Recent legislation<sup>48</sup> has established a programme to restore 200,000 ha of forest and to plant a further 43,000 ha of new forests. This programme of work is to be implemented by the Ministry, and forest restoration work already increased by 1.6 times between 2001 and 2002.

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<sup>47</sup> Agricultural output in 2002 included 54,428 tonnes of grain, 13,454 tonnes of potatoes, 42,723 tonnes of vegetables, 33,567 tonnes of melons, 28,444 tonnes of fruits, 14,015 tonnes of grapes, 45,499 tonnes of sugar-beet and 28,200 tonnes of tobacco were produced

<sup>48</sup> Presidential Decree " National Programme on the restoration and increase of the forests in the Republic of Azerbaijan" dated 18<sup>th</sup> February 2003

Table 5.2 Estimated amount of timber resources in Azerbaijan, divided by main forest types

Forest type	Timber resources (m <sup>3</sup> )
Pistachio forest	59,730,000
Oak forest	27,970,000
Beech forest	26,220,000
Mountain forest	110,920,000
Coniferous forest	114,850,000

Few forests exist in Nakhichevan Autonomous Republic, and most of these are open 'park-like' forests, which are highly fragmented. Most of the forests are located in Shabuz region, at Batabat and around the village of Bichenek. No forests exist in the regions of Sederek or Sherur. Cutting of forests over recent years has fragmented woodland, resulting in scrubby re-growth and in some places management of grassland on forest edges is preventing natural regeneration. Pests are also a problem in the remaining forests.

### 5.2.2. Impacts of forestry on biodiversity

- Forests are affected by both ecological and anthropogenic factors throughout Azerbaijan, but the over use of forest resources (as a result of economic pressure and fuel shortages) has led to decline in forest areas (particularly within Nakhichevan Autonomous Republic).
- Recent restitution of forests (for example in Nakhichevan) has also contributed to forest destruction. In addition, a number of forest areas have been cleared for agriculture.
- Forests support important mammalian and avian biodiversity, but a range of forest species such as bears, wild boars, lynx and birds continue to be hunted, and it is not clear whether levels of exploitation are sustainable.

## 5.3 Fisheries

### 5.3.1. Current situation

The country's large reservoirs<sup>49</sup> and the lakes around the River Kura are the key areas for the freshwater fishing industry. However, the construction of dams on the River Kura has reduced the water supply to some of these lakes, and the productivity of the lakes for fisheries has declined. In the last 50 years the productivity of the fisheries has declined 15-20 times (see table 5.3). This is due to overfishing and a reduction in the release of farmed fry into the lakes and reservoirs.

Fish	1990	1995	1996	1997	1998	1999	2000	2001
<i>Acipenseridae</i> (Sturgeons)	0.08	0.16	0.12	0.13	0.08	0.10	0.09	0.07
<i>Cyprinidae</i> (Minnows and carp)	2.33	0.43	0.36	0.28	0.28	0.36	0.33	0.08
<i>Clupeonella spp.</i> (sprats)	38.80	9.30	6.70	5.05	9.00	20.44	22.00	9.00
<i>Alosa spp.</i> (herrings)	0.30	0.07	0.09	0.04	0.06	0.06	0.06	0.05
<b>Total:</b>	<b>41.51</b>	<b>9.96</b>	<b>7.27</b>	<b>5.50</b>	<b>9.42</b>	<b>20.96</b>	<b>22.48</b>	<b>9.20</b>

<sup>49</sup> Varvara, Mingachevir, Yenikand Reservoirs, and Hajigabul, Ag-gol, Sari-su, Mehman-gol and Jandar-gol

In recent years there have also been serious declines in sturgeon populations. This decline is thought to result from a combination of overfishing, loss of spawning areas (due to the construction of dams on the rivers Kura and Araz), and the introduction of the invasive comb jelly (*Mnemiopsis leidyi*) into the Caspian. An inter-state commission established to regulate the Caspian's natural resources set quotas for the fishing of sturgeon, which in 2003 totalled 1,483 tonnes of sturgeon (of which Azerbaijan's quota was 130 tonnes).

