AZERBAIJAN

NATIONAL ECOSYSTEM ASSESSMENT

SUPPORTING DECISION MAKING AND BUILDING CAPACITY TO SUPPORT IPBES THROUGH NATIONAL ECOSYSTEM ASSESSMENTS

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SUMMARY FOR POLICYMAKERS

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CONTENT

LIST OF ABBREVIATIONS

MENR	Ministry of Ecology and Natural Resources of Azerbaijan
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
NEA	National Ecosystem Assessment
BMU	Germany Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
IKI	International Climate Initiative
UNEP-WCMC	United Nations Environment Programme World Conservation Monitoring Centre
BAU	Business As Usual
SEM	Sustainable Ecosystem Management
UNDP	United Nations Development Program
GIZ	Germany International Cooperation
FAO	Food and Agriculture Organization
GAHP	Global Alliance on Health and Pollution
NBP	National Biodiversity Platform
ILK	Indigenous and local knowledge

INTRODUCTION

The Republic of Azerbaijan is a transcontinental country located at the boundary of Eastern Europe and Western Asia. It is a part of the South Caucasus region and is bounded by the Caspian Sea to the east, Russia (Republic of Dagestan) to the north, Georgia to the northwest, Armenia and Turkey to the west, and Iran to the south. Baku is the capital and largest city.

Azerbaijan forms an integral part of the Caucasus Ecoregion, a region with exceptional levels of biodiversity. Azerbaijan is also located on the shores of the Caspian Sea, the world's largest inland body of water. One of the most valuable characteristics of Caspian biodiversity is high endemism.

The Azerbaijan NEA aims to form an essential knowledge ground for the management, use and protection of biodiversity and ecosystem services that is important in national and subnational level.

NEA will help policy makers to improve existing ecosystem management policies and create new grounds for management approaches.

NEA's key policy questions are cover all sphere of science-policy interface and process of Government design making. The key policy questions were identified during the scoping phase with the participation of experts and stakeholders, and focused on the status of ecosystems, the relationship between people, economy, and ecosystems. The questions also concern future trends and needed policies and activities regarding sustainable use of selected ecosystems.

The establishment of the National Biodiversity Platform (NBP) was an essential part of the NEA process. NBP is a platform created by stakeholders, which include academia, NGO, government, and community representatives.

The Ministry of Ecology and Natural Resources (MENR) is a main coordinating authority and Azerbaijan Branch Office of REC Caucasus is an implementing agency for the NBP. NBF supports science-policy dialogues on issues related to biodiversity and ecosystem services, foster the dialogue between science and policy and thereby seeking to stimulate the biodiversity research community to address policy or user relevant questions, inform national stakeholders on NEA processes. In carrying out its functions and exercising its rights, the NBP interacts with central and local executive authorities of the Republic of Azerbaijan, local self-government entities, academia, various scientific research institutes, as well as in mutual cooperation with the international and non-governmental organizations.

KEY FINDINGS

1. Azerbaijan is situated at the juncture of several bio-geographical areas (the Eastern Palearctic, Turan, the Mediterranean, Asia Minor, and the Middle East) and contains broad range of species of European, Central Asian and Mediterranean origin. The country is an important migratory path for many bird species travelling from Europe and Russia and south to Africa and Asia.

2. The lakes and wetlands of Azerbaijan support high numbers of waterfowl species that migrate through or winter here, including the White-Headed duck and the globally threatened Lesser White-fronted Goose. Fifty-one Important Bird Areas (IBAs) – hosting 31 globally threatened species, 9 biome-restricted species and 15 congregator species - and one Endemic Bird Area (EBA) have been identified.

3. The territory of Azerbaijan is a center of origin for several globally important food crops, including wild rye, wheat, barley, millet, wild pears, cherry, and more than 200 varieties of grapes.

4. Azerbaijani watercourses are the preferred spawning grounds for valuables Caspian sturgeons, which account nearly 90% of the world's sturgeon populations. Rivers and small streams are under extreme pressure at present due to intensive water withdrawals for agriculture, particularly during the low-flow period, when some of them run dry—a situation which is not natural in this region. Intensive water withdrawals in many small streams have led to significant changes in flow regime downstream.

5. Threats to ecosystems have reached large scales and require urgent actions from environmental managers and

policy makers. These threats include climate changes, environmental pollution, degradation of ecosystems and deforestation. These changes occur against the backdrop of rapid population growth, characterized by increasing urban growth and increased demand for ecosystem resources.

6. Land degradation is being further exacerbated by the weak regulation of building and construction activities and illegal urbanization in Azerbaijan, as well as the limited capacity for effective controls on mitigating the environmental impacts of industrial developments.

7. The conversion of the lowland grasslands into agricultural land, through ploughing and scrub removal, is fragmenting many remaining areas of natural steppes. Several steppe ecosystems are also being further fragmented by the extensive network of irrigation channels, particularly in the central lowland part of the country.

8. Local and transboundary pollution in the Kura Basin is one of the main causes of pollution in the country's main waterways. Municipal, industrial, and agricultural wastewaters from neighbouring countries are being drained into Azerbaijan.

9. Forests of Azerbaijan have significant ecosystem services. These services may play a key role in supplying sustained sources of long-term gains, if proper approaches will be applied. These approaches may ensure not only sustained gains, but also protection of forest resources. However, many problems exist that prevent shifting from traditional approaches to sustainable management in the forestry sector. These problems include both institutional and legal aspects.

10. Illegal timber production, unsustainable tourism and overgrazing are the major threats to sustainable forestry. These factors notably reduce quality of ecosystem services provided by forests.

11. Financial problems are one of the major factors that create barriers to sustainable forestry. Allocation of financial resources is not sufficient and most of local forestry units have no adequate capacity to improve forest governance.

12. Current legislation has insufficient capacity to ensure public and community participation in the governance of forests. Communities located rather close to forested areas have no special rights in governance of forests. Municipalities are not involved in forest governance as well. Timber harvesting by local communities would be one of the options to be involved in forest management. Current Forest Code reduces options for public participation in the forest management. Although the code tries to balance economic, social, and environmental factors to ensure sustainable forestry, local forestry departments do not strictly follow the relevant requirements due to the lack of capacity and qualified staff.

13. Because improving ecosystem management the participation of multiple sectors, e.g., HPP/dams, agriculture, forestry, fisheries, tourism, water supply, a comprehensive package of interacting policy reform measures is needed, both at national and at regional level. This is defined as a “policy mix” package that is indispensable to introduce sustainable basin in Azerbaijan.

14. To mainstream nature-based solutions into the policies, strategies, and development programs of the government institutions. The current issues should be mainstreamed across all the relevant sectors which in turn would reduce vulnerability of ecosystems human-driven factors.

15. To develop a stakeholder engagement strategy including information and advocacy materials to build understanding and demand for proper budgeting in ecosystem finance within international donors and finance institutions.

16. Azerbaijan has already provided its contribution to the global efforts to cope with climate change and the submitted Intended Nationally Determined Contribution (INDC) presents a very ambitious commitment. However, the presented INDC has no adaptation component. It is very necessary to set clear adaptation goals in the next INDC for all sectors, taking into consideration children and youth issues. It is also important to encourage youth engagement in the review of INDC.

17. To lobby with the government organizations for increased availability of environmental data to community organizations and academia.

18. Conduct capacity building projects and trainings for government representatives on ecosystem-based solutions. The projects should involve international donors and local business to provide nature-based solutions in ecosystem management.

CHAPTER 1

1.1. THREATS TO BIODIVERSITY IN AZERBAIJAN

Land degradation

Extensive areas of Azerbaijan are being severely impacted by soil erosion and salinization. It is estimated that 3.7m ha (~42% of the territory of Azerbaijan) is subject to the damaging effects of erosion, while 0.6m ha (~7% of the territory of Azerbaijan) is adversely affected by salinization, to the extent that it is now no longer suitable for agriculture. The salinization and erosion of soils tend to be a result of poor irrigation and drainage systems, overstocking of livestock, unsustainable levels of ground water extraction and ongoing deforestation. Desertification due to climate change and reduced natural water supply is a new negative phenomenon in the lowlands of the country.

Land degradation is being further exacerbated by the weak regulation of building and construction activities and illegal urbanization in Azerbaijan, as well as the limited capacity for effective controls on mitigating the environmental impacts of industrial developments.

Habitat fragmentation

The alteration and depletion of forest resources has historically had severe ecological impacts in Azerbaijan. In some parts of the country (e.g. on the slopes of the Talish mountains) forests are being still further fragmented as economically valuable timber species (such as nut and oak) are being illegally harvested. Forests are also occasionally impacted by wildfires, most occurring because of the burning of maize fields in winter and grass in summer. Fires are constantly observed in the occupied territory of Karabakh and in the on the front lines.

The conversion of the lowland grasslands into agricultural land, through ploughing and scrub removal, is fragmenting many remaining areas of natural steppes. Several steppe ecosystems are also being further fragmented by the extensive network of irrigation channels, particularly in the central lowland part of the country.

The construction of dams and reservoirs on the major rivers flowing into the Caspian Sea has created obstacles that are effectively fragmenting riverine habitats for some key species. For example, the construction of the Mingechevir and Bahramtapa reservoirs on the Kura and Araz rivers has reduced the spawning grounds for anadromous sturgeon species because they are now unable to pass the dams to reach upstream breeding areas. Small mountain streams represent the preferred spawning grounds for valuable sturgeon of the Caspian Sea and other types of fish, but experience continuously increasing exploitation in the form of water withdrawals for industry and irrigation.

Unsustainable levels of natural resource use

Overgrazing has become a major problem both in winter pastures in the lowlands and in summer pastures in the high mountain grasslands. The intensive use of pastures in pastures result in accelerated soil erosion, and the increasing land desertification. The loss of traditional and historical pastures in the occupied territories of Karabakh has led to more cattle grazing in other pastures of the country. Additional herds have also been brought in by refugees from the occupied districts around the

Karabakh region. Many of the animals owned by these communities are now concentrated in areas that are largely unsuitable for livestock, for a variety of reasons, including competition for water and food near settlements and exclusion from summer grazing areas due to conflicts in some mountainous areas. Many winter grounds are now being utilized for livestock grazing throughout the year.

While all types of hunting are strictly regulated in Azerbaijan, illegal hunting - for both subsistence and commercial purposes - of wild birds and game species is still widespread and relatively poorly controlled.

Overfishing - driven by subsistence uses, the demand of local consumers and international demand for black caviar - is widespread in the Caspian Sea and spawning rivers. In spring, spawning sturgeon in the shallow warmer waters often become the victims of illegal poachers.

Of the approximately 1 billion m3 of freshwater used each year, just under 350 million m3 is lost due to the poor state and management of the water distribution systems in Azerbaijan. Of the water used, 70% is sourced from neighbouring countries, and there is currently an annual water deficit in the country of ~400 million m3.

Pollution

Over the last 150 years Azerbaijan was one of the principal oil producing and processing countries without adequate environmental management practices. It is estimated that 14,000ha of land in Azerbaijan is still contaminated with oil and petroleum products. Large-scale use of fertilizers, pesticides, and herbicides has notable polluted lands in rural places. Soils throughout the region were also previously contaminated by DDT and toxic defoliants used in the cotton production during the Soviet era and legacy DDT sites remain major sources of pollution.

Although several actions have recently been taken to clean up the country - particularly in Baku and the Absheron peninsula - severe pollution is found in many areas of the country.

Transboundary pollution in the Kura Basin is one of the main causes of pollution in the country's main waterways. Municipal, industrial and agricultural wastewaters from neighbouring countries are being drained into Azerbaijan.

In Azerbaijan, toxic pollutants have caused a broad range of negative health impacts within the population and have increased the cost of living. A broad range of studies confirmed that pollution causes negative impacts on the local ecosystems of Azerbaijan. For example, the discovery of polychlorinated biphenyls, organochlorine pesticides, and organotin compounds found in the blubber and liver of Caspian seals (Phoca Caspica), which has been identified to have caused mass mortality of this species. In addition, there are discovered traces of acute genotoxic effects from pollution in the Russian sturgeon, acipenser gueldenstaedtii. There is also evidence of a strong correlation between three-ring PAH pollution and chromosomal damage in aquatic turtles (E. orbicularis). Moreover, a study done by Matson confirmed that the cities, Sumgayit and Neftchala in Azerbaijan, have soils contaminated with genotoxic and PAHs, which have a direct effect on observed genotoxicity.

Birds that land in oil-contaminated lakes on the Absheron Peninsula often drown there. This is a very dangerous phenomena for both domestic and migratory birds.

Excessive water withdrawals

The outlet parts of Azerbaijani rivers flowing into the Caspian Sea are the preferred spawning grounds for the valuable sturgeon fish of the Caspian Sea, which contains over 90% of the world's sturgeon population. Rivers and small streams are under extreme pressure at present due to intensive water withdrawals for agriculture, particularly during the low-flow period, when some of them run dry—a situation which is not natural in this region. Intensive water withdrawals in many small streams have led to significant changes in flow regime downstream.

Because Azerbaijan is located in the lower reaches of the Kura and Araz rivers, the water withdrawals carried out by the upstream countries have a serious impact on biodiversity in the downstream part of these rivers.

Invasive species

There are several species that are invasive in Azerbaijan. One of the most notable is the comb jelly Mnemiopsis leidyi - an introduced species that invaded the Caspian Sea 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.

Invasive plant species include the widely distributed common ragweed, buffalobur nightshade and the Russian knapweed. The introduced American racoon has now successfully spread into most of the forests of Azerbaijan. The invasive fall webworm is also known to cause substantial damage to commercially grown ornamental trees and shrubs and to several agricultural crops.

Climate change

Climate change in Azerbaijan is projected to increase average temperatures, resulting in hotter and longer summer heatwaves and droughts, as well as a likely reduction in average annual rainfall. Overall, this means the country will likely become hotter and more arid, with major implications for water availability and ecosystem productivity. The tendency in temperature and precipitation on the territory of Azerbaijan is varied by areas and highlands. Calculations according to all scenarios of GCM models forecasts an increase of monthly average temperature in a range of 0,72-1,580C during 2015-2050 years in comparison with average values of 1961-1990.

Forest, high mountain, water and marine ecosystems in Azerbaijan may be particularly vulnerable to the effects of climate change. Climate change will cause deforestation, river depletion, soil erosion, and warming of the Caspian Sea, which will have various negative effects on biodiversity.

Although the impact of climate change on biodiversity in Azerbaijan has not yet been assessed, based on global assessments, it can be said that these effects will appear as long-term, negative, and serious consequences.

Rare, threatened and endangered species

The Red Book of Azerbaijan (2013) contains updated information on the status of rare, threatened, and endangered wild plant and animal species for the entire territory of the country, including Azerbaijan's sector of the Caspian Sea. The current version of the Red Book lists 338 species of higher plants, 12 species of fungi, 23 species of lower plants and 223 species of fauna (including 74 insect species, 6 amphibian species, 14 reptile species, 9 fish species, 72 bird species and 42 mammal species).

Many valuable species live in protected areas. At present, there are 10 reserves and 10 national parks in Azerbaijan, the total area of which is 893,000 hectares. This is 10.3 percent of the country's territory (Fig. 1.1).

Fig. 1.1. Protected areas of Azerbaijan[1]

[1] Source: Ministry of Ecology and Natural Resources of Azerbaijan Republic (www.eco.gov.az)

1.2. AZERBAIJAN'S NATIONAL ECOSYSTEM ASSESSMENT FOR BIODIVERSITY AND ECOSYSTEM SERVICES

1.2.1. Project Background

As part of the global initiative, "Supporting decision-making and building capacity to support the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) through National Ecosystem Assessments", Azerbaijan was selected as one of the participating countries. Other project countries include Grenada, Bosnia and Herzegovina, Cambodia, Cameroon, Colombia, Ethiopia and Vietnam. The project began in 2019 and is scheduled to conclude in 2023. Funding is provided by the Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), International Climate Initiative (IKI) with global project oversight by the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC).

The Azerbaijan NEA provides an information on the country's biodiversity and ecosystems which can then be used for national reporting on regional and international biodiversity-related frameworks. The following documents and reports will be prepared during the project:

- Azerbaijan NEA scoping report
- Summary for policy makers
- Azerbaijan NEA technical report
- A plan for dissemination and use of NEA findings
- Supporting information products, briefs, videos etc.

1.2.2. Project Objectives

The objectives of the Azerbaijan NEA have been identified with the participation of all stakeholders in the various meetings that took place during the scoping process and include:

Using the IPBES's ecosystem assessment process as a ground point, the NEA also intends to:

- Establish key policy questions that are relevant to guide the assessment
- Assess the condition and trends of the country's ecosystems and their ecosystem services.
- Describe the primary drivers of change influencing the country's ecosystems, such as changes in land use, development, pollution, and climate
- Consider possible futures (scenarios) for the nature and its contributions
- Outline response options to ensure the sustained supply of ecosystem contributions for the benefit of all society.
- To start establishment of National Biodiversity Platform (NBP) and develop the conceptual framework of NEA and NBP

The NEA provides an evidence base, highlights gaps in knowledge (research and monitoring), explores plausible futures, and provides a critique of different response options available (including trade-offs between different decisions and outcomes that might need to be made). Broad stakeholder participation was ensured during the preparation of the NEA. Representatives of the state, community, civil society, and research institutes attended the launch of the NEA and the initial stakeholder meeting.