The current focus of fisheries development in Azerbaijan is the restoration of populations of economically valuable fish species in the Caspian Sea, and to internal waters of the country, led by a department within the Ministry of Ecology and Natural Resources. This office acts to restore fish populations through artificial methods, and has helped to protect species such as the sturgeon and carp. However, parts of the fish reproduction facility have been damaged due to changes in sea level. In 2002 632.2 million manats was invested by the Government in fisheries administration and operations.

Declines in fish stocks have been very notable in the Autonomous Republic of Nakhichevan, as a result of a number of factors. Although Nakhichevan's fish catch increased in the 1980's (to over 260,000 kgs in 1989), there has been a sharp fall during the 1990's through to 2002 (when only 41,800 kgs were caught). Over this period there has also been a change in catch composition. For example sazan carp (*Ciprinus carpio*) represented over 90% of the catch in the 1980's, but only 13% of the catch since 2000. In Nakhichevan one organisation

**Picture 5.2.** Fishing for sturgeon *Acipenser spp.*

undertakes artificial fish breeding (Fishing JV), and reintroduces fry into waterways. Two companies, Nakhichevan Fishing Office and Lake Fishing Private Company (in Tumashli village of Sharur district) have licences to fish commercially, but their quota are reduced each year

### **5.3.2. Impacts of fisheries on biodiversity**

- Fish populations and diversity in inland water have been reduced as a result of changes in water flow (following damming of key rivers), pollution loads, and overfishing.
- Sturgeon populations in the Caspian have been reduced as a result of sustained overfishing combined with destruction of spawning grounds associated with damming of rivers

## 5.4 Industry

### 5.4.1. Current situation

The climate of economic reform has seen a steady development of industry in Azerbaijan over recent years. By 2002, over 5,000 companies were registered, with annual industrial growth equivalent to around 5%. The privatisation of state enterprises has resulted in an increase in market share by private enterprises (up to 47% in 2001, compared to only 5% in 1995). Industry has grown in a number of sectors<sup>50</sup>, but is dominated by crude oil production. In 2001, Azerbaijan produced 14.9 million tonnes of crude oil.



Picture 5.3. Aluminium factory in Ganja

The economic crisis of the early 1990s resulted in the closure of many industries, and a consequent reduction in the outputs of industrial waste and pollution. Between 1990 and 2001, water pollution, air pollution and water extraction (mainly by industry) were significantly reduced (Table 5.3).

*Table 5.3 Comparison of emissions and water extraction by industry between 1990 and 2001, and % reduction over this period*

Output or extraction	Total levels		% reduction
	1990	2001	
Water extraction (m <sup>3</sup> )	16,176,000	10,012,000	38%
Polluted water (m <sup>3</sup> )	303,000	170,000	44%
Air pollution (tonnes)	2,846,100	978,900	66%

However, a legacy of industrial pollution from Soviet times still persists in Azerbaijan. Many of the old industrial facilities were poorly decommissioned resulting in ongoing soil pollution and leaching into water sources, and 8 millions tones of toxic waster remain untreated. Mediation works have been initiated, and in 2001 over 100,000 million mantas were spent on environmental protection and restoration.

In the Autonomous Republic of Nakhichevan the industrial sector consists of 163 companies making some 15 products<sup>51</sup>, of which 37 are large operations. Total industrial output was worth 70 billion manats in 2002, with a predicted growth of 1-2% from 2002-2003.

<sup>50</sup> Including crude oil extraction, petroleum processing, nitrogen extraction, chemical plants, iron and steel production, cement, manufacturing of oil industry equipments, refrigerators and food processing (including meat products, milk products, flour, alcohol, tea and tobacco).

<sup>51</sup> Examples of enterprises include: electrical factory, stone processors, salt production, mineral water processing, knitting and sewing enterprises, carpet factory, glassware products and furniture factory.