1.2.3. Methodology of the Azerbaijan NEA

The following key questions emerged as an output of stakeholder meetings, expert discussions, and preliminary research:

1. ***What is the status of and trends of selected ecosystems?***
2. ***What direct and indirect drivers affect selected ecosystems?***
3. ***What is the status of knowledge on ecosystems, and their benefit to the wellbeing of people?***
4. ***How much do people know about the status of ecosystems, and how does this affect their lives?***
5. ***Do people have information about ecosystem changes in recent decades?***
6. ***How do ecosystem degradations affect human health and their quality of life?***
7. ***What policies and activities are needed to turn future negative trend into positive ones?***

The selection of these ecosystems is based on the following criteria:

- Level of degradation of ecosystems (more degraded ecosystems were selected)
- The role of ecosystems in human life (the most important ones in terms of the level of impact on human quality of life and NCP were selected)
- Expert opinion (determined by financial resources and expert preassessments)

In addition to the selected ecosystems, the nature-related knowledge of local people living in mountainous regions (Indigenous and local knowledge) was also studied and assessed for a better assessment of human-nature relations. The NEA critically assesses the state of knowledge on past, present and possible future trends in multi-scale interactions between people and nature, taking into consideration different views and knowledge systems. The NEA also analyses the status of ecosystems, past conditions, and future trends, as well as the factors that led to these changes and their causes, as well as existing national policies for the protection of ecosystems. The assessment analyses the role of ecosystems in human life in the past, as well as the gradual changing trends of this role.

Fig. 1.2. Conceptual framework of assessment[2]

1.2.4. Nature's contributions to people/ Ecosystem Services

At the same time, NCP means food, energy, and water, and they come directly from nature to humans. According to this concept, the NCP is the main provider of quality of life. Quality of life means food, energy and water, physical and mental health, moral values, environmental justice and equality.

Water, plants, fruits and berries, clay, soil, medicinal plants, wild honey are the main products taken from the surrounding areas. Regulatory services include the benefits obtained from ecosystem processes. E.g. natural purification considerably improves quality of water in rivers and streams.

Forests have a vital role to maintain regulatory ecosystem services at the watershed level. It is recognized that forests increase infiltration and interception, considerably storing a larger percent of incoming precipitation in the basin. Generally, alpine ecosystems have important functions that support tourism and recreation. Cultural services are becoming increasingly important as incomes and leisure time off people increase. Cultural services are becoming increasingly important as incomes and leisure time off people increase. Impact of supporting services on people occurs over the long time. For example, forests have direct and non-direct impact on the climate that supports health of people over the long periods. In the mountainous regions of Azerbaijan, ecosystem services penetrate all spheres of life and leave indelible marks on people's lives.

[2] IPBES conceptual framework (https://www.ipbes.net/conceptual-framework)

1.2.5. National Biodiversity Platform

MENR, NGOs, academia, and governmental authorities have established the National Biodiversity Platform (NBP) in Azerbaijan to connect expert communities on biodiversity and ecosystems services. NBP supports science-policy dialogues, stimulates research, and informs national stakeholders on IPBES processes.

The NBP, a neutral platform, establishes working bodies, including expert groups and commissions. It is open to academia, civil society, and policy makers, and is responsible for reviewing and approving all NEA documents. Members are paid by REC Caucasus, and funding sources include ministries, research institutions, and the private sector.

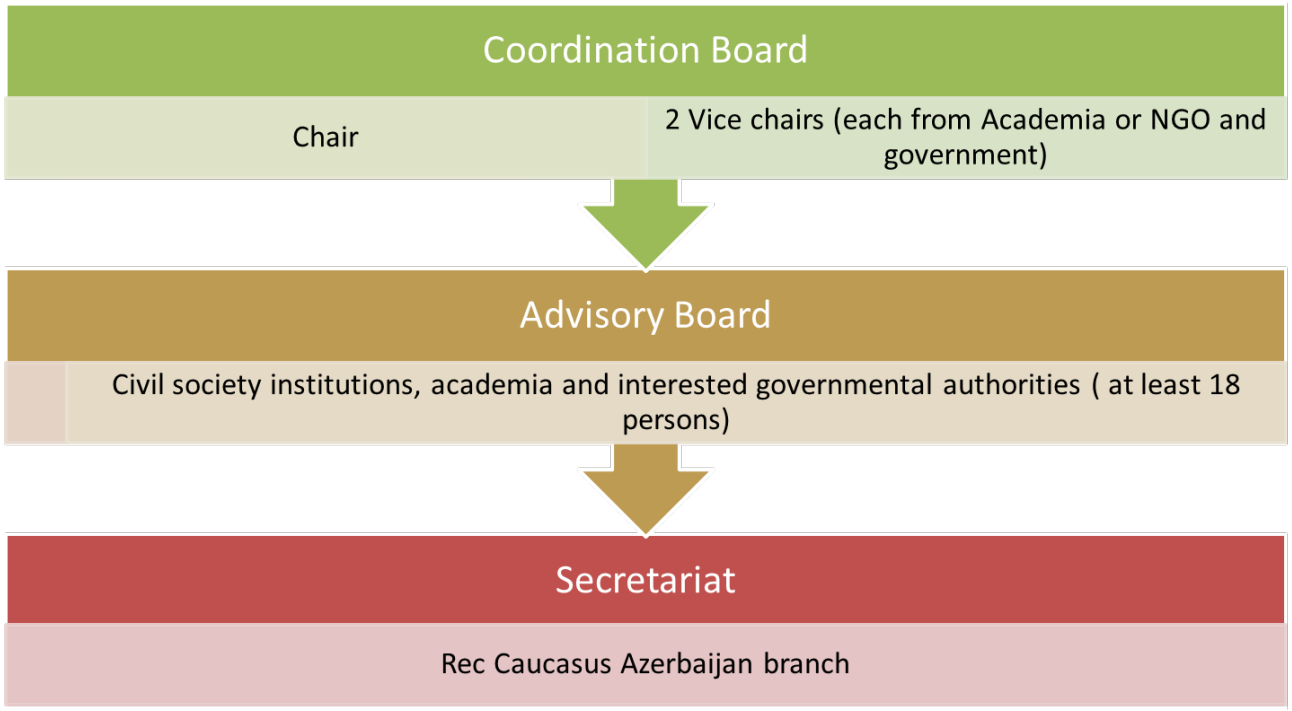

Fig. 1.3. National Biodiversity platform Structure

1.2.6. Impacts of Policies and Institutional Arrangements on Biodiversity Conservation and the Ecosystem Services

Current environmental policy in azerbaijan

Azerbaijan's main objective of the environmental policy is the protection of health of people, existing ecological systems, economic potential, and efficient use of natural resources to meet the needs of present and future generations. During the long decades of the Soviet era, environmental policy in Azerbaijan consisted only of a set of documents based on general principles and did not set any time-limited goals. However, after the country gained independence, radical reforms in environmental policy were gradually launched and significant steps were taken in this area. The legal legislative platform consists of laws and codes related to biodiversity, water resources and ecosystem protection.
The country has adopted many laws related to environmental protection and biodiversity and ecosystem management.

- Creation of modern environmental legislation that meets modern requirements
- Creation and development of a new institutional framework
- Implementation of environmental programs based on specific goals

International agreements, treaties, and other national obligations

Azerbaijan is a country with many environmental problems, many of which has transboundary nature. The country is in the downstream part of the Kura and Araz rivers, and restrictions from neighbouring countries are brought to the country through these rivers. On the other hand, the country is located on the shores of the Caspian Sea and the Caspian Sea is polluted by the five countries that surround it, and these pollutants are migrated with sea currents and brought to the coastal areas of Azerbaijan. Therefore, Azerbaijan is actively cooperating in the international arena to address the problems of pollution in its territory.

At this time, the Republic of Azerbaijan has acceded to the following international conventions to facilitate the protection of the environment and its individual components, as well as the management of toxic substances polluting the environment at the national, regional and global levels (table 1.1).

Table 1.1. Environmental treaties of Azerbaijan[3]

OFFICIAL TITLE OF TREATY	DATE SIGNED
Paris Agreement adopted under the United Nations Framework Convention on Climate Change	12/12/2015
European Convention for the Protection of Animals during International Transport (revised) (No 193, Council of Europe)	25/06/2004
Stockholm Convention on Persistent Organic Pollutants	22/05/2001
Cartagena protocol on biosafety to the convention on biological diversity	24/05/2000
Convention on access to information, public participation in decision making and access to justice in environmental matters	24/06/1998
Kyoto Protocol to the UN Framework Convention on Climate Change	11/12/1997
International Plant Protection Convention - New revised text approved by Resolution 12/97 of the 29th Session of the FAO Conference in November 1997 - Declaration	07/11/1997
Amendment to the Montreal Protocol on substances that deplete the ozone layer, adopted at the ninth meeting of the Parties	17/09/1997
Energy Charter Protocol on energy efficiency and related environmental aspects	17/12/1994
Energy Charter Treaty (ECT)	17/12/1994
United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa	17/06/1994
Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer	25/11/1992
Convention on biological diversity	05/06/1992
United Nations Framework Convention on Climate Change	09/05/1992
Convention on the Transboundary Effects of Industrial Accidents	17/03/1992
Convention on the protection and use of transboundary watercourses and international lakes	17/03/1992
Convention on environmental impact assessment in a transboundary context (Espoo Convention)	25/02/1991
Amendment to the Montreal protocol on substances that deplete the ozone layer (London Amendment)	29/06/1990
Basel Convention on the control of transboundary movements of hazardous wastes and their disposal	22/03/1989
Vienna Convention for the protection of the ozone layer	22/03/1985
Convention on the physical protection of nuclear material	03/03/1980
Convention on long-range transboundary air pollution (Geneva Convention 1979)	13/11/1979
Convention on the conservation of European wildlife and natural habitats (No 104, Council of Europe)	19/09/1979
International Convention for the Protection of New Varieties of Plants, as revised at Geneva on 19 March 1991	02/12/1961

[3] Source: Ministry of Ecology and Natural Resources of Azerbaijan Republic (www.eco.gov.az)

Legal framework

The Law on Environmental Protection The law establishes a comprehensive legal framework for environmental protection, outlining rights, duties, regulation, monitoring, compliance with norms, research, public education, and data management.

The Forest Code regulates the protection and utilization of forests. The Code establishes the legal basis for the regulation of forests and their funding, use, protection, preservation, reintroduction, and expansion. The Forestry Code also makes provision for a number of regulations that more specifically define the general rules laid down in the Code. The Law on Fauna and the Law on Protection of Flora establishes the legislative framework for the protection and sustainable use of fauna and flora.

The Law on Fishing establishes legislative provisions for: the organisation and management of fishing operations; and the breeding, use and protection of fish stocks.

The Law on Specially Protected Nature Areas and Objects provides the legal framework for the classification, establishment and expansion of 'Specially Protected Nature Areas' (SPNAs).

The Law on Environmental Safety determines the legal basis for organizing and exercising phytosanitary controls and regulating cooperative governance in the field of plant protection and plant quarantine.

The Law on Phytosanitary Control regulates the manufacturing, sales, and import of pesticides, agrochemicals, biological and other related substances.

The Law on Protection of the Atmospheric Air provides the legal framework for mitigating the effects of harmful and polluting atmospheric substances.

The Law on Environmental Education and Awareness of the Population defines the national approach to, and requirements for the implementation of, environmental education and awareness-raising activities.

The Law on Obtaining Environmental Information establishes everyone's rights to obtain environmental information. Any person may obtain environmental information irrespective of time and without any terms, except information obtaining which is limited. The information obtaining, which is limited, includes the information assumed to be of state/public importance.

The Water Code of Azerbaijan regulates the use, protection, and management of internal water resources, promoting environmental protection, economic development, and quality water provision for the population.

The Law on Water Supply and Wastewater was adopted in 2000. The main goal of the law is to determine the provision of the population, enterprises and institutions with water and management of wastewater. According to the law, the Cabinet of Ministers and the local bodies of executive power are key executive bodies. This law establishes the main water rights and wastewater management rights.

The International Commission on Aquatic Resources of the Caspian Sea (ICARCS) regulates fisheries in the Caspian Sea region by defining the Total Allowable Catch (TAC) and distributing the catch quota regarding major commercial fish species (sturgeon, kilka, seals) between Iran, Kazakhstan, Russia, Azerbaijan and Turkmenistan. The Commission also coordinates conservation activities related to the sustainable use of Caspian aquatic bio-resources, supports scientific cooperation and data exchange, and coordinates scientific research.

Institutional framework

The stakeholders involved in the natural resources and environmental management in the territory of the Republic of Azerbaijan include state, non-state and local self-governing institutions. Municipalities, CSOs, local community organizations, public environmental movements, environmentally active people represent public sector. The institutional situation in Azerbaijan is characterized by independently operating ministries and entities that form a group of related stakeholders with very limited coordination, mostly on an as-needed basis only.

The Ministry of Ecology and Natural Resources (MENR) The MENR in Azerbaijan is responsible for biodiversity conservation and sustainable resource use, covering six areas: environmental policy development, protection, water monitoring, water management, freshwater and marine resources protection, forest management, and protected areas.

The Ministry of Agriculture (MA) regulates and controls agricultural production and processing in Azerbaijan, covering policy, livestock, crop, food security, land use, environmental protection, and research.

The State Tourism Agency (STA) is the primary government agency responsible for the development of tourism in Azerbaijan. The key responsibilities of the STA cover four broad areas: (i) tourism policy and planning; (ii) tourism media and communications; and (iii) tourism development.

The Ministry of Economy (ME) is the primary government agency responsible for the development of the industrial manufacturing and energy production sectors in Azerbaijan. The key responsibilities of the ME cover four broad areas: (i) industrial and energy planning, policy and standards development; (ii) facilitating investment conditions for the manufacturing sector; (iii) improving the efficiencies of energy supply; and (iv) energy research and development.

The Ministry of Finance (MF) is the primary government agency responsible for regulating the financial sector in Azerbaijan. The key responsibilities of the MF cover four broad areas: (i) financial, budgeting and tax policies; (ii) forecasting, budgeting and financial management of state budget; (iii) development of financial markets; and (iv) controlling the movement of funds.

The Ministry of Emergency Situations (MES) is entitled to reduce the risks of natural disasters, flood and flash floods, landslides, avalanches, droughts, forest fires and manage them during emergency situations and apply emergency zone when necessary. Currently, MES only controls the operation of large water bodies and takes measures to prevent possible natural disasters.

State Agency of Water Resources The State Agency of Water Resources has been established recently with the mandate to play a coordinating role in water resources management. It is instructed by- and report back to the Cabinet of Ministers who may set up a Water Commission for this task. It is envisaged that the State Agency be strengthened in its coordinating and instructing role while it is not intended that it should take over mandates from the other stakeholder institutions. It will be important that the State Agency is empowered by the Cabinet of Ministers to carry out its role and that a respective legal base for binding instructions to the involved ministries and stakeholders is created.

CHAPTER 2

2.1. FRESHWATER ECOSYSTEM ASSESSMENT FOR AZERBAIJAN

Freshwater bodies are crucial sources of drinking and irrigation water, as well as performing environmental functions. Azerbaijan's freshwater ecosystems have both use and non-use values, contributing to the well-being of water users. Use values involve the consumption and production of water and related environmental goods or services, while non-use values involve the willingness to pay for the preservation or improvement of natural resources without intent. Azerbaijan's water sources are ecosystems that meet economic, domestic, and drinking water needs. These water sources also provide a wide range of values related to history, culture, and natural peculiarities of the country. The Kura and Araz rivers, located between Turkey and Azerbaijan, are crucial water sources for agriculture, industry, and households. Water is valuable not only for its use but also for its environmental and ecosystem functions. Economic value creation follows water uses and the role of water as a renewable natural resource. The bequest value is the most important non-use value of natural heritage, as it involves the transmission of special qualities to future generations. The protection of water bodies like Goygol, Aggol, Isa spring, Istisu mineral spring, Kura, and Tartar rivers is crucial for future generations. The loss of these values can also result in the loss of ecosystem services, such as small rivers in the Kura basin that are spawning grounds for sturgeon fishes. Altruistic value involves individuals spending money or time to protect natural heritage and biodiversity. Small rivers in the Kura basin and Caspian Sea have historically been migratory routes and spawning grounds for valuable sturgeon. Today, many of these rivers retain their value, serving as a source of drinking water and natural heritages of high ecological value.

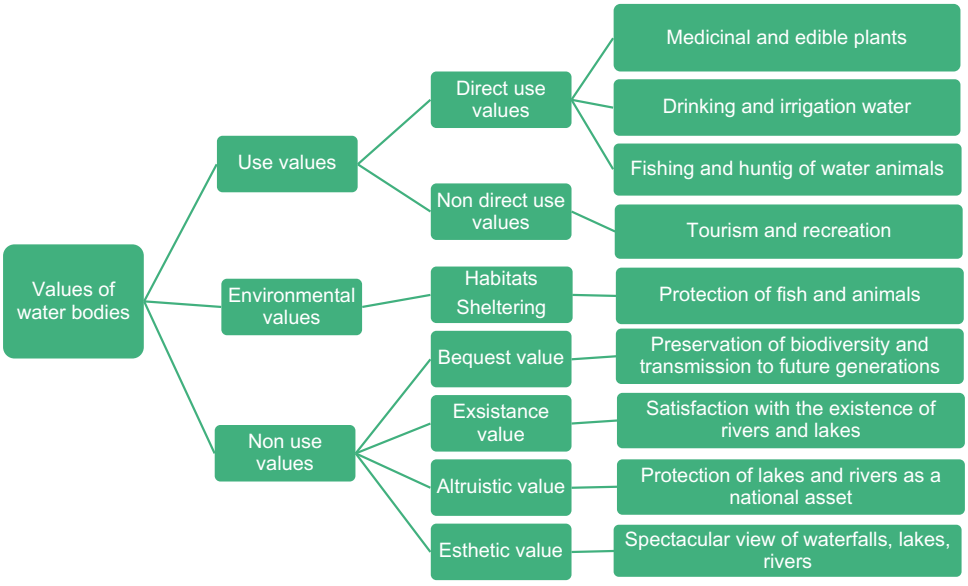

Fig. 2.1. Contributions of Freshwater Ecosystems to People and Quality of Life[4]

[4] Abbasov, R., Karimov, R., & Jafarova, N. (2022). Ecosystem Services in Azerbaijan: Value and Losses. Springer.

2.1.1. Status, Trends, and Future Dynamics of Freshwater Ecosystems Underpinning Nature's Contributions to Peoples

Azerbaijan, located in the downstream part of the Kura Basin, is highly dependent on transboundary watercourses in terms of water resources, and 77% of the country's water resources come from upstream countries.

Rainfall varies from less than 250 mm/year in the Absheron peninsula, to about 400 mm/year in the lowlands of the Kura basin, 600 to 900 mm/year in the foothills overlooking the Caspian Sea, to between 1,000 and 1,300 mm/year in the mountains and internal valleys on the southern slope of the Lower Caucasus Range. The water balance of Azerbaijan (Table 3.1) also shows the importance of flows entering Azerbaijan from upstream countries—76.5 percent of total renewable water resources available to the country.

Precipitation is falling both as rain and as snow with the latter forming a significant part of the runoff during snowmelt in spring. Estimates show that internal renewable water resources amount to about 8.12 km³/year. Annual local surface runoff formed in Azerbaijan is estimated at 5.96 km³ and groundwater recharge at 6.51 km³, of which 4.35 km³ constitutes the base flow of the rivers. The estimated incoming surface flow is 26.56 km³/year, of which 11.91 km³ originate from Georgia, 7.50 km³ from the Islamic Republic of Iran and 5.97 km³ from Armenia and Turkey. The total renewable surface water resources, including incoming and bordering flows, are therefore estimated at 34.68 km³/year.

Azerbaijan has four major river basins: the Kura and Araks rivers, which form the largest transboundary river system in the southern Caucasus, originating in Turkey and flowing through Georgia and Azerbaijan into the Caspian Sea. The Kura River system, which is 1,515 km long, has an estimated annual inflow of 11.91 km³ from Georgia and 13.47 km³ from the Araks River and its tributaries from Armenia and Iran. The Samur River Basin, located in the northeast, forms the border with Russia and has an estimated annual discharge of 2.36 km³. The Caspian Sea coastal river basins, between the Samur and Kura River Basins, have an average water resource of 1 km³. However, river flows from neighboring countries into Azerbaijan have been declining due to climate change and growing water demand in these upstream countries. (Fig. 2.2).

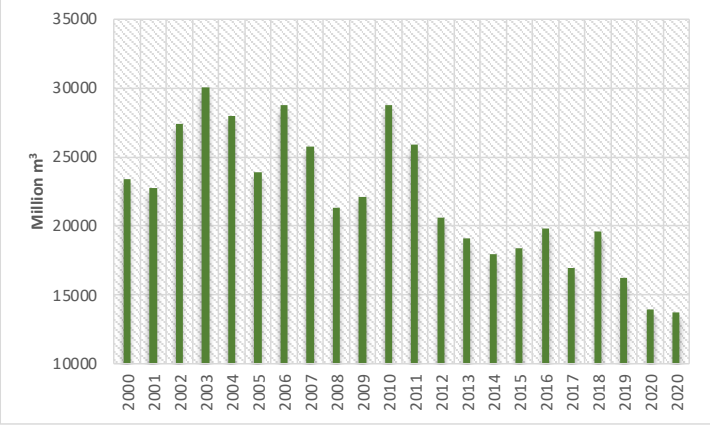

Fig. 2.2. Water resources of Azerbaijan[5]

[5] Source: Ministry of Ecology and Natural Resources of Azerbaijan Republic (www.eco.gov.az)

2.1.2. Status of water use in Azerbaijan

The arid climate increases the demand for water in the agricultural and drinking water sectors, and therefore irrigation plays an important role in the development of the country's economy. Azerbaijan's water resources play an invaluable role in providing water to agriculture, population, and industry. Rivers, groundwater sources and springs are used for the following purposes:

- Provision of the population with drinking water
- Provision of agriculture with irrigation water
- Use of water as a raw material in the industry
- Use of water sources as habitats, fishery, and recreation

Annually 11,000-13,000 million m^3 of water is taken from rivers for agricultural irrigation purposes. The volume and timing of water flowing within the rivers of Azerbaijan have a serious effect on all economic, agricultural, and social activities in the. Due to population growth, the expansion of irrigated lands, and the increase in industrial needs the amount of water taken is increasing rapidly.

The Agricultural sector of Azerbaijan is highly dependent on irrigation. Most of the territory of Azerbaijan has rather dry climate, and therefore, irrigation very important in the Kura-Aras plain that occupies nearly 40% of the country's territory. 77% of the water taken in Azerbaijan is used for irrigation purposes. At the same time, 19% of water is used for electricity generation. Between 2000 and 2020, the area of cultivated lands in the country increased rapidly. Currently, more than 90% of the country's agricultural output is taken from irrigated lands. An analysis of water uses by sector from 2000 to 2020 confirms that agriculture is dominant compared to other sectors. This is due to the rapid increase in the area of irrigated lands in the country. The second major water user is the electricity generation sector. The methods currently used for irrigation are outdated and cause excessive water wastage. The water sector of Azerbaijan did not undergo key rehabilitation work since the early 1980s and is in urgent need of complex changes, repair or replacement. A significant amount of water taken for use is lost during transportation. This loss is primarily due to the fact that irrigation canals are located at the base of the soil and, as a result, water leaks into the soil, as well as leaks in distribution networks. Old irrigation methods also cause water loss during irrigation. Due to climate change, it is expected that there will be more need for water for agricultural production, which will cause adverse impacts on food security of children.

Water supply of Ganja city is provided mainly by small rivers of the Lesser Caucasus. Nearly 95 percent of all households in the Greater Baku Area are connected to the water supply system. Despite the high coverage of water supply systems in urban areas, the major concern and source of discontent of the population, as demonstrated by several independent studies, are the poor state of repair of facilities, lack of adequate maintenance, and insufficient resources available for operations, and, more generally, the reliability and safety of the service. According to official statistics, the urban population is constantly rising in the country, and, over the past 20 years, an astonishing amount of illegal urbanization occurred in the Greater Baku Area. Various types of small and big houses built by refugees and other migrating population have turned the Baku suburban area into a huge illegal region of shanty towns. None of these shanty towns have been built by planning water supply networks, but only after construction, in order to meet daily needs, illegal pipe networks have been laid out and connected to the main pipelines. In these illegal residential areas city water is supplied for only few hours each day on a rotating schedule that is incompatible with sanitary requirements. The related water shortages thus cause many people in the suburban regions of Baku city, where there is no centralized sewer system, to use untreated groundwater for their needs.

Hydropower

According to estimates, the hydropower potential of all rivers in Azerbaijan is 40 billion kilowatt-hours. The main hydropower facilities are located on the Kura and Araz rivers. Currently, the amount of water in both the Kura and Araz rivers continues to decline, mainly due to the influence of two factors. The hydropower potential of the country's small rivers will also decline due to climate change and increased water withdrawals. Reservoirs in Azerbaijan are used for several purposes; for instance, municipal water supply, hydropower, irrigation, fisheries, and recreation purposes; however, energy production is the most important use of dams. The main aim of the reservoir is an agricultural water supply and power generation. The reservoir provides irrigation water to 46,000 ha of land in Shamkir, Samukh, Goygol and Goranboy rayons. The Yenikend reservoir also provides water for 6000 ha of irrigated land. This dam is operational since 1971 and used jointly with Iran, for agricultural water supply and power generation. Araz reservoir irrigates more 400000 ha of the land in Iran and Azerbaijan. Other HPP/dams that produce hydropower within the territory of Azerbaijan are Bilav and Vaykhir. Map 2 provides the location of HPP/dams in the Kura-Araz river basin. At least 10 additional dams are expected to be built on small rivers to meet the water demand in Azerbaijan.

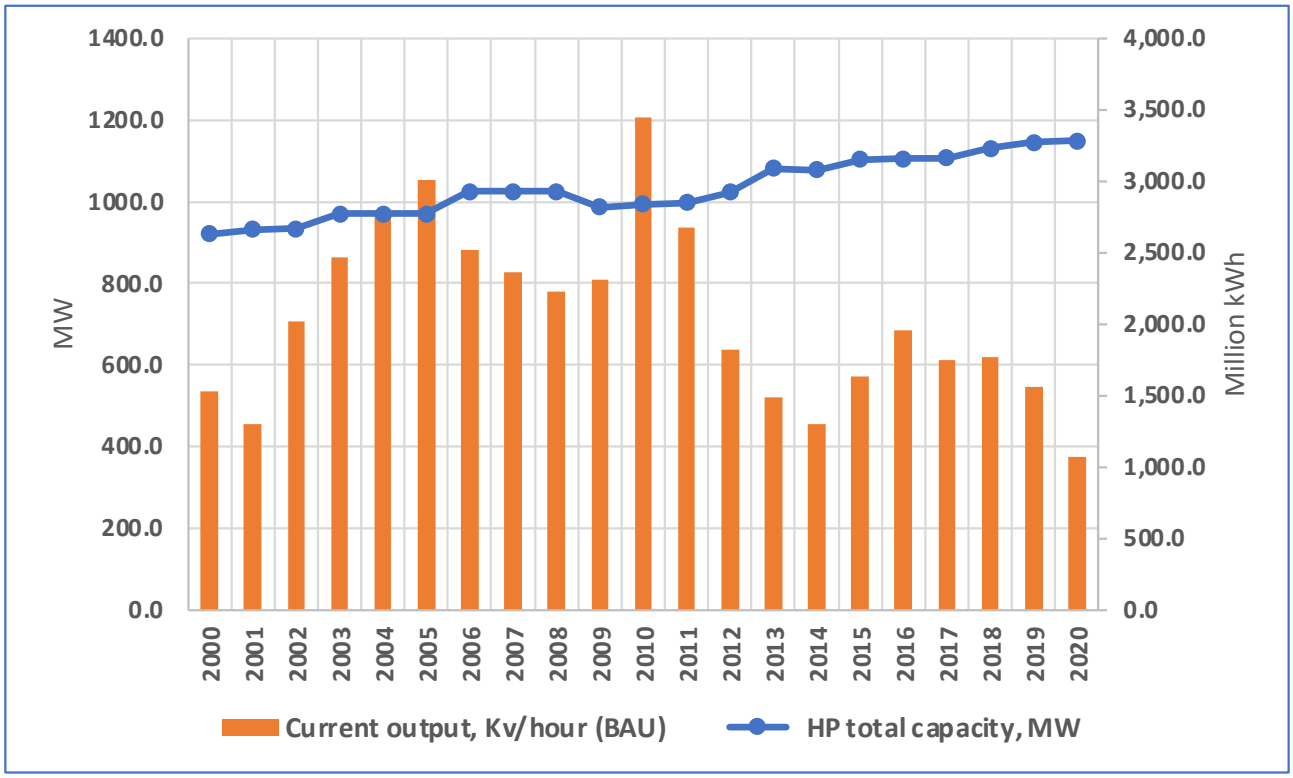

Fig. 2.3. Hydropower generation in Azerbaijan (1990-2019)[6]

[6] Source: State Statistical Committee of Azerbaijan Republic (www.stat.gov.az)

Fishing and hunting

Lake Agzibirchala (port) is located close in the north part of Azerbaijan, close to the Caspian Sea. The fauna of the lake is mainly represented by wolves, foxes, jackals, badgers, beavers, etc .Birds include geese, green ducks, partridges, etc. Yashma Hunting Farm is located in the administrative territory of Khizi district, with an area of 4,000 hectares. Mahmudchala Hunting Farm is located in the administrative territory of Bilasuvar region, its area is 7136 hectares. Zavvar Hunting Farm is located in the administrative territory of Jalilabad region, with an area of 20,000 hectares. Kirmizikend Hunting Farm is located in the administrative territory of Masalli and Neftchala districts, with an area of 10,000 hectares. Agzibir Hunting Farm is located in the administrative territory of Shabran district, with an area of 21,000 hectares. Gilazi Hunting Farm is located in the administrative territory of Khizi district, with an area of 25 hectares.

Regulatory services of freshwater bodies

The regulatory services of water bodies include natural water filtration, flood control, climate regulation etc. Historically, the remaining lakes around the Kura and Araz rivers have also played an important role in the natural regulation of floods. The oxbow lakes have also played an important role in regulating floods in the Kura and Araz rivers. During the spring highwater season, when the level of the Kura River rises, some of the river water flows into these lakes, thus reducing the risk of flooding in the downstream areas.

Fig. 2.4. Mingechevir (1), Shamkir (2) and Yenikend reservoirs on the Kura river[7]

[7] National Ecosystem Assessment technical report

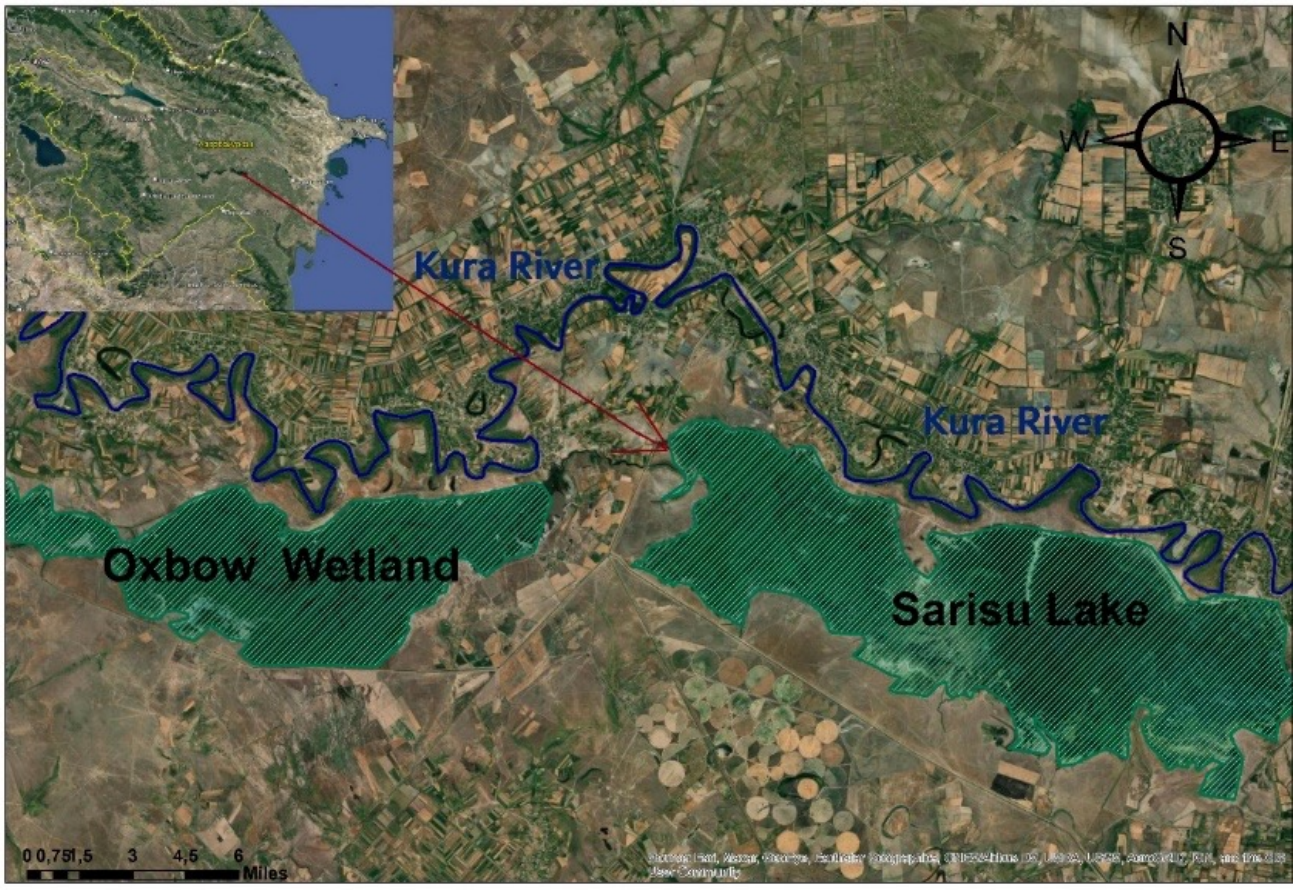

Fig. 2.5. Oxbow lakes around the Kura River[8]

Climate regulation

Relatively large cities such as Mingachevir, Yevlakh, Shirvan, Kurdamir, Salyan are located on the banks of the Kura River and close to reservoirs. During the summer months, water evaporating from both the Kura and reservoirs and lakes increases relative humidity and lowers temperatures.

Habitat support

Azerbaijan's water bodies are located in very favorable areas, such as habitats for wild animals, birds and fish, and are of great importance. Rivers and lakes are not only the habitats of fish, birds, and many mammals, but also the main carriers and supporters of environmental processes in nature. The small mountain rivers flowing into the Kura and Araks are the preferred spawning grounds for the valuable sturgeon fish of the Caspian Sea, which contains over 90% of the world's sturgeon population. Lake and swamp systems, mainly in the Kur-Araz and Caspian coasts, are the main wintering grounds for migratory birds. Several national parks and numerous sanctuaries have been established in Azerbaijan to protect migratory birds and other animals living in these lake-swamp systems. The high level of groundwater tables near water bodies and the periodic increase of water in rivers in the spring contribute to the growth of forests in the coastal areas of rivers. Currently, riparian forests in Azerbaijan occupy mostly floodplain areas, where groundwater table is rather close to the surface and may permanently supply trees with water. In addition, there are nearly 20000 ha of riparian forests in Azerbaijan, that mainly occupy floodplains and banks of the Kura and Araz rivers. Close to rivers and where groundwater table is rather high, the forests are usually dominated by willow and poplar species. There is a historical evidence that the Tugai forests used to occupy extensive areas along the Kura and Araz rivers. Currently, flow regulation in the Kura river has also affected Tugai forests, reducing areas of floodplains. Part of the forests and shrublands are protected relatively well and included to the areas of national parks and reservations. Qarayazi State Reserve is the only protected area that includes riparian forests along the Kura river, Azerbaijan. The forested area includes willow and poplar

[8] National Ecosystem Assessment technical report

species. These plane trees grow on the banks of the Basitchay River, in areas with very high groundwater tables. Tugai forests can adversely affect and even lose many of its species, reduce its role in protecting river banks and protecting the purity of their waters.