## 5.4.2. Impacts of industry on biodiversity

- The key biodiversity impact of industry, in addition to underlying land take, is the release of toxic and hazardous materials into the natural environment. These include air emissions, smoke, dust and other particles, and release of chemicals and waste into water, polluting surrounding water sources and rivers, which not only damages biodiversity but also affects human health.

## 5.5 Construction

### 5.5.1. Current situation



Picture 5.4. National Bank of Azerbaijan

Economic and social development between 1990 and 2001 has been associated with significant increases in construction. New industrial and non-industrial buildings were constructed, and existing ones reconstructed and improved. It is estimated that over 30 trillion manats has been invested in capital development (see Table 5.4), of which 64% was financed by private companies and 36% by the State. Most investment (82%) has been directed into construction of industrial manufacturing facilities. Additionally, favourable conditions for foreign investment have enabled 18.3 trillion manats of foreign investment to be made (80% of the total investment).

Table 5.4 Money invested in construction in different sectors between 1990 and 2001

Sector	Amount spent on construction (manats)	% of total investment
Industrial	21 trillion	69%
House-building	3.2 trillion	11%
Transport infrastructure	1.5 trillion	5%
Trade and service sector	1 trillion	3%

Between 1990 and 2001, private individuals constructed housing covering a total of 9.9 million m<sup>2</sup> with just over half of which was constructed in rural areas. In many cases this private construction occurred without the appropriate Government permission (such as the construction that occurred along the Baku-Rostov highway, in the protected Jeyranbatan watershed). In Baku, much of the construction, repair and reconstruction work has been conducted in violation of the city development plan. In Baku and other regions, houses and other buildings have been built in the protective buffer zones around gas, oil and water pipelines, underground communication lines, power stations and in forest areas. Often these new buildings lack proper connection to infrastructure such as roads and electricity, and

servicing these buildings causes further environmental impacts. The construction of housing in coastal areas, in violation of Government regulations, has also caused damage to the environment. A presidential decree was passed in 2003 on the use of coastal areas in order to increase protection of such areas in future.

The Autonomous Republic of Nakhichevan has a number of sources of construction materials, which provide materials for the Republic's ongoing construction. At present 91 companies carry out construction work, and building has been extensive over the last five years, with the development of a new medical clinic, a university, a military school, a business school, a power station, over 20 schools, a hospital, municipal buildings, and bridges. Investment into construction has increased by 2.5 times over this period, with a total spent of 180 billion manats on construction.

### **5.5.2. Impacts of construction on biodiversity**

The major impact of construction is change in land usage and degradation of natural systems, reducing the overall amounts of natural habitat. In particular this is an issue when construction is poorly regulated and impacts sensitive environments, such as coastal zones and protected areas.

## **5.6 Transportation**

### **5.6.1. Current situation**

Several factors currently influence growth in the transport sector in Azerbaijan, including increases in traffic due to the TRACECA programme<sup>52</sup>, increases in the numbers of transportation companies and the increase in industries reliant on transportation (such as agriculture and construction).

Freight transportation increased by 93 million tons in 2001 since 1995 (an increase of 2.2 times), and income from freight transport increased 1.6 times. The number of transportation companies increased by 7.2 % between 2001 and 2002, over which period the number of unregistered companies also increased 8.8%. Between 1990 and 2001, the number of vehicles in Azerbaijan increased from 52,900 in 1990 to 451,600 vehicles in 2001. Of these, 76% are cars, 17% are trucks, 3.8% are buses, and the rest are other types of vehicles. In 2002, car ownership was equivalent to approximately 19 cars per 100 families.

The reestablishment of the Ancient Silk Route is one of the great achievements of the country in the years since its independence. This has resulted in the establishment of an effective transportation system for movement of freight between Asia and Europe through the Caucasus. The level of traffic on this route increased 1.5 times between 1998 and 2001, while the overall transport passing through the country increased 1.9 times.