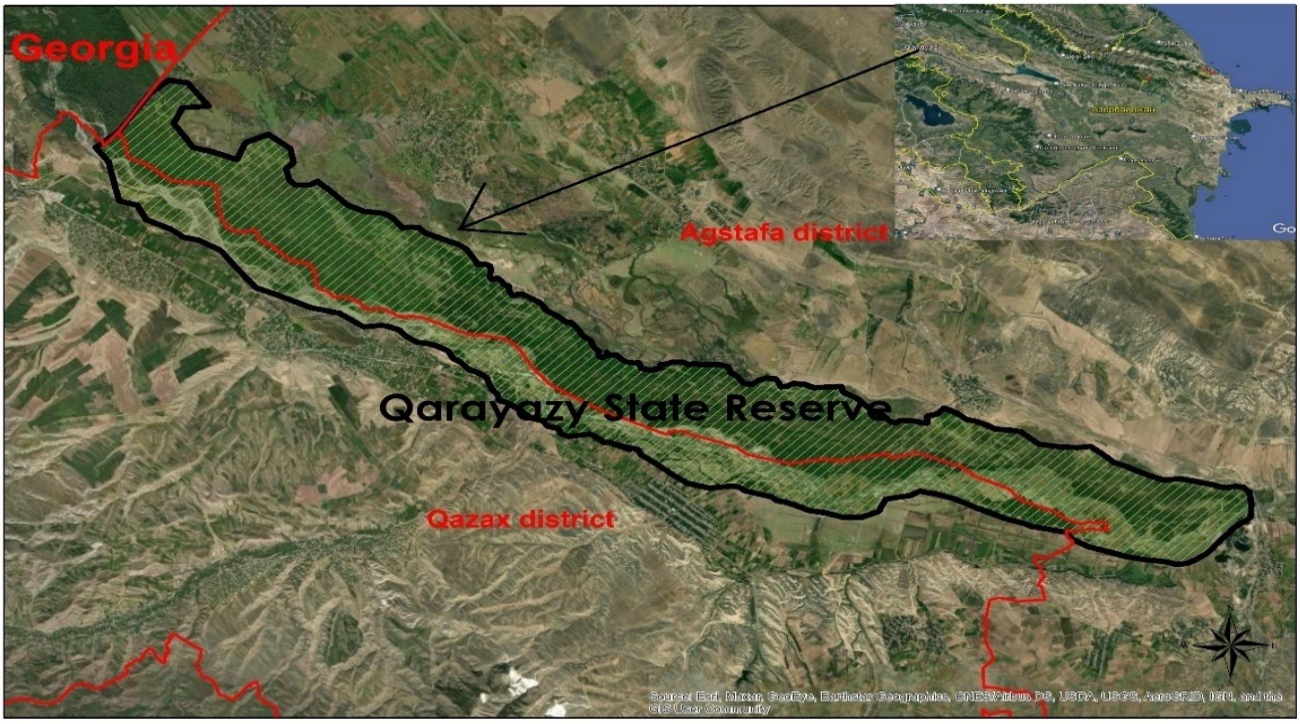

Fig. 2.6. Tugai forests of the Kura floodplain in the Garayazi state reserve and adjacent areas[9]

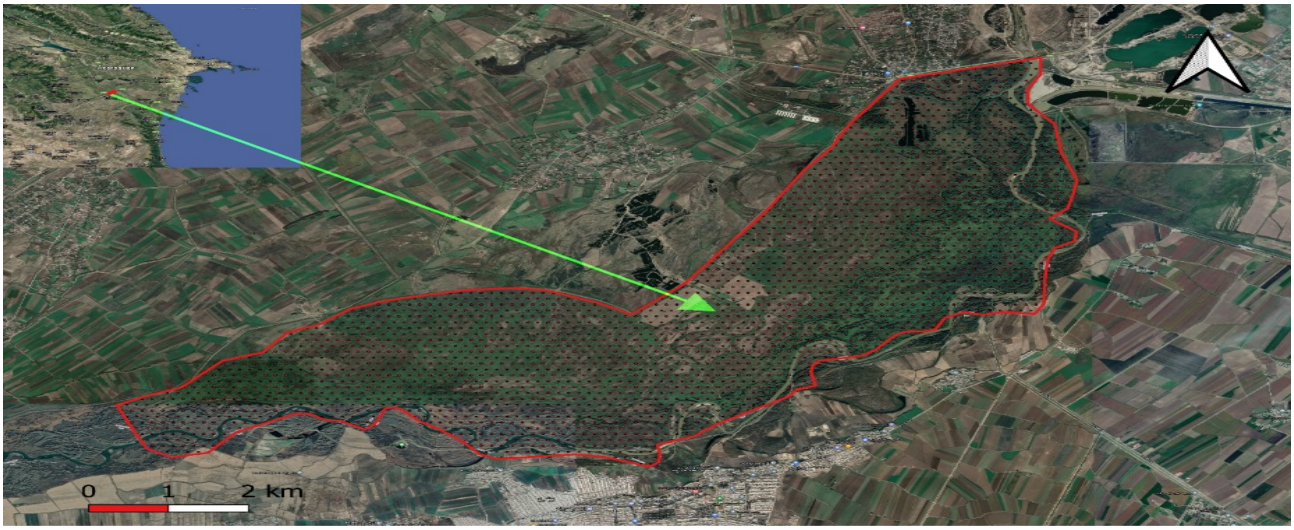

Fig. 2.7. Lake-wetland ecosystems near Araz river[10]

[9] National Ecosystem Assessment technical report
[10] National Ecosystem Assessment technical report

2.1.3. Non-use values of freshwater bodies

Azerbaijan's water bodies are crucial habitats for wildlife, including wild animals, birds, and fish. Rivers and lakes are vital carriers of environmental processes, with small mountain rivers spawning sturgeon fish and lake and swamp systems providing wintering grounds for migratory birds. Azerbaijan has several national parks and sanctuaries to protect these ecosystems. Riparian forests in Azerbaijan occupy floodplain areas, dominated by willow and poplar species. However, flow regulation in the Kura River has reduced floodplain areas, affecting Tugai forests. Some forests and shrublands are protected, including the Qarayazi State Reserve, which includes riparian forests along the Kura River.

Goygol lake and Goygol National Park In addition to Goygol, 19 other lakes have been created in the surrounding areas. Lake Maral is 1910 m above sea level, 700 m long, 500 m wide and covers an area of 23 km². Goygol National Park includes all the 19 lakes in Goygol lake and forests and mountain meadows. The mountain forests, which cover an altitude of 1100-2200 m, are very diverse and have about 80 species of trees and shrubs. These species are most common in subalpine meadows. Covering the territory of the national park at an altitude of up to 2,000 meters, the interchangeability of different plant formations, the general geographical position of the area has created conditions for a significant richness of fauna. In the territory of Goygol National Park, mammal species include Caucasian deer, roe deer, brown bear, goat, badger, forest cat, sable, lynx, stone squirrel, doll, common hedgehog, fox, Radde brown, Caucasian mole, white-tailed deer, etc. Rare species of Caucasian deer are protected in the national park, and trout in the Blue Lake. The diversity of natural beauty, richness of flora and fauna in Goygol National Park has created conditions for the organization and development of ecotourism, as well as the attraction of many local and foreign tourists to the area.

Lake Batabat is located in the mountainous part of Nakhchivan AR, at an altitude of 2424 m above sea level, surrounded by picturesque alpine meadows where the Nakhchivan River begins. The total area of the lake is 16 hectares. There is a floating peat island in the middle of the lake, and this island is constantly changing its location. The picturesque pool is covered with greenery and flowers in spring and summer. Water from carbonate, hydrocarbonate and calcium-sodium-magnesium mineral springs around the lake is used to treat gastrointestinal diseases. The large number of sunny days, mild climate and beautiful mountainous landscape give the lake a unique color, attracting many vacationers from Nakhchivan and other regions of Azerbaijan, as well as foreign tourists.

Fig. 2.8. Batabat Lake[11]

[11] Photo of Rec Caucasus Azerbaijan

2.1.4. Direct and Indirect Pressures on Biodiversity and Ecosystem Services in Selected Ecosystems

Freshwater ecosystems in the country are one of the most threatened habitats due to anthropogenic pressures mainly stemming from unsustainable urban water use, industry and infrastructure development projects, agriculture and increasingly the development of the hydropower sector. Sectors such as agriculture and forestry contribute by supporting unsustainable forestry, farming and husbandry (extensive/over-grassing) practices in the upper watershed including catchment areas; these unsustainable practices have a negative impact on freshwater ecosystems.

Water withdrawals

Rivers and small streams are under extreme pressure at present due to intensive water withdrawals for agriculture, particularly during the low-flow period, when some of them run dry—a situation which is not natural in this region. Intensive water withdrawals in many small streams have led to significant changes in flow regime downstream.

Because Azerbaijan is located in the lower reaches of the Kura and Araz rivers, the water withdrawals carried out by the upstream countries have a serious impact on biodiversity in the downstream part of these rivers.

Intensive withdrawal of water from rivers has led to significant changes in their natural flows. Small rivers of the country are under extreme pressure at present due to intensive water withdrawals for agriculture, particularly during the low-flow period, when some of them run dry—a situation which is not natural in this region. Intensive water withdrawals in many small streams have led to significant changes in flow regime downstream. The more intensive impact of anthropogenic factors on the river flow regime began with the commissioning of the Varvara and Mingachevir reservoirs in 1950-53. Currently, there are 25 large and small reservoirs in the Kura River basin in Georgia, and the annual irreversible flow is -1 656.54 million m³. As in the Kura River, the intensive influence of anthropogenic factors has been observed in the Araz since the middle of the 20th century.

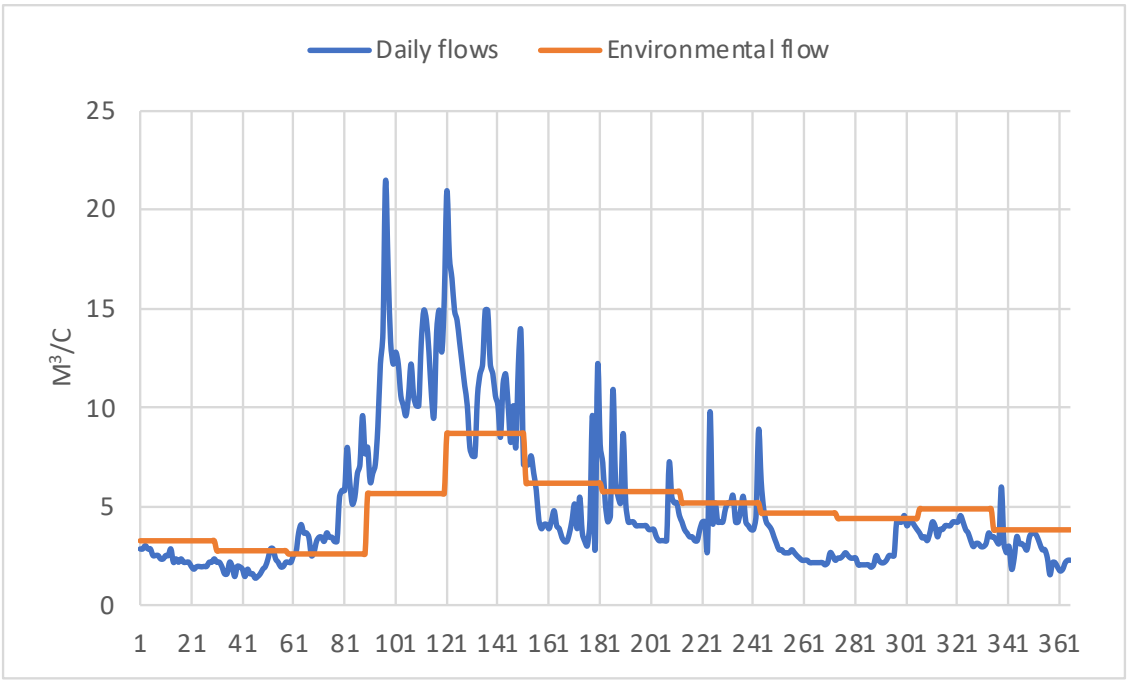

Fig. 2.9. Comparison of monthly ecological flow and daily observed water consumption in Agbashlar site of Zayam river[12]

[12] Abbasov, R. K., & Smakhtin, V. U. (2009). Introducing environmental thresholds into water withdrawal management of mountain streams in the Kura River basin, Azerbaijan. Hydrological Sciences Journal, 54(6), 1068-1078.

Climate change

Long-term projections show that in 2020-2100, against the background of rising temperatures in the territory of Azerbaijan, atmospheric precipitation will decrease, and water content in all freshwater basins, including rivers, lakes and ponds will decrease. Climate change influences is expected to stress water resources. The studies confirm that climate changes started to cause a reduction in the major rivers and water resources of Azerbaijan. The research results confirm the significant impact of climate change on water resources during recent 21 years. According to the "HadCM3 modeling of MAGİCC/SCENGEN" scenario in 2011-2040, 2041-2070 and 2071-2100 in the condition of increase in temperature and decrease in precipitation (especially in the Lesser Caucasus) the water resources over the country predicted to decrease by 10-15% in 2011-2040, by 15-20% in 2041-2070, by 20-25% in 2071-2100 years. Country reliance on surface water can be dramatically affected as supply from river waters becomes more variable, and more demand is placed on other sources, such as groundwater, storm water and desalinated sea water. Given that climate change is also likely to negatively affect groundwater resources, the role of storm and desalinated waters becomes more important. This will increase expected water withdrawals from the country's rivers and groundwater sources. As a result of climate change, the demand for water is expected to increase against the background of a decrease in surface area.

Drinking water problems

As far as I know, more than 70% of Azerbaijan's water resources fall on the Kura and Araz rivers. The increase in the number of reservoirs built by neighboring countries on these rivers in recent decades has sharply reduced the water content of these rivers. From this point of view, there is a shortage of both drinking and irrigation water in the Kura River in 2020 and in the lower reaches of the Kura. As a result of the drying up of the Kura River in 2020, serious problems have arisen in the supply of drinking water in many parts of Azerbaijan, mainly in the Salyan and Neftchala regions. The Kura and Araz are claimed to be one of the most turbid in the world, with high turbidity increasing the cost of treatment for drinking water. Sediment flows of these rivers are conspicuous, so that the water quality of the rivers requires large facilities to reduce sediment load near the withdrawal site and conventional treatment to meet drinking water standards. The government has made notable efforts to improve water supply and sewage systems in the country. A considerable part of the Baku population still depends on Kura water. Nearly 25% of the Greater Baku area that has more than 4 million of residents are supplied by water withdrawal facilities located in a downstream part of the Kura River.

Floods

In Azerbaijan reservoirs play an important role in prevention of floods capturing water during high seasons and reducing flow peaks. Reservoirs in Azerbaijan are mostly used to balance the flow in rivers with spring high flows, taking in water during high flows and releasing it again during low flows. Over the past century, notable floods in the downstream part of the Kura river were observed in 1915, 1936, 1942, 1944, 1946, 1952, 1969, 1976, 2002, 2003 and 2010 years. After dam and reservoir construction, the highest peak flows were notably reduced. Regulated flow from the reservoir altered the annual flow distribution of downstream, and flood events were almost eliminated during the first 40 years after construction. Due to the destructive nature of these floods, the strongest are the floods observed in the Kura and Araz rivers.

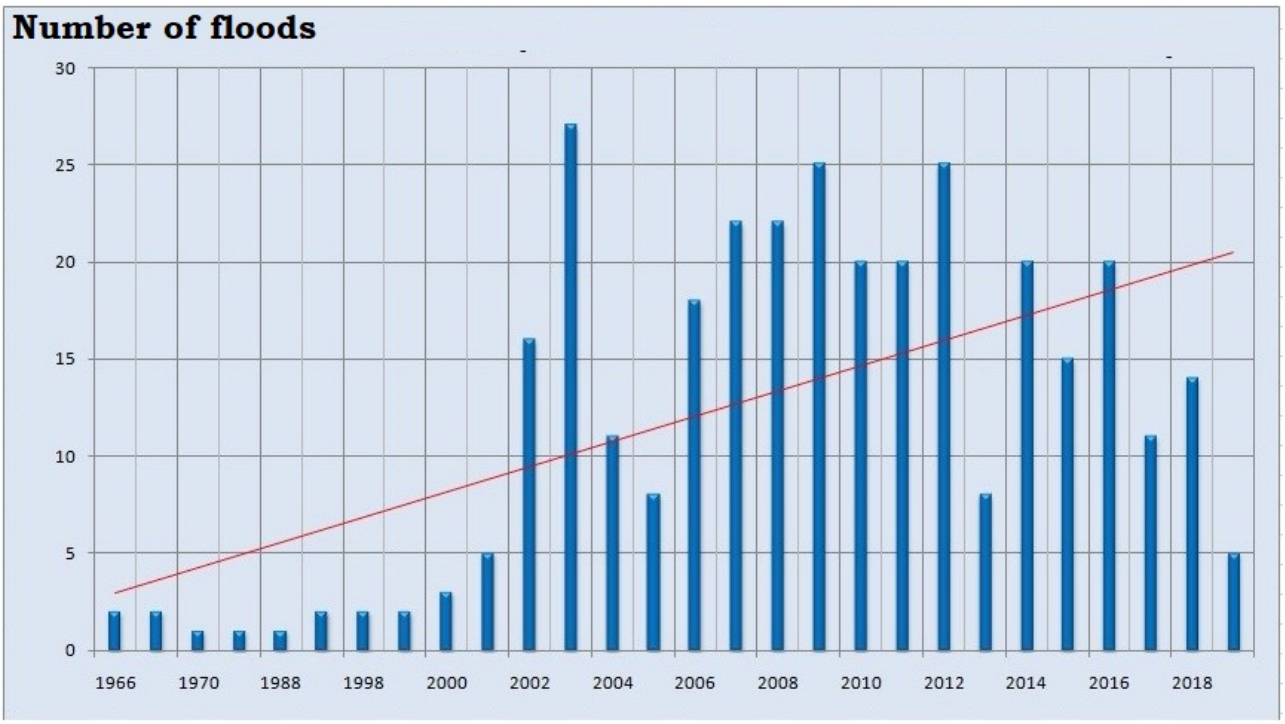

Fig. 2.10. Floods in Azerbaijan[13]

Pollution of watercourses

The main sources of pollution in the Kura Basin, where transboundary pollution is strong, are industrial activities and polluted municipal waters. Various measurements indicate that the Kura and Araz rivers and their tributaries are polluted by wastewater from the mining industry and large cities, and as a result, it has been determined that the water of these rivers cannot be used directly as drinking water. İn the Kura river, pollution evidently coming from the settlements of central region of Georgia and the Alaverdi copper mining region in Armenia. he main sources of pollution in the Araz River come from gold, copper and molybdenum mines in the Syunik region of Armenia, as well as settlements in Turkey, İran and Armenia.