Transportation is economically important in Nakhichevan Autonomous Republic, and is a sector undergoing development. The blockage by Armenia led to the closure of railway routes supplying the Republic in 1989, and at present access in and out of Nakhichevan is only possible by air or by an extensive road trip. The airline capacity is relatively small, and does not meet demand. The airport of the Autonomous Republic was reconstructed, with the

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<sup>52</sup> Transport Corridor Europe-Caucasus-Asia

aim of accepting international flights. In addition, efforts are made to support the growth of the road traffic sector, and the number of cars and trucks is increasing each year.

### **5.6.2. Impacts of transportation on biodiversity**

- Although positive for the economy, the increased traffic in the country does contribute to the levels of air pollution. In 2001 out of estimated 402,000 tonnes of pollutants to the atmosphere 42% was affected by the transport industry. In Nakhichevan the Silk Road route is notable with regard to the pollution emitted by large diesel trucks travelling up mountain passes.
- The growing traffic network also fragments the environment, and may cause a barrier, or increase mortality, for certain species. In Nakhichevan some roads pass through important forest areas, and their construction has destroyed forest cover (with a loss of approximately 1-1.5 ha per 1km of road built) and also affects roadside vegetation.

## **5.7 Mining**

### **5.7.1 Current situation**

Geological exploration and the mining industry started in Azerbaijan in the second half of the nineteenth century. Azeris, Russians, Germans and English undertook mining in the region, including extraction of cobalt deposits in Dashkasan, and copper deposits in Gadabay. By the 1930s, geological exploration had become more intensive, and deposits of iron, molybdenum, and cobalt were discovered. The main mining industry is the extraction of iron ore deposits in Dashkasan and Alunite deposits in Zaylik. Iron deposits have been mined in the South Caucasus since 1950, and silver lead deposits have been extracted from Nakhichevan since 1954.

Currently, the mining industry in Azerbaijan is based around 441 registered fields, including 18 ore deposits<sup>53</sup> and 29 non-ore deposits<sup>54</sup>, and 297 sources of construction materials<sup>55</sup>. In addition 155 mineral deposits exist in the occupied territories, including five of gold, six of mercury, and two of copper, along with 13 important sources of construction materials. At present the government licenses the mining of 19 non-ore deposits (65.5% of such deposits), and 57 stone/cement quarries (19% of construction material sources). Between 1998 and 2000 151 licences were granted to state, private and foreign companies for the exploration of deposits, use of ground water and extraction of non-ore deposits. Legislation has been developed in respect with this extraction<sup>56</sup>.

New technologies to increase extraction rates have increased the impact of mining on the environment. The long-term extraction of deposits in Dashkasan has reduced the area of forest and degraded other natural habitats. In Absheron and Gobustan regions, winter pasture has been degraded because of the large number of quarries that continue to be worked. In addition, due to the unplanned, unsystematic extraction work in these areas, some of the minerals deposits have also been destroyed, and the situation of inappropriate extraction has not changed greatly since the country's independence.

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<sup>53</sup> Including iron, alunite, copper, lead, gold, cobalt, mercury, and molybdenum.

<sup>54</sup> Such as clay, dolomite, gypsum, sulphur, and kaolin.

<sup>55</sup> Such as stone and cement materials (lime, gravel, sand).

<sup>56</sup> Presidential decree N439 13<sup>th</sup> February 1998

Quarrying and mining operations in mountains accelerate erosion processes, destroy natural habitats and produce large amounts of waste materials, which overall cover thousands of hectares of natural habitat and which pollute the land, water and air. Polluted water from mines is carried away in rivers and pollutes environments further downstream. The pollution of land and water by heavy metals originating from mines in the Caucasus is a major problem in Azerbaijan. Under current regulations, when a mine is decommissioned, the area it covers should be reclaimed and plant cover restored.

The territory of Nakhichevan Autonomous Republic is rich in minerals, including deposits of molybdenum, cobalt, copper, zinc, silver, lead, gold, mercury, and chromite. In addition, a number of significant deposits of rock salt exist, along with sources of limestone used in cement manufacture.

### **5.7.2 Impact of mining of biodiversity**

- Areas of natural habitat are affected by mining in terms of the direct land take and subsequent erosion and degradation, and in many cases the location of mining activity is not well planned with regard to environmental impacts.
- Secondary impacts of mining result from the use of inappropriate and inefficient technologies, and from pollution and dumping of waste products on surrounding land. The issue of pollution from mines is a highly significant one, especially where it involves the contamination of water sources with heavy metals.

## **5.8 Energy and oil extraction**

### **5.8.1 Current situation**

The energy industry is one of the leading sectors in Azerbaijan, and is dominated by oil production. In 2001, 14.8 million tonnes of crude oil was produced (89% from off-shore deposits, marking an upturn in production, along with 5.5 billion m<sup>3</sup> of gas (96% from off-shore deposits).

Of the hydrocarbons produced in 2001, 28% were used for the production of electricity. In that year oil- and gas-powered power stations produced 92.5% of electricity (with hydroelectric power accounting for a further 5.9% and generators for 0.6%). However, the oil- and gas-based power stations are major contributors to air pollution in the country.

The oil industry has underpinned the economy of Azerbaijan for many years, and as well as extraction it also supports a number of related industries such oil refining and chemical processing. The importance of oil extraction to the economy of Azerbaijan is increasing. After independence, companies such as the State Oil Company (SOCAR) were created in order to extract and refine oil. The companies were given the jurisdiction explore, extract and refine oil and gas deposits from the Azeri sector of the Caspian Sea and from on-shore sources. At present SOCAR operates within 22,000 ha of land and 10,000 km<sup>2</sup> of sea, and employs 60,400 people, of which the majority (46,000) work in extraction. In 2002 SOCAR's income represented 9,693 billion manats<sup>57</sup>.

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<sup>57</sup> This includes: 5,595 million from oil and gas production, 3,172 million from pipeline transportation, 216 million from drilling, 268 million from construction and 346 million from sea transportation

Oil and gas are currently extracted from 54 deposits, of which 37 (69%) are on-shore and 17 (31%) are off-shore. However, the production from these deposits has declined due to the long-term extraction and contamination with water (except for the Gunashli and Chirag off-shore deposits). More than 70% of the wells are no longer suitable for extraction because of technical problems, and are a potential source of pollution. A consortium (consisting of SOCAR and eleven foreign companies) undertakes the extraction of oil from three of the largest oil deposits (the Azeri, Chirag and Gunashli fields). The Azeri International Operation Company leads this operation, and 20 contracts have been signed with foreign

**Picture 5.5.** Oil rig in the Caspian Sea

companies for the joint exploration, use and distribution of the products. As a result extraction has been possible from the Ashrafli oil deposit, and the Garabag and Shah-daniz gas deposits. The Shah-daniz deposit alone contains one trillion cubic metres of natural gas and 300 million tonnes of gas condensate.

The construction of the Baku-Tbilisi-Arzurum gas pipeline and the Baku-Tbilisi-Ceyhan oil pipeline has now begun and is scheduled to finish at the end of 2004. In Azerbaijan, the length of the construction corridor will be 443km with a width of 44m. Environmental impact assessments have been carried out at every phase of preparation, extraction and exploitation and are agreed with the Ministry of Ecology and Natural Resources.

Oil and gas extraction and refinery industries have had a significant influence on the environment and biodiversity of Azerbaijan. The industrial extraction of oil began in 1871, and as new oil and gas deposits were found they were exploited without the use of appropriate facilities, and for many years reservoirs and open channels were used to collect and transport the oil from the wells. Terrestrial and marine environments were damaged

due to the use of poor technology, inadequate construction, poor maintenance standards and the lack of environmental protection in the early years of the industry. Terrestrial environments were directly affected by pollution from waste materials, chemicals and heavy metals. Natural lakes became polluted, and new reservoirs were formed. Oil and its by-products seeped down over 3m into the ground, polluting the ground water. Some areas also became polluted by radio-nuclides. In turn, such pollution affected fisheries. Some of the most polluted areas include the Absheron peninsular, (an important migration route for birds), the Guba-Caspian and Kura River region.