Subsequently, metal contaminants discharged from the Yerevan region and mining industries in Armenia, and possibly also from sources in Turkey and Iran, appear to change the quality of the Araz river system all the way down to the confluence with Kura and even farther down. Over the past 50 years, metal (As, Cd, Pb, Cr, U) concentrations in some streams have been increasing due to the growth of the mining operations in Azerbaijan and Armenia. The source of the Tartar River, one of the main right tributaries of the Kura River in Azerbaijan, was illegally controlled by the Armenian military sources in 1992-2020, where the Zod gold mines were illegally exploited. The results of statistical analysis based on data sets of the period 2020–2021 confirms that as a result of wastewater drainage of mining areas, heavy metal concentrations in the Okhchuchay river significantly increased.

[13] Source: Ministry of Ecology and Natural Resources of Azerbaijan Republic (www.eco.gov.az)

Pollution of lakes

Most of the lakes are primarily located in the areas of oil production. Long-term wastewater discharges from oil fields have heavily polluted these lakes. The studies done by PE confirm high-level pollution with oil products, VOCs, PAHs, heavy metals. VOCs, crude oil products, heavy metals, benzene, and toluene are the most common chemicals in these lakes. Lakes of Bulbula, Girmizi, Zabrat and Lokbatan are heavily polluted with municipal wastewater as well. Pollution of these lakes has many negative environmental impacts on the attached areas such as soil degradation, salinization, and emission of harmful substances into the atmosphere as a result of evaporation process and lands left underwater due to the risen level of lakes. In the Lokbatan lake both water and bottom sediments are heavily contaminated with As, Cd, Pb, phenol, PCBs. Sampling results in the Masazır lake show that the water, bottom sediments and soil in nearby areas are heavy contaminated by cadmium. Water and bottom sediments and soil near the Gu lake are contaminated by arsenic, phenol, cadmium and lead. Kirmizi Lake sampling results show that both water, bottom sediments and soil in areas close to the shore are characterized by heavy arsenic contamination. Bulbula lake is polluted with arsenic and phenol contamination. The main pollution source is old legacy oil wells and dump site located near the lake. However, this treatment project did not yield positive results until the end, and Boyukshor still remains a polluted lake. Lake Khojasan is an inland body of salt water in a valley next to Baku. Samples from the lake confirm heavy cadmium and arsenic contamination. The lake has been used for salt production for many years.

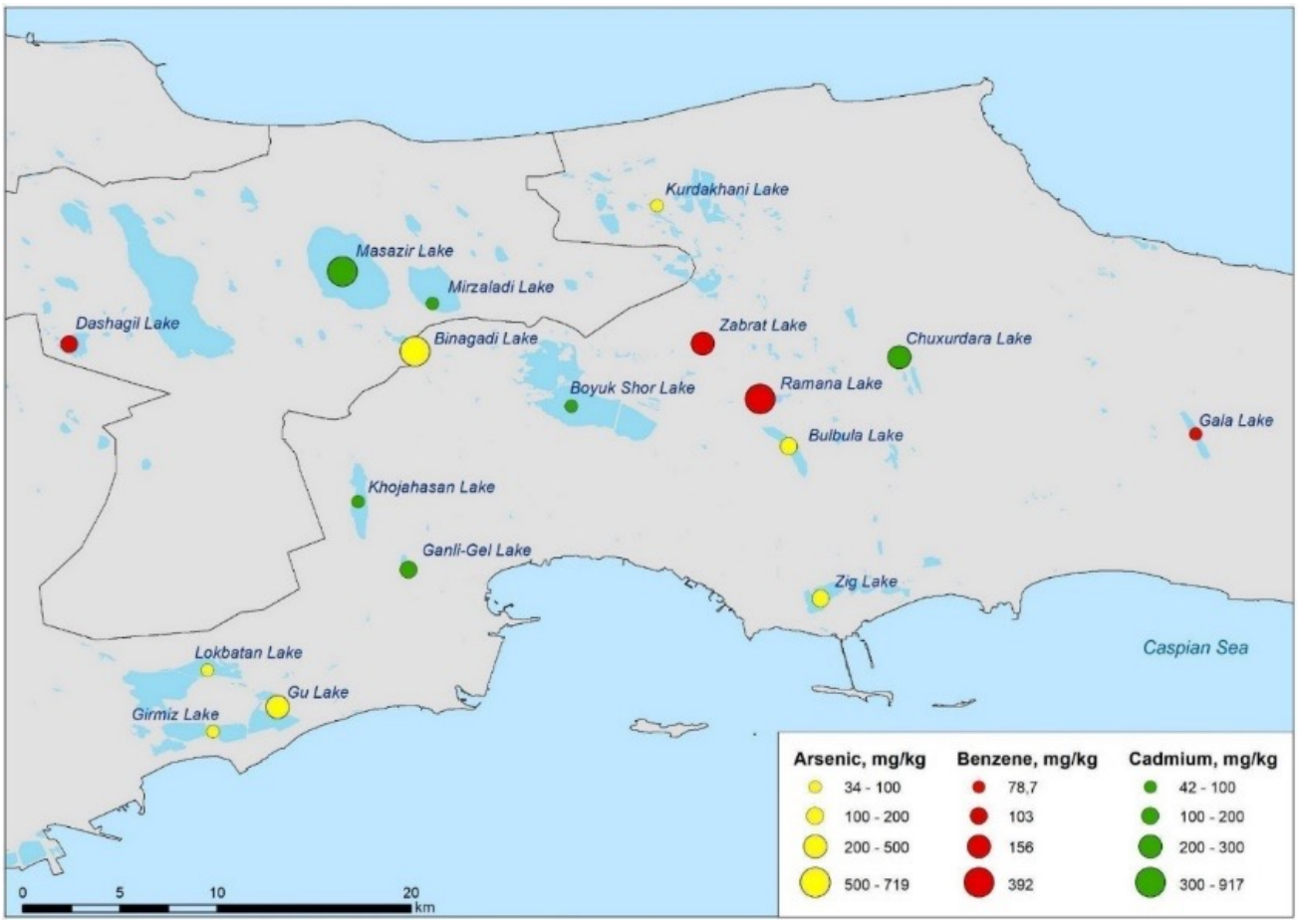

Fig. 2.11. Concentrations of key pollutants in sediments of lakes[14]

[14] Abbasov, R., Cervantes de Blois, C. L., Sharov, P., Temnikova, A., Karimov, R., & Karimova, G. (2019). Toxic site identification program in Azerbaijan. Environmental management, 64, 794-808.

How to protect the values of freshwater ecosystems?

However, over the last 100 years, pollution of the lake with oil products and dangerous pollutants has not only reduced the natural value of the lake, but also made it a source of environmental danger for the surrounding areas. Pollution in upstream countries and in Azerbaijan has significantly reduced the value of these rivers as a source of natural water. As a result of the pollution of the Absheron lakes, which were once a valuable source of fish, all ecological functions were completely destroyed, and these lakes became wastewater destinations. These management principles should be based on the integrated management of river basins and take into account the interests of all parties interested in water use, and the ecosystem needs should be a main priority. The implementation of integrated management in transboundary rivers requires more will and cooperation from stakeholders, and Azerbaijan, as a downstream country, has more responsibilities and activities in this regard. Rehabilitation of the Absheron lakes, which have lost their value as a result of pollution for many years, requires multifaceted activities, and these activities should be preceded by the cessation of pollution discharged into the lakes and the application of more advanced coastal management principles.

CHAPTER 3

3.1. OVERVIEW OF FORESTS IN AZERBAIJAN: IMPORTANCE, MANAGEMENT, AND CONSERVATION

3.1.1. Contributions of Biodiversity to Humans and Their Relationship to Quality of Life

Biodiversity, as defined by the United Nations Convention on Biological Diversity, encompasses the variety of living things on Earth and the evolution of these organisms over billions of years. It is crucial for our livelihood, health, and environment. Biodiversity provides food, water, air, and acts against pollution and climate change. It also promotes social cohesion, reduces stress, and regulates climate. It is a transmitter of culture and contributes to economic and social development. However, biodiversity is vulnerable and must be protected to ensure its vital resources and effects are not lost. Factors contributing to biodiversity loss include urbanization, infrastructure construction, deforestation, pollution, climate change, invasive species, and land use modification. The current drivers of biodiversity loss are based on an over-consumption and resource-intensive economic model, which ignores the long-term consequences for society and future generations. Protecting biodiversity is essential to ensure the legacy and life of future generations.

3.1.2. Forest Ecosystems: Status and Criteria

Change in land cover use

Among the six types of land use in Azerbaijan (forests, arable lands, other lands, pastures, wetlands, and residential areas), land use change and area growth were mainly observed in residential areas. This is followed by grasslands and woodlands. On the other hand, the area of farmland, other lands and wetlands has decreased.

Table 3.1. Land use change in Azerbaijan[15]

Soil use type	İnitial area (ha)	Current area (ha)	Change of area (ha)	Change in area (%)
Forest	1 299 729, 29	1 301 188,32	1 459,03	0,11
Sown area	3 305 138,59	3 270 192,26	-34 946,33	-1,06
Other soils	1 019 834,86	1 011 951,91	-7 882,95	-0,80
Pasture	2 298 562,71	2 305 186,62	6 623,91	0,29
Swamp	256 429,12	253 213,71	-3 215,41	-1,25
Residential areas	480 305,43	518 267,18	37 961,75	7,90
Total	**8 860 000,00**	**8 860 000,00**	**0,00**	**0,00**

[15] Source: Ministry of Ecology and Natural Resources of Azerbaijan Republic (www.eco.gov.az)

Cropland, other land, and wetlands decreased by 1.06%, 0.80%, and 1.25%, respectively, while forests, grasslands, and settlements increased by approximately 0.11%, 0.29%, and 7.90%, respectively. It should be noted that between 2000 and 2016, no forest area was converted into farmland or other land. In addition, due to the increase in population or infrastructure needs in Azerbaijan, part of the farmlands, other lands, and pastures have been converted into residential areas.

Stress tendencies

From the past to the present, various concerns such as logging, fire, and flooding have been detected based on satellite images. For example, if the presence of trees was detected earlier, the destruction of trees has been detected in the same areas until now. A fire disturbance was detected based on the NDVI graph. Stress has been detected in pastures. According to the results of Saiku's analysis, fires occur at different levels in all types of land use in Azerbaijan.

Compared to other land use types, the majority of stresses occurred in cropland (50.8%), pastures (25.7%) and forests (11.2%). fire is a major hazard in all land use categories.

Saiku analysis has determined that a total of **1,078,512.85 ha** of land has been burned for all types of land use. Hansen et al reported a total of 3,090,864 ha burned between 2000 and 2018. Logging, fire and other violations of classification affected **122,504.65 ha** of forest area, which is equal to 9.4% of the total forest area.

Erosion trends

Erosion is one of the main factors causing soil degradation. In many areas, the land cover and geography of the region accelerates the rate of erosion. The total area of the erosion-prone area is **161,073.48 ha.**

Minimum erosion trend is observed in micro crops (1773.69 ha-1.1%) and forests (8868.69 ha-5.5%). However, 76111.43 ha of other lands and 42325.93 ha of pastures are prone to erosion, followed by 31993.73 ha of wetlands.

Distribution of tree cover

Trees can be found in different land use types such as farmlands, grasslands, wetlands, settlements and other lands. The table below presents tree cover in different land use types The analysis shows that tree cover covers 31.77% of the total area, with existing forests covering 47.29%. Other land types include cultivated land, pastures, residential areas, and low amounts in other lands and wetlands.

Oak forest formations Chestnut oak (Talish) forests Low mountain belt forests consisting of Caucasian oak Upper montane belt forests consisting of eastern oak Plain forests of long-stemmed oak A relict forest formation of Demiragaci Birch forest formation Although forests in Azerbaijan are small in area, they are famous for their richness of species. Broad-leaved forests are typical for the entire territory of the Republic. 95% of Azerbaijan's forests are located in mountainous areas, and the remaining 5% are located mainly in water valleys and plains.

Forest consist of three main tree species: beech, hemlock, and oak. 7 out of the 107 tree species growing naturally in Azerbaijan are conifers. Among the relict and rare trees of the third period growing in the Talysh mountains are ironwood, Lankaran acacia, chestnut-leaved oak, azat, Caucasian palm, boxwood, walnut, Hirkan fig, Hirkan maple, etc., which are rare pearls of nature.

Vegetation trends

All types of land use include trees, shrubs and other greenery. Trees in forest areas cover an area of 1,301,088 ha. The total area of trees in Azerbaijan is 2,751,167.46 ha, 31.9% of the country's territory. In other words, 47.3% of trees are in forest massifs, and 52.7% are in other types of land use.

Forests cover 1 million 213.7 thousand hectares of Azerbaijan's territory, managed by the Ministry of Ecology and Natural Resources. The forests are crucial for preventing climate change, desertification, and biodiversity loss. Azerbaijan's forests are unevenly distributed, with 85% in mountainous areas and 15% in plains. The forest fund performs irrigation, soil protection, and climate regulation functions.

Forests belong to the first group of forests, as they perform purely protective functions due to the area where they are spread. Azerbaijani forests have unique forest formations. These formations are:

Shrub cover trends

In the analysis, it was determined that the total area of bushes in Azerbaijan is 1,385,010.59 ha. Shrub cover is found in all land use types. Shrubs are found mostly in pastures (52.7%), followed by cultivated fields (26.8%). 85,102.70 ha (6.1%) of forest areas also have shrubs. 2-19% of the area covered with bushes is 871,720.09 hectares. This is equal to 62.9% of the total bushes. In the remaining 513,290.5 ha, the bush cover is more than 20%.

3.1.3. Forest Ecosystem Services

Forests are home to many species of trees and plants. In addition, forests provide habitat for numerous species, some of which may be of special interest because they are endemic to the area, rare, threatened, or collected for traditional purposes.

Biodiversity impacts that can be demonstrated using the Ecosystem Services Procedure are:

- restoration of natural forest cover
- protection of intact forest landscapes
- maintenance of a network of ecologically protected areas,
- preservation or restoration of natural forest features,
- conservation or restoration of species diversity

Forests play an important role in mitigating the effects of climate change through their ability to act as carbon sequesters. Forests cover about 30% of the planet's land surface and contain 77% of all land surface carbon. Trees absorb and store carbon as they grow. Forest carbon is stored in five types of stocks (pools):

- aboveground biomass
- below-ground biomass
- soil (organic carbon in soil)
- dead wood
- waste

More than half of the carbon in broadleaf forests is stored as living biomass (aboveground and belowground biomass). Carbon is also stored outside the forest in the form of wood products.

The effects of carbon used in the Ecosystem Services Procedure are conservation and restoration of forest carbon stocks.

Forests significantly impact the hydrological cycle by influencing soil structure, stabilizing soils, consuming more water, and affecting climate. They

positively affect water quality and variability, and their watershed services are closely related to soil conservation, biodiversity, and recreational services.

- The Ecosystem Services Procedure can be used to demonstrate watershed services
- maintenance or improvement of water quality,
- storage or recovery of water,
- to clean the streams of river basins,
- the ability to adjust

Soil conservation is crucial for plant growth and life on Earth. Forest vegetation, decomposition of dead leaves, and recreational activities can negatively impact soil health. Soil conservation and watershed services are closely related.

In Azerbaijan, the use of forests for recreational and tourism activities (e.g., sports hiking, wildlife viewing) is popular. Recreational activities in the forest reduce stress and promote psychological and physiological recovery. The availability and quality of infrastructure (e.g., roads, campsites), the nature of the forest, and the intensity of its management affect the attractiveness of the forest for recreation. Impacts on recreational services that can be demonstrated using the Ecosystem Services Procedure include conservation of areas of importance for recreation or tourism and populations of species of interest for nature tourism.

Sustainable forest management and ecosystem services

In Azerbaijan, forests are regularly evaluated in order to determine the main criteria of "Sustainable Forest Management" such as forest resources, biodiversity, forest health, vitality, integrity, forest production capacity, functions, protective, ecological, socio-economic functions of forests.

Table 3.2. Sustainable Forest Management Criteria and Indicators

CRITERIA	INDICATORS
Criteria 1 Conserve and appropriately develop forest resources and their contribution to the global carbon cycle Size of forest and other clearing areas; share of forests and other wooded areas in the total area	The size of the forest and other clearing areas, the share of forests and other wooded areas in the total area
	Stock of wood in the forest and other stands
	Age and diameter distribution in forests and other wooded areas
	Carbon stock and carbon stock change in forest biomass, soil, and wood products
Criteria 2 Maintaining forest ecosystem health and vitality	Deposition and concentration of air pollutants in forests and other wooded areas
	Soil chemical properties (pH, CEC, C/N, organic C, and base saturation) in relation to soil acidity and eutrophication are classified by major soil types in forests and other wooded areas
	Leaf shedding from each shedding class affects one or more major tree species in forests and other wooded areas
	It is classified in terms of forests and other wooded areas damaged by primary damage factors (of abiotic, biotic, and human origin)
	Forest area degradation trends
Criteria 3 Production functions of forests sustain and promote (wood and non-wood)	Balance between annual net growth and wood cutting in forests suitable for wood supply
	Work tree volume
	Amount of non-wood products from forests and other wooded areas
	Value of services delivered to market from forests and other wooded areas
Criteria 4 The size of forests and other woody covers is classified by the number of tree species	Maintain, protect, and appropriately enhance biodiversity in forest ecosystems
	Total forest area by forest origin, annual reforestation and expansion area, volume of firewood, and felled dry wood
	The size of forests and other wooded areas according to naturalness class
	The extent of forests and other wooded areas dominated by exotic tree species
	Dry root in forests and other wooded areas

	Size of areas managed for exploitation and conservation of forest genetic resources (genetic conservation in situ and outside natural habitat) and areas managed for seed supply
	Area of forest fragments separated by continuous forest and non-forest areas
	The number of endangered forest species according to the Red Book in relation to the number of all forest species
	The extent of forest and other wooded areas protected to protect biodiversity, landscape, and certain natural components
	Observation of widespread bird species associated with forest ecosystems
Criteria 5 Maintain and appropriately enhance conservation functions in forest management (especially land and water)	Conservation forests: land, water, and other ecosystem elements; infrastructure and managed natural resources
Criteria 6 Maintenance of other socio-economic functions and conditions	Contribution of wood and non-wood product production to GDP
	Net income of forest enterprises
	Total public and private investments in forestry
	Personnel in the forest sector by gender and age group, education, and professional qualifications
	Frequency of industrial accidents and occupational diseases in forestry
	Recreational use of forests and other wooded areas in terms of conditions of use and intensity of use

Biodiversity values and global importance of Azerbaijani forests

Protection of biological diversity is the maximum condition for the sustainability of the global activity system of the Earth as an ecosystem. It includes transcendental aspects such as maintaining the current composition of atmospheric gases or regulating the cycles of the biosphere, including the water or nitrogen cycles. For example, a tree in a tropical forest returns 7.5 million liters of water to the atmosphere over a hundred years or more.

Biodiversity-related values can be classified as ethical, aesthetic, direct economic and indirect economic. On the other hand, economic values are important as they ensure the future of man and the environment by contributing to a more harmonious human development. Ethical values are based on the right of all living things to exist. Aesthetic values are a constant source of beauty for living things. Direct economic values, however important it is to protect ecosystems, do not necessarily mean preserving resources independent of human activity. By conserving biodiversity, not only is research looking for solutions to some current problems, but all the existing natural heritage must be preserved to meet future needs. Biodiversity as a source of food from a human perspective is of great interest because it is traditionally based on plant species. The value of food should not only be considered from a human perspective; it serves as a food link in the chains of living things in both aquatic and terrestrial environments. Biotechnology-controlled genetic modifications, which involve the introduction of foreign genes into other organisms, can be very beneficial to humans (disease prevention and treatment) and the environment.

Biodiversity is the diversity of life on the planet (including terrestrial and marine ecosystems and the ecological complexes that make them up), in addition to the diversity among species and ecosystems. However, the main threat to biodiversity is human activity manifested in deforestation, forest fires, climate change, and ecosystem changes. So we can argue that biodiversity is important not only for humans but also for life on the planet, so we should try to protect it. The geographical position of Azerbaijan distinguishes it as a combined territory of two biogeographical regions, a mountainous and a lowland region, which have developed various types of ecological and geographical kinship in the country. 70 species of trees and shrubs are endemic to the country.

However, we don't know much about genetic awareness, and much less has been researched. Similarly, as the extent of the country's territory increases, it is not observed that there is significant genetic variation in many developments, although some species also require very little variation and special care.

Invasive plant species

An inventory of the invasive flora of the Azerbaijani part of the Greater Caucasus was carried out. 39 plant species of foreign origin (60.9% of the total flora of Azerbaijan, including 64 species) are listed here, of which 12 (30.7% of the region's foreign flora) are invasive species. Asteraceae Dumort (11 species, 28%), Poaceae Barnhurt (13 species, 33.3%), and Amaranthaceae Juss (5 species, 12.8%) are the main groups of invasive flora in the region. The life form analysis showed that annuals were dominated by herbaceous plants, represented by 25 species (64.1%), and perennials by 12 species (30.8%). In the Azerbaijani part of the Greater Caucasus, most of the invasive species are distributed in the regions bordering Russia and Georgia. The analysis of the situation of invasive flora shows that now the representatives of foreign flora species are beginning to intensify in the region, and the first measure to control them is regular monitoring.

Protection of forest ecosystems and increase of forested areas

Thus, during these years, reforestation measures were carried out on 71634 hectares, out of which 28030.0 hectares were planted in open areas. The

most forested regions in the world are the countries of Russia, Brazil, Canada, and Finland. Taking into account the reduction of forest areas, the "Bonn Call" document was prepared, and the restoration of the forest landscape in 130 million ha by 2030 was envisaged by the countries. Since this challenge is voluntary, each country, taking into account its potential, was informed about the contribution it would make and joined the challenge. Since the main priority direction of our country is the increase and restoration of forest areas, as well as the increase of the percentage of forests, the Republic of Azerbaijan joined this call in 2018 and undertook to carry out forest restoration measures in 170 thousand ha by 2030.

Here are the recovery principles based on scientific and practical evidence:

- Restoration enhances biotic integrity in ecosystems and landscapes.
- Recovery is sustainable in the long term.
- Recovery is based on scientific knowledge.
- Recovery benefits society.
- Restoration interacts with the surrounding landscape.
- Restoration helps reduce the impacts and vulnerability of climate change.

On the other hand, as a result of continuous and decisive measures taken in the field of forest protection, the cases of illegal logging have decreased by 2.5 times in the last ten years (shown in point 3.1). As a result, the import of wood and wood products to the republic increased 10 times in the last 10 years and reached 180 million US dollars. In addition, 12.1 thousand tons of grass, 1.3 thousand tons of grain, and 792 tons of additional use of the forest were supplied in connection with the implementation of the "State Program on reliable supply of food products to the population in the Republic of Azerbaijan" (2003-2008 and 2008-2015) garden fruit, 1.4 thousand tons of garden pomegranates, 1.2 thousand tons of nuts, 214 tons of citrus fruits and 32065 kg of honey were supplied.

3.1.4. Direct and indirect effects on forest ecosystem service

As in many parts of the world, there is strong pressure on biodiversity in Azerbaijan on three levels. The main threats are the conversion of natural ecosystems to productive systems (agriculture or livestock), pollution, climate change, overexploitation of populations and the introduction of exotic species.

Threats affecting the forests of Azerbaijan affect not only the trees, but also fungi, microorganisms, fauna, etc., which are the basis of the forest. disappears with them. Types of threats to forests can be divided into two large groups: those that occur directly in the forest and indirect threats that are not directly in the forest, but whose consequences affect it. Direct threats are:

Deforestation

Deforestation has the following causes:

- Use of firewood - fuel and industrial shredding.
- Urbanization - destruction of forest areas due to urbanization.
- For livestock. Cutting and in some cases burning trees to create pasture for animals.
- For agriculture. The forest is cleared to grow the species consumed in that area for both food and biomass.
- Infrastructure construction. When roads, ports, etc. large amount of natural forest is lost.

For centuries, forests have been considered the main source of human economic activity. Like other countries, forests in Azerbaijan, especially those located near settlements, performed two main economic and cultural/spiritual. Even now, there are forest areas that are considered sacred and no economic activity is carried out there.

During the 9 months of 2021, 12,834 trees were cut down illegally. Illegally cut trees amount to 6050 m^3 and amount to 277495 manats.

Preliminary calculations show that forest areas in the Karabakh region were intensively changed during the occupation. Deforestation under occupation in 1992-2020 is initially estimated at more than 54 thousand hectares.

Table 3.3. Illegal logging was detected in the service area of the Forestry Development Service in 2010–2020 (excluding occupied territories)[16]

Year	Number of trees cut (number)	Volume, m^3	Value (manat)
2010	61637	34483	245813
2011	38587	24300	172922
2012	52563	24066	157437
2013	56958	32623	222348
2014	47389	22051	152032
2015	42152	21362	147687
2016	43365	22253	154619
2017	81420	55437	470138
2018	49816	26355	289941
2019	38956	19107	337290
2020	21583	11041	453836
Total	**534426**	**293078**	**2804063**

[16] Source: Ministry of Ecology and Natural Resources of Azerbaijan Republic (www.eco.gov.az)

Fires

Fires can be divided into three groups according to the cause of their occurrence:

- Intentional provocation. In some cases, it is caused by people interested in the destruction of natural forests in order to use the land for their own benefit.
- Unwitting provocation. Throwing away cigarette butts without putting them out or starting a campfire is caused by carelessness. Farmers who are not careful and burn straw cause fires.
- Natural. Occurs due to lightning or other natural causes.

Every year, forest fires affect important areas of the country, mainly during the dry season. 133 forest fires occurred in 2014–2021, with an average of 17 fires per year. As a result of the fire, 1393.7 hectares of forest were burned. According to the last eight years, the worst year was 2019–2021, which accounted for 67.71% of the burned areas due to high temperature conditions and affected about 943.7 hectares of land in the country. Although fires are considered a natural risk, most of them are caused by human activities, mainly agricultural activities such as burning pastures and grasslands.

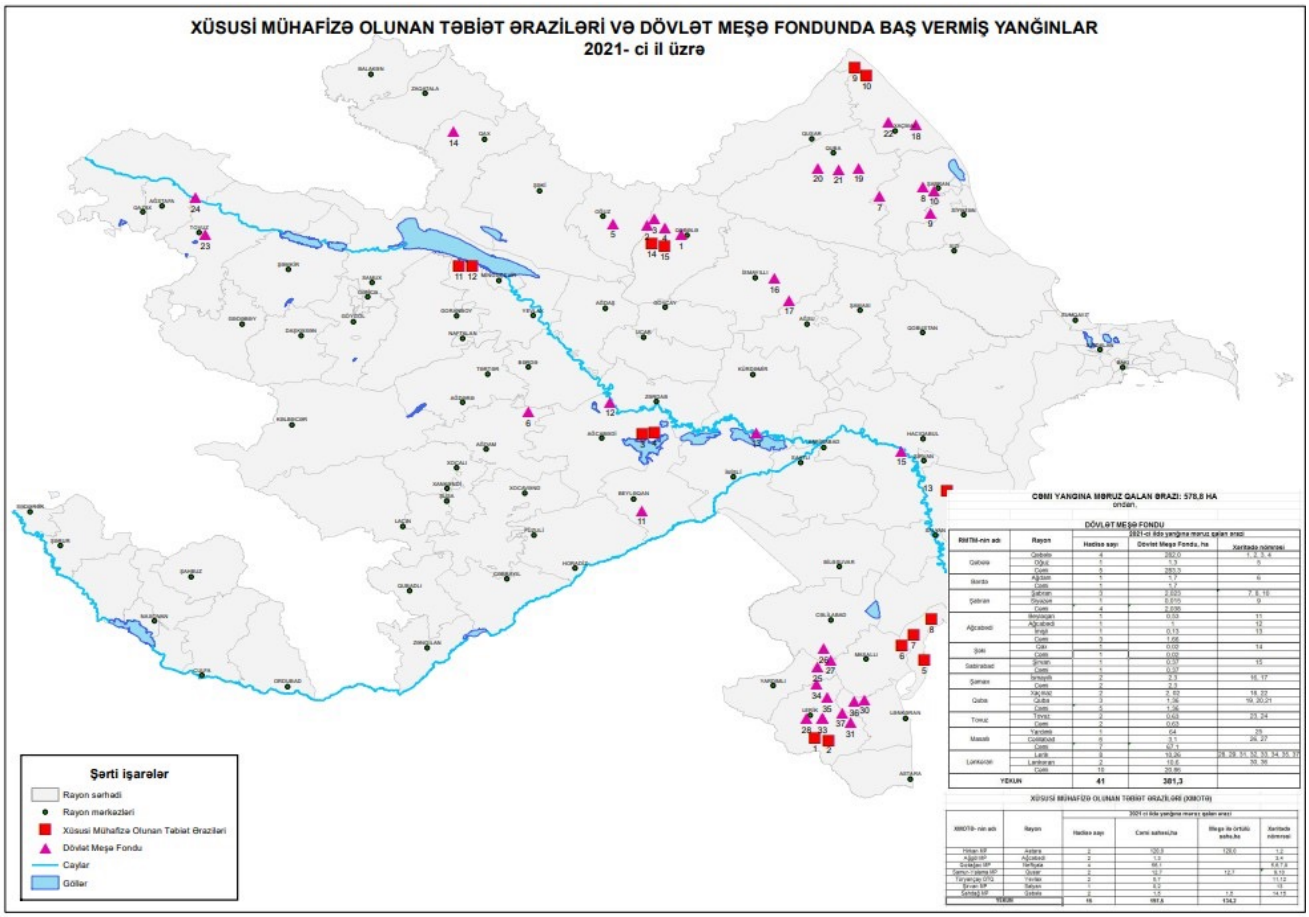

Fig. 3.1. Areas where fires occurred in specially protected nature areas and forest fund in 2021[17]

[17] Source: Ministry of Ecology and Natural Resources of Azerbaijan Republic (www.eco.gov.az)

3.1.5. Changes in Forest Management, Forest Products and the Provision of Ecosystem Services Under Climate Change

Fuelwood supply in productive and accessible forests in the 1990s was characterized by underutilization of less valuable tree species, natural regeneration of forests without assistance measures, and a lack of care for young trees. Sustainable forest management is a management system that includes the sustainable use of forests and forest lands to ensure that the biodiversity, productivity, self-regeneration capacity, and viability of forests fulfill their important ecological, economic, and social functions now and in the future at the local, national, and global levels (Helsinki 1993). International associations and organizations have developed specific indicators and criteria for sustainable forest management within several processes (the Montreal process and the Helsinki process).

1. Assessment of forest resources and the role of forests in the global carbon cycle;
2. Biodiversity;
3. Liveability and health of forests;
4. Productivity functions of forests;
5. Ecological functions of forests;
6. Economic and social functions;
7. Legal, political and organizational conditions that ensure sustainable use of forests.

One of the main indicators of compliance with the basic principles of sustainable forest management is forest certification. In Azerbaijan, which has joined international conventions, in the fields of sustainable forest management, mitigation of climate change, and forest management, Azerbaijan has already defined social and economic development and poverty reduction as the country's priorities. The country's climate change mitigation and adaptation strategies are reflected in long-term state programs and a number of measures by the private sector and NGOs. An example of this is the mandatory certification of forest resources according to Article 42 of the Forest Code of the Republic of Azerbaijan.

Degradation of forests

The main cause of deforestation is unsustainable and illegal agriculture. In terms of land mass, forest degradation is a more serious problem than deforestation: approximately 6.5 million square miles of forest are at high risk of decline in the next 10 years. However, the main cause of forest degradation is unsustainable and illegal logging. In the last 20–30 years, the pressure on the remnants of Tugai forests has intensified due to the shortage of fuel and the resettlement of refugee families in the surrounding regions of Kura, The existing forests have become rarefied, their condition has deteriorated, and their area has decreased. In the conditions of natural existence, from the formation of vegetation to its destruction, trees and shrubs undergo changes in dynamic situations caused by the hydrographic network, which are completely dependent on the irrigation characteristics of the region and determine their spatial-temporal development. Against the backdrop of the decline of Tugai forests and the intensifying trend of deforestation, the natural and artificial forest areas in the Kura region are being replaced by thickets, reed beds, swamps. This creates the danger of complete destruction of the remnants of the Tugai forests.

Problems, gaps and barriers in forest ecosystems

The main problem in Azerbaijan's forestry is the replacement of the broad operational nature of forest management with a continuous intensive forest management model. Another important issue is that the political, social and economic changes in Azerbaijan caused the deterioration of the country's forest management in the early 1990s.

The most important ones are:

- The economic and organizational conditions of forest firefighting services deteriorated, and the number of aviation units and fire-chemical stations gradually decreased.
- The level of information support for forestry and forest management has decreased significantly. The main sources of information on forests are now outdated, and a significant part of the forest inventory data has not been updated for decades.

3.1.6. Forest ecosystem management and knowledge level

Forest management as an administrative process

Rapid demographic change, rapid technological advances, and increasing energy demand have created new pressures on forestry to address emerging global challenges, particularly energy and climate change. The increase in demand for forest products and services is determined by many factors, and population growth is one of the most important reasons.

- What are the goals that the management activity hopes to achieve?
- What operational procedures and financial resources are required to implement the programmed action plan to achieve the objectives?
- What are the criteria that can be used to assess the extent to which the objectives have been achieved?

The complex task of defining forest management goals, defining the products and services to be obtained from the forest, and defining measures to achieve the related goals is regulated under Ecosystem-based Functional Forestry projects. Long-term planning will undoubtedly continue to have a place in forest management, given that in this new era changing objectives will characterize forestry practices and affect adaptive management. The goals of forestry not only differ at different scales, but also change over time and differ from one socio-economic context to another.

3.1.7. Legal, institutional, and technical framework for Sustainable Forest Management

The analysis of the new forest plans adopted in Azerbaijan in 2018 shows that the adaptation measures do not correspond to the consequences and dangers of the possible consequences of climate change. A common problem with the new plans is that measures to protect forests from fires or pests are designed without consideration of climate change or consistent forecasts. It requires integrating vulnerability reduction and risk management into planning processes, selecting credible, multifaceted, and cost-effective adaptation measures, and adopting an appropriate institutional framework. Effective implementation of adaptation measures requires changes in numerous regulations (forest management regulations, service logging, reforestation, etc.). There is a need to improve the monitoring of the state of forests and their ecosystem services as a basis for decision-making on forest management in the face of climate change and mitigating the effects of climate change.

National Policy and Legal Framework

The national policy defines priority objectives, guiding principles and key content, as well as national compliance and performance standards to be achieved to ensure adequate service delivery and the normal development of public and private activities. The national forest policy also proposes an organic integration of forest management with biodiversity conservation, climate change mitigation and adaptation, desertification control, watershed and aquatic ecosystem management, poverty alleviation and social inclusion. It also incorporates considerations outlined in the National Compact, National Forestry Strategy, National Biodiversity Strategy, National Climate Change Strategy, National Rural Development Strategy, and National Food Security Strategy (based on forest products).

Legal Basis

- The Constitution of the Republic of Azerbaijan
- Forest Code of the Republic of Azerbaijan
- Law of the Republic of Azerbaijan "On Environmental Impact Assessment"
- Law of the Republic of Azerbaijan on environmental protection
- Law of the Republic of Azerbaijan on specially protected natural areas and objects
- Law of the Republic of Azerbaijan on protection of greenery
- Law of the Republic of Azerbaijan on phytosanitary control
- Law of the Republic of Azerbaijan on selection achievements
- Law of the Republic of Azerbaijan on seed production
- Law of the Republic of Azerbaijan on obtaining environmental information
- Law of the Republic of Azerbaijan on Amendments and Additions to the Law of the Republic of Azerbaijan "On Environmental Protection" in connection with the implementation of the Law of the Republic of Azerbaijan "On Specially Protected Natural Areas and Objects"
- Law of the Republic of Azerbaijan on environmental education and awareness of the population
- Law of the Republic of Azerbaijan on the accession of the Republic of Azerbaijan to the Agreement on cooperation in the field of plant quarantine
- Law of the Republic of Azerbaijan on environmental safety
- Law of the Republic of Azerbaijan on joining the Kyoto Protocol "On the United Nations Framework Convention on Climate Change"

The country has a number of international obligations, including:

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES Convention);
- UNESCO Convention on the Protection of World Cultural and Natural Heritage;
- European Convention on the Protection of European Wildlife and Natural Environment (Bern Convention);
- UN Convention on Biological Diversity;
- UNESCO Convention on Wetlands of International Importance Mainly as Waterfowl Habitat (Ramsar Convention);
- European Landscape Convention;
- UN Convention on combating desertification in countries with severe drought and/or desertification, especially in Africa;
- Convention of the UN European Economic Commission on obtaining information on environmental issues, public participation in decision-making and open court of justice (Aarhus Convention);

The country has commitments to the United Nations Forum on Forests' Millennium Development Goals (MDGs) and Global Forest Goals. Goal 7 of the Millennium Development Goals (MDGs) is aimed at ensuring environmental sustainability. Its goal is to incorporate the principles of sustainable development into national policies and programs and reduce the loss of environmental resources. Similarly, its indicator is the proportion of the area covered by forests. The Global Goals related to forests include:

1. Reversing forest cover loss worldwide through sustainable forest management, which includes conservation, restoration, afforestation and reforestation, and increased efforts to prevent forest degradation,
2. Increasing the economic, social and ecological benefits of forests and their contribution to the achievement of internationally agreed development goals,
3. A significant increase in the area of protected forests and sustainably managed forests, increasing the share of forest products obtained from sustainably managed forests. Among the main opportunities in the forest sector, we can mention the following:

National aspects

The National Forest Program envisages achieving the following goals: "These are to help create appropriate institutional capacity and mechanisms for forest management, paying special attention to changing requirements and future needs that contribute to the overall sustainable development of the country; to implement concrete measures for the protection and sustainable management of our country's forests to ensure the development and improvement of relevant policies and strategies for implementation; to encourage stakeholders to closely cooperate and participate in planning, implementation, control, monitoring and evaluation; to strengthen the restoration of forest resources and the management of their functional use, as well as those dependent on forest resources to raise the standard of living of the rural population; to contribute to the increase of national and international financial support for forestry activities. At the same time, strengthening the restoration of forest resources and the management of their functional use, raising the standard of living of the rural population dependent on forest resources, and contributing to the increase of national and international financial support for forestry activities are also included in the program.

Regional aspects

The process of transferring environmental forest functions and powers to regional administrations is underway. Regional administrations perform environmental and land use functions assigned to them, including:

a. Prepares, approves, implements, evaluates, directs, controls and manages environmental and land use plans and policies in accordance with local organizations' plans.

b. Implements regional environmental systems and coordinates environmental coordination.

c. Oversees the formulation, coordination, management and implementation of regional strategies related to biological diversity and climate change within the framework of relevant national strategies.

d. Monitor compliance with regulations, agreements, projects and studies on environmental issues and efficient use of natural resources in their respective jurisdictions. Takes measures for violations of regional environmental regulations.

e. Develops and implements plans and programs for the sale of environmental services in regions with natural forests or protected areas.

Policy on sustainable management of forest ecosystem services

- Promotes sustainable management of forest ecosystems, taking into account the ecosystem characteristics of each of the natural regions of the country.
- Promotes the reuse of forest products and services by supporting initiatives related to wood and non-wood forest products, wildlife and environmental services.
- Promotes forest education, technological innovation, applied research and the use of appropriate and clean technologies for the utilization of wood and non-wood forest products.
- Promotes the formalization of informal activities in the use of wood and non-wood forest products.

Forest ecosystem loss and deforestation recovery

- Promotes forest conservation by preventing forest decline and degradation due to illegal practices such as logging for agriculture, slash-and-burn trade, land-use change, or the introduction of exotic species that create productive forest management alternatives.
- Promotes public and private investment in the reforestation of degraded areas with native tree species and other areas with the greatest potential to provide ecological services and economic potential to contribute to development.

Sustainable management of transformed ecosystems

- Promotes territorial management with landscape management criteria and taking ecological and economic zoning into account.
- Promotes the management of secondary forest products for economic, social and environmental purposes.

- Promotes the adoption of agroforestry systems with an agroecological approach on farms.
- Promotes inter-institutional coordination for granting rights based on a unified cadastre.
- Promotes the development of tools to help balance productivity and conservation among forest management and other productive activities of renewable and non-renewable natural resources.

Forest plantations for industrial and ecological purposes contribute to the economic development of the country

- Promotes responsible private investment in forest plantations.
- Prefers legal security conditions for forest investors.
- Promotes economic incentives for reforestation.
- Develops scientific and technological research for the development of forest plantations.
- Promotes the development of forestry projects to contribute to climate change mitigation and adaptation.

Effective forest management targets

- Strengthen governance and forest management
- To develop a forest management system
- To promote capacity building for effective forest management
- To increase production, productivity and competitiveness of the forestry sector.
- Promote appropriate financing mechanisms.
- To develop a forest information system.
- To develop a national forest monitoring and control system.
- To develop forest research.

CHAPTER 4

4.1. SUMMER PASTURES IN AZERBAIJAN: CONDITION, MANAGEMENT, AND VALUING RANGELAND RESOURCES

4.1.1. Summer grassland ecosystem values

The economic values associated with summer pastures can be divided into four categories: direct use values (including consumptive and non-consumptive values); indirect use values; option values; and asset and heritage values.for society and future generations. Protecting biodiversity is essential to ensure the legacy and life of future generations.

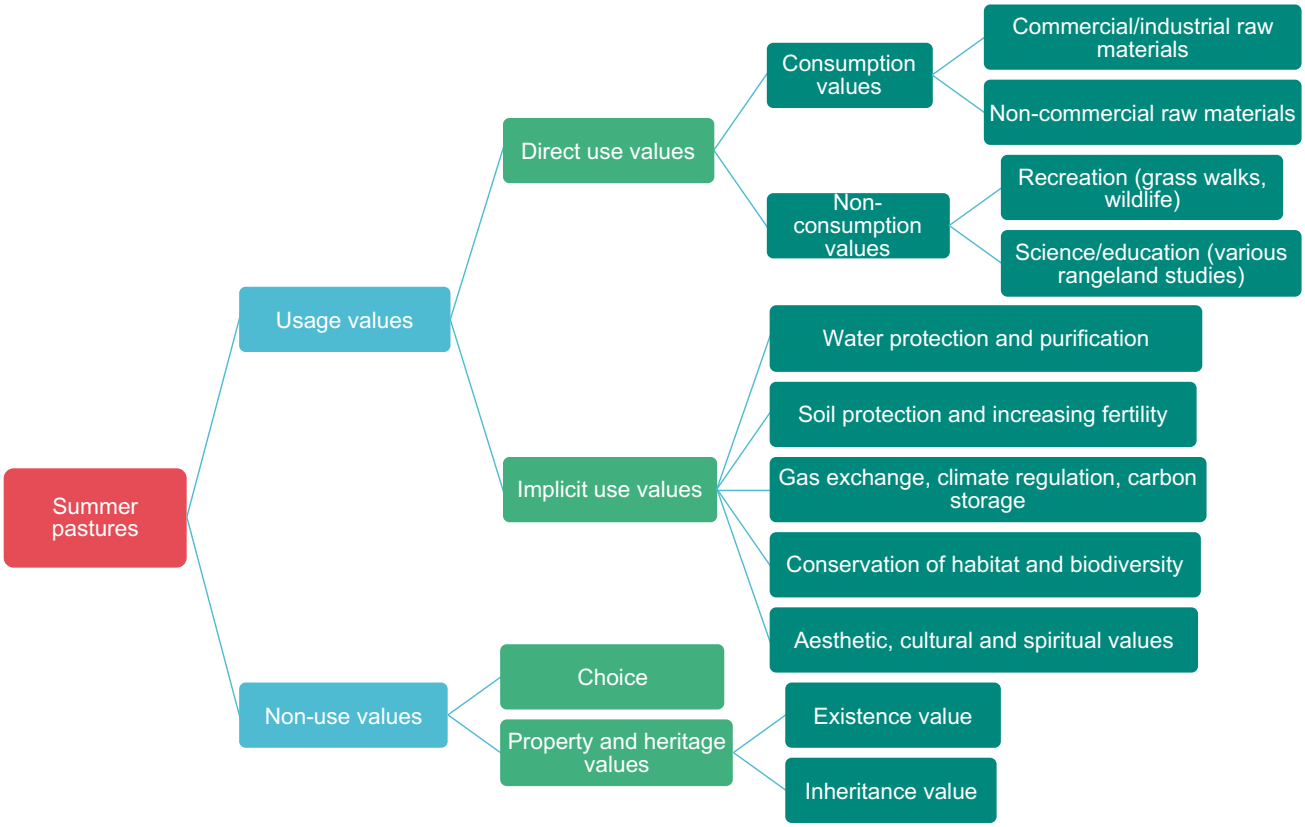

Fig. 4.1. Summer grassland ecosystem values[18]

[18] Abbasov, R., Karimov, R., & Jafarova, N. (2022). Mountain Ecosystem Values. In Ecosystem Services in Azerbaijan: Value and Losses (pp. 29-69). Cham: Springer International Publishing.

Direct use values (including consumptive and non-consumptive values) are defined as the value derived from the actual use as a good or service of food and feed obtained from grazing areas, raw materials for industry, hunting and fishing products, recreation, or tourism. Since animal husbandry constitutes the livelihood and income of the majority of the rural population, the fodder obtained from the pastures is of particular importance in keeping the animals of the community living there. Thus, summer pastures form an important fodder base for the rural population.

Indirect use values may include use values. For example, summer pastures provide direct value to the people who visit the area where they are located. Other people may enjoy watching a television show about terrain and wildlife, deriving indirect use values. Non-use values, also called "passive use" values, are values unrelated to the actual use or choice to use a good or service.

Option value is the value that people have when they have the option to enjoy something in the future that they do not currently enjoy. So it's kind of a use value. For example, a person may hope to visit a summer pasture in the future and thus choose to be willing to pay any amount to protect that area.

Existence or presence value is the value that people use simply because they know that some grazing land exists, even if they do not see or use it. For example, the availability of Khoshbulag in Dashkasan, Shahnabat in Gusar, Batabat in Nakhchivan, Khanyaylaggi in Sheki, and Miskinli in Gadabay are the best examples of this value. A person may be willing to pay to protect any summer pasture simply because they value its existence, even if they never expect or want to go there.

Bequest value is the value people place on knowing that future generations will have the option to enjoy something. Thus, the value of heritage is measured by people's willingness to pay to protect the natural environment for future generations. For example, a person may be willing to pay to preserve their summer grazing land so that future generations can enjoy it. Heritage value derives from the satisfaction of preserving the natural environment—rivers and lakes, soil, forests, plants, and animals—for future generations. People are happy to preserve these values and take pride in preserving them for future generations. Protecting the unique beauty of individual summer pastures for future generations shows how important heritage value is. It should also be noted that many values that existed in the past have not reached our times, and our generation has been deprived of these values. These include extinct animals and plants that once lived in the area but no longer exist.

4.1.2. Nature's Contributions to People and the Quality of Life

The Ecosystem Services concept, published by the Millennium Ecosystem Assessment (2005), focuses on the relationships between ecosystems, including agroecosystems and human existence. Ecosystem Services are direct and indirect contributions that people receive from ecosystems. Designing a hedgerow network in a multifunctional agricultural landscape: balancing trade-offs among ecological quality, landscape character and implementation costs. Contributions can be monetary or socio-cultural (i.e., benefits the ecosystem provides to users' cultural identity, moral values or social relationships). Rethinking ecosystem services to better address and navigate cultural values.

Nature's contributions to people are mainly divided into regulatory, material, and non-material contributions.

The summer pastures, which are the object of our research, are formed in well-lit, nutrient-rich soils above the forest belt in our republic, with high abundance and tall grass, and cover the Talysh, Nakhchivan MR, Big and Small Caucasus Mountain ranges.

Meadows used as summer pastures are very important in human life and activity, creating a fertile environment for sanitary-hygienic, protective-hydrological, animal husbandry, recreation, an aesthetic environment, hunting, beekeeping, medicinal and industrial raw materials. Summer pastures have a very high economic and social value in our republic.

Use of summer pastures: Dye plants growing wild in nature are important and safe for the human body both in terms of their biochemical composition indicators, that is, from the point of view of being ecologically clean, and in contrast to cultivated, i.e., dye plants and dye substances obtained through artificial synthesis.

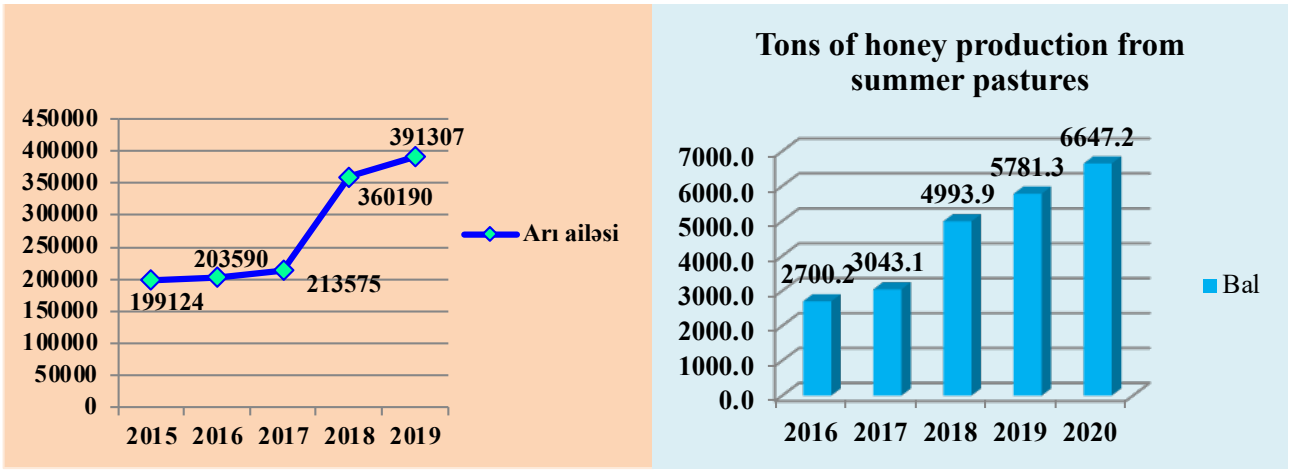

Fig. 4.2. Bee colonies and honey production kept in summer pasture areas in the country[19]

[19] Source: State Statistical Committee of Azerbaijan Republic (www.stat.gov.az)

Climate regulation The global carbon cycle is a complex system that regulates carbon movement between the atmosphere, land, and oceans. Human activities, particularly burning fossil fuels, can alter these transfers, leading to increased CO2 concentrations and greenhouse gases like nitrogen oxides and methane. To reduce these gases, anthropogenic waste reduction and carbon sequestration can be implemented. Reforestation and afforestation are effective methods, while grasslands have the potential to store carbon in soil. Grasslands can act as a significant carbon sink, with global carbon stocks estimated to be around 343 Gt C. Plants absorb carbon during photosynthesis, but carbon must be stored or sequestered to address human contributions.

Fresh water quality regulation: Kalbajar and Lachin districts account for 33% of the total mineral water reserves in Azerbaijan. The total reserve of mineral water in these regions is 7393 m³/day, of which 42% belongs to Lachin and 58% to Kalbajar. Resources of mineral and thermal waters of Azerbaijan. The water of the spring is hyperthermal, contains carbon dioxide, hydrocarbons, and chloride-sulfate-sodium. Mineral water sources include Upper and Lower Istisu, Turkhun, Keshdak, Koturlu (Kalbajar), Minkend (Lachin), etc. The temperature of thermal waters in Kalbajar, Lachin, and Shusha regions is 60-100ºC.

Soil formation and conservation: Sustainable grasslands help prevent soil loss, enhance soil and ecological functions, increase herbage biomass, and minimize nonproductive species growth. Restorative sustainable grazing management has been shown to reverse degradation caused by long-term livestock grazing globally. Vegetation plays a crucial role in regulating soil erosion, which is a major factor in degradation and desertification. In densely vegetated areas, plants protect soil from erosion and prevent floods and landslides. Excessive grazing can disturb the grass and soil layer, strengthening erosion and creating flood flows. Vegetation plays a vital role in regulating soil erosion, as soil fertility is essential for plant growth and agriculture.

A well-maintained pasture has soil conservation mechanisms that:

- protects the soil from the effects of raindrops with its vegetation cover;
- keeps surface water flowing;
- stops humus loss;
- improves soil fertility and structure;
- improves soil permeability.

Medicinal and genetic resources: The summer grassland ecosystem is considered a potential source of raw material for medicinal plants. Among the other useful values of the biodiversity of the summer grassland ecosystem, it is necessary to point out the rich gene pool of species that represent a potential source for the creation of high-yielding and durable varieties, decorative plants, medicinal, aromatic and technical raw materials. The improved forms of alfalfa and khasha plants, which grow wild in meadows, especially in summer pastures, were created as a result of the folk selections “Nakhchivan clover” and “Nakhchivan khashasi”.

Cultural services: In the summer, meadows covered with green cover, wide meadows, dense forests, small rivers flowing from the top of the mountains along the slopes, waterfalls, lakes, and ice springs flowing through the rocks are considered a source of recovery for people both physically and spiritually. The areas where the summer pastures are located have been holiday homes in the summer season since ancient times, and this tradition has continued since then. Even in modern times, mountain pastures and springs, rich in clean air and subalpine and alpine meadows, attract both tourists and just vacationers here. Summer meadows are a source of aesthetic appreciation and inspiration for culture, art, and design. Spiritual impression and sense of place In most parts of the world, natural features such as special forests, caves, or mountains are considered sacred and have religious significance.

Aesthetic and recreational value of summer pastures

The aesthetic and recreational value of the biological diversity of the areas covered by summer pastures is very high. Upland summer grassland ecosystems are strong stabilization centres for not only mountainous but also adjacent lowland areas. The summer grassland ecosystem has favourable microclimate conditions. It is possible to organize mountain climate resorts in Shamakhi, Ismayilli, Gabala, Sheki, Guba, Gusar, Gadabey, Lerik, Yardimli, Ordubad, and Shahbuz regions and in newly liberated regions if there are favourable conditions for the organization of mountain climate resorts. According to the opinion of many scientists.

Hunting resources

The aesthetic and recreational value of the biological diversity of the areas covered by summer pastures is very high. Upland summer grassland ecosystems are strong stabilization centers for not only mountainous but also adjacent lowland areas. The summer grassland ecosystem has favourable microclimate conditions. It is possible to organize mountain climate resorts in Shamakhi, Ismayilli, Gabala, Sheki, Guba, Gusar, Gadabey, Lerik, Yardimli, Ordubad, and Shahbuz regions and in newly liberated regions if there are favourable conditions for the organization of mountain climate resorts. The region's clean air and mountain pastures rich in alpine meadows and springs attract both tourists and those who just relax here. The flora and fauna of the Gadabey region are rich and diverse.

4.1.3. Status, Trends and Future Dynamics of Biodiversity and Ecosystems that Support Nature's Contributions to Humans

According to the Land Use Control Department of the Ministry of Agriculture of the Republic of Azerbaijan, as of January 1, 2021, there were 547.5 thousand ha of summer pastures in the country.

According to the same source, the availability of 2648.9 thousand head of cattle and 7899.7 thousand head of small cattle in the country and the fact that a certain part of them is fed on pastures cause the grazing areas to be loaded 4-5 times more than the norm.

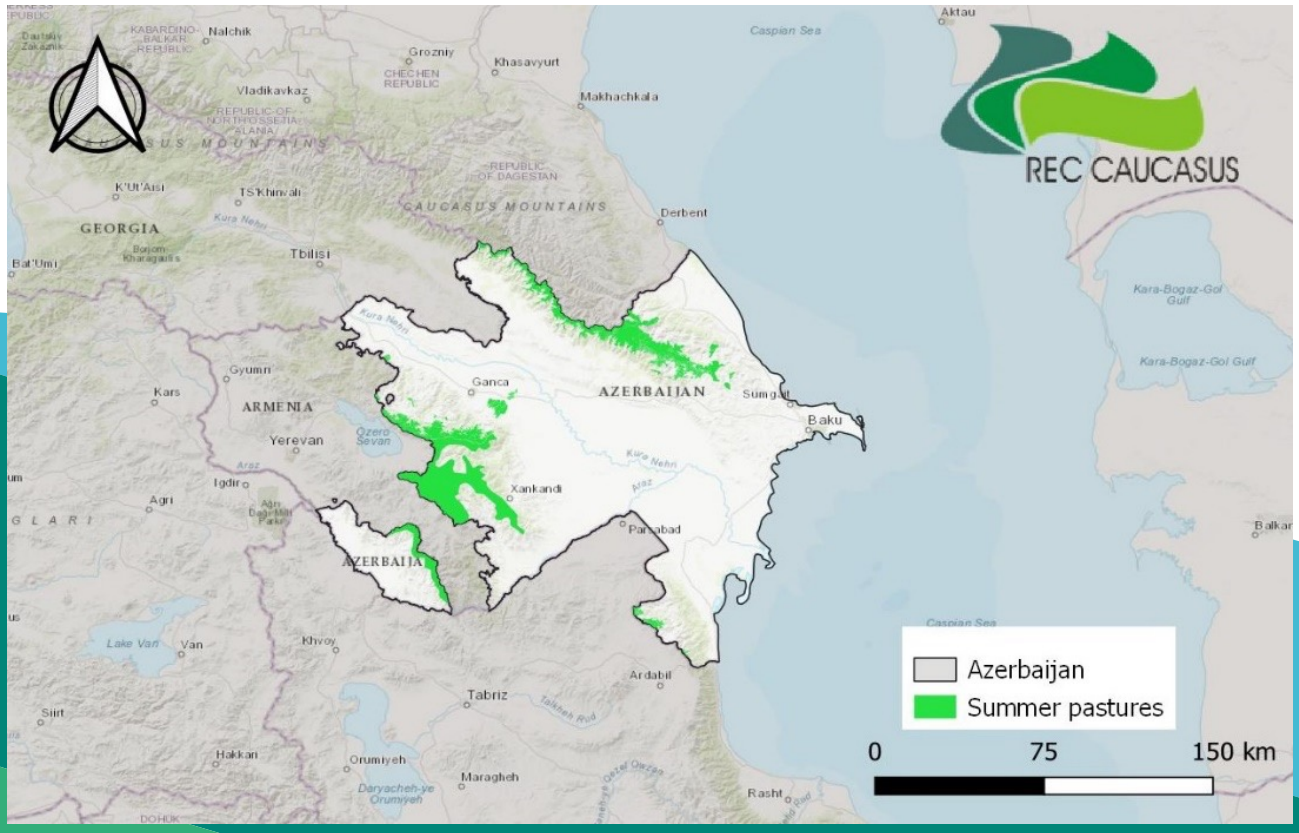

Fig. 4.3. Distribution of summer pastures in the country[20]

[20] Map of Rec Caucasus

Great caucasus region

The Greater Caucasus region occupies the northeastern part of Azerbaijan. The main part of the Greater Caucasus covers the territory from Tinov-Rosso peak (3374 m) to Bazarduzu peak (4466 m), from there to Babadag peak (3629 m) and from Babadag to the shores of the Caspian Sea. To the east of Babadag, the Baş Suayirc range gradually descends and divides into several branches. Parallel to it, the Yan ridge descends sharply and merges with the Gusar sloping plain in the northeast. Langebiz mountains, Gobustan, Alat dash, Harami ridge and Absheron peninsula are located at the south-eastern end of the main Suayrici mountains.

The topography of the area where the summer pastures are located has a complex geomorphological structure. The surface inclination of these areas reaches 45–60°. The relief of the low and middle highlands consists of strongly and moderately fragmented relief surfaces and subduction cones. This area is composed of Jurassic sand, limestone, and clay shales. Landslides and avalanches due to gravitational processes occur in areas with a high relief tendency, which causes the area of mountain meadows to decrease year by year.

The average temperature in July is 20–15°C in the middle mountainous parts of the area, and 10-5°C in the high mountainous parts. The average temperature in January varies between 5-6ºC in the middle mountainous areas of the area and between 6°C and 14°C in the high mountainous zone. The average temperature is up to -4.5°C in mountainous areas in January and up to 19°C in July. Often, hot, dusty, dry air masses entering from Central Asia cause an increase in temperature and a decrease in humidity. These winds play an important role in cleaning the air of settlements located in large valleys in the mountainous zone. The mountainous zone where the summer pastures were located had cold, humid, and cold climatic conditions. The average annual amount of precipitation varies from 550 to 1500 mm in the areas where summer pastures are located.

1. A mild, warm climate with an almost even distribution of precipitation, this climate type is mainly spread in the form of a narrow strip in the north of Ismailli district and partly in the northwest of Shamakhi district, the altitude of these areas is between 600-1500 m. The humidity ratio is up to 75–100%. It is characterized by mild winters and mild hot summers. Temperatures above 10ºC are only between 2500-3000ºC.
2. Mountain tundra climate. This type of climate is common in the highlands of the region, especially in the area of the Babadag peak, which has an altitude of more than 3000 m.

It is distinguished by extreme humidity (150–200%) and coldness in all seasons temperatures above 10ºC are only between 4000ºC.

Alpine and subalpine meadows covering the areas remaining between 1200-2000 m and 3000-3200 m of the absolute heights of the Greater Caucasus. The forms and development of soil deposits in the alpine and subalpine zones are subject to certain physical-geographical laws, depending on the climate, altitude, exposure of the slopes, and morphology of the relief. Within these zones, primitive mountain meadows, grass-peat mountain meadows, grassy mountain meadow soils, blackish mountain meadows, black soil-like mountain meadows, and mountain meadow steppe lands are spread.

In the mountainous areas of the province, alpine and subalpine meadows occupy a large area and are used as summer pastures.

Lesser caucasus region

Summer pastures are found in various regions, including Ganja-Dashkasan, Gazakh-Tovuz, Eastern Zangezur, and Karabakh. The Ganja-Dashkasan region covers 52.4 thousand hectares, while the Gazakh-Tovuz region covers 33.7 thousand hectares. Eastern Zangezur covers 164.5 thousand hectares, and Karabakh covers 31.1 thousand hectares.

Various subtypes of mountain meadow and mountain forest soils are spread in the areas where the summer pastures of the Lesser Caucasus are spread. Mountain grass and mountain forest soils are spread in the mountainous parts, so alpine and subalpine plants have developed grass layers. The presence of a grass layer prevents soil erosion and regulates the water regime of the area.

The highlands of the region have a rich and fertile vegetation with up to 420 plant species. Mustached meadows are home to Caucasian violet, alpine sedge, Steven's dandelion, Caucasian campanula, pharmacist's chamomile, furrow lame, grass, and more. Shahdag and Murovdag ridges are covered with mustache meadows and subalpine meadows, with boundaries based on mountain height and slope steepness. Subalpine meadows have great soil conservation value and are home to phytocenoses like fescue, sulcata, alpine fescue, and cranberry. The botanical composition of these subalpine plant groups includes 55 types of genuine grass plants, single purple barley, common buckwheat, large-flowered cranberry, Caucasian sedge, and iris sedge.

Alpine meadows, starting at 2300m in rocky and gravelly areas, are widespread and form the basis of summer pastures. They consist of various types and compositions, depending on the area's geomorphological characteristics and relief forms. The alpine zone is characterized by short grasses, mosses, sedges, and various herbs. In stony-rocky areas, mosses and sedges are common. Mountain-steppe plants in stony and rocky areas include sweet lame, stony lame, hill thyme, and thorny gorse. Research shows that unsystematic and intensive cattle grazing leads to further vegetation thinning and soil degradation.

Lankaran region

There are 21,100 hectares of summer pastures in the Lankaran-Astara economic region of this province, of which 2,100 hectares are in Astara, 13,900 hectares in Yardimli, and 5,100 hectares in the Lerik region.

Under the vegetation cover of the summer pastures of the area, mainly soft grass mountain-meadow and soft grass mountain meadow steppe soils are spread, grassy mountain meadow, etc. types of soils are common.

Nakchivan region

The total area of summer pastures in the Nakhchivan Autonomous Republic is 29.7 thousand ha (Julfa 5.2 thousand ha, Kangarli 1.2 thousand ha, Ordubad 9.0 thousand ha, Sharur 1.4 thousand ha, Shahbuz 12, 9 thousand ha), which is 5.5% of the total area. These pastures start at 1700–1800 m a.s.l. and continue up to 2900–3000 m.

Summer pastures in Nakhchivan are mountain-meadow lands, partially forest lands, with over 20% of plants being valuable fodder. Grassy soils spread in altitudes and rainfall.

In the alpine and subalpine belts of the mountainous zone of Nakhchivan MR, due to the influence of soil-forming factors (relief, climate, vegetation, geological and geomorphological structure of the area, etc.), the following soil types and their various subtypes are formed according to local conditions:

- Primitive grassy mountain-meadow lands
- Grassy mountain-meadow lands
- Mountain-meadow soils with soft grass
- Steppe-meadow lands

Nakhchivan's elevation between 2800-3900m influences soil types and subtypes, with intensive erosion causing rough rock accumulation, avalanches, and landslides in mountain-meadow soils.

Subalpine high grass, mesophytic multi-grass-cereal grass, and grass-steppe vegetation have formed on the mountain-meadow soils. Among mesophytic subalpine high-altitude grasslands and multi-grass-cereal meadow vegetation, species such as Astragalus glycyphylloides and Astragalus glycyphyllos are often found.

Subalpine meadows in the Autonomous Republic consist of mesophilic forest meadows with a mixture of cereal legumes, with tall, dense vegetation reaching 150-180 cm in height and forming multiple layers, forming phytocenoses.

Draba bruniifolia, Gentianopsis barbata, Campanula tridentata, and others spread on the stony slopes of the upper alpine zone have adapted to the environment and formed a firm pillow form of mossy small stems, leaves, and umbels. On the stony slopes of the upper alpine zone, ciliate-leaved cushion grass, bearded bellflower, three-toothed bellflower, and others have adapted to the environment and formed a solid cushion form of many small stems, leaves, and umbels.

4.1.4. Direct and Indirect Impacts on Selected Biodiversity and Ecosystem Services

Recently, as a result of the unsystematic grazing of livestock in summer pastures, the pastures have been subjected to an intensive erosion process, are unable to provide livestock with necessary fodder, and turn into unusable stony areas completely out of use. As a result of overgrazing of livestock in summer pastures (the norm should be 4–8 heads per hectare), the vegetation is destroyed, the grass layer is destroyed, the soil is washed away during the rains, and the pasture lands are subjected to various degrees of erosion. The main reasons for the strong erosion process here are the destruction of the grass layer in the mountain-meadow zone as a result of unsystematic and excessive grazing of cattle in the subalpine and alpine summer pastures.

Fig. 4.4. Photo pollution of mountain pastures during gold production

4.1.5. Levels of Knowledge about Nature Benefits, Status and Management of Biodiversity and Ecosystem Services

Alpine and sub-alpine meadows in Azerbaijan have rich vegetation; they are a fodder base for the development of livestock, protect the soil from erosion, and regulate the water regime of mountainous regions. Summer pastures are located in the mountain-meadow belt and prevent the surface water from the upper mountain zone from turning into underground flow and preventing the development of the erosion process. In pastures and meadows, 60–70% of the root system of plants settles in the top layer of the soil and forms a turf layer, which strengthens the structural units of the soil and protects them from the destructive effect of water. Intensification of erosion processes in grassland areas disrupts the water regime not only of those areas but also of the outlying areas; the soil cover is washed away on the slopes, and the formation of destructive water flows is observed. The ground mass and root system of the developed vegetation in grassland areas protect the structure of the soil on the slopes and affect the regulation of the water regime. Surface water flow and soil washing are not observed in slope areas that are completely covered with grass plants. As a result of the correct construction of the management system, conditions are created for the development of plant species with high nutritional value for animals in pasture areas and the formation of food potential.

4.1.6. Impact of Policy and Institutional Arrangments on Biodiversity Conservation and Ecosystem Services

The "National Program for Ecologically Sustainable Socio-Economic Development in the Republic of Azerbaijan" was approved by President Ilham Aliyev in 2003, aiming to strengthen coordination in environmental protection and natural resource protection at national, regional, and international levels. The program focuses on economic development that benefits present and future generations. Experts from regional ecology departments and local executive authorities hold regular meetings with farmers to discuss livestock's role in soil fertility, desertification, and erosion. The program also recommends increasing protected areas and creating new national parks, reserves, and sanctuaries based on the Biological Convention.

CHAPTER 5

5.1. INDIGENOUS AND LOCAL KNOWLEDGE IN MOUNTAIN AREAS

5.1.1. Mountains in Azerbaijan

The Greater