Even today, the activity of SOCAR releases significant pollution into the atmosphere, despite a reduction in extraction and refining, and implementation of improved technologies. Approximately 198,000 tonnes of harmful substances, including 165,000 tonnes of carbon and hydrogen, were released into the atmosphere in 2002.

The economic blockage of Nakhichevan Autonomous Republic has restricted the supply of coal and gas into the territory. A power station was built in co-operation with Iran on the Araz River, however at some times of year the energy that can be generated internally is insufficient to meet demands, and requires import of electricity from Iran and Turkey to meet the deficit. Currently, the Nakhichevan Electric Network is working to improve the electricity supply system. Although no oil extraction has yet occurred in the territory, geological exploration is underway and has confirmed the presence of oil, as the basis for future extraction. However, exploration around villages Keshmebasar and Shahtaxti did not take account of the rare plants and animals that occur there.

### **5.8.2 Impact of the energy sector on biodiversity**

- The extraction of hydrocarbons affects biodiversity in a number of ways. The legacy of oil extraction from on-shore and off-shore sources has resulted not only in changes to natural habitats, but wide ranging impacts from pollutants which have leached into water systems.
- In addition, the wider energy sector has impacts for biodiversity such as the mortality caused to raptors and migrant birds by high tension electric power lines, and the contribution the energy sector makes to global climate change.

## **5.9 Tourism**

### **5.9.1 Current situation**

Azerbaijan is a country with a significant potential for tourism – based on its rich natural history and culture. During the Soviet era, tourists visited from other parts of the Soviet Union and from foreign countries, and tourist facilities existed in many regions of the Republic. However, many of these places have since fallen into disrepair, and a third is no longer habitable. In addition, many of the previous tourist resorts are now settled refugees and internally displaced people.

In 2002 there were 793,000 overseas visitors to Azerbaijan, and in this year tourism brought in \$51 million. Tourism is now being actively encouraged, and is recognized as an area for

potential economic growth. A presidential decree in 2002<sup>58</sup> encouraged the development of tourism to its full potential, and is implemented by the Ministry for Youth, Sport and Tourism. A number of tourist areas were constructed last year, and the involvement of the private sector has increased, with 90 licences issued for tourism businesses. International tourism is being promoted through participation in, and staging of international tourist exhibitions, and as a member of the World Tourism Organization, Azerbaijan has agreements with 15 countries to cooperate in the tourism sector.

Tourism infrastructure is very restricted in the Nakhichevan Autonomous Republic. During the Soviet Era it was a closed part of the country, and not open to foreign visitors. The only tourist resort was established in the Batabat region, with space for 200 people. Batabat is in a mountain area (2200 m) and is only accessible in summer. In summer time hundreds of families visit this area, using summerhouses and camping due to lack of tourist beds. There are a number of other beautiful and natural areas in Nakhichevan with some potential for tourism<sup>59</sup>. In addition, a number of spa centers and sanatoria exist, although they need investment to become fully functional once more.

### **5.9.2 Impact of tourism on biodiversity**

Unregulated tourism can negatively affect the environment and biological diversity. Illegal construction destroys natural habitats, tourists use natural resources and often collect wild plants

**Picture 5.7.** Tourist adventure sports - parascending

and animals, and tourist sites often have problems of waste management and from damage by off-road vehicle use.

<sup>58</sup> Presidential decree "The State Programme for the development of Tourism 2002-2005" N 1029 27-8-2002

<sup>59</sup> For example, Qanlı Lake in Shahbuz region, Derebogaz (bottom of Kuku Mountain), Salvarti, Erefse in Julfa region, Xezinedere (Geyik forest), Leketag (Demirlidag Plateau), Beyehmed (Goydag Plateau), areas around River Saqqarsu in Ordubad region, and Goygol Plateau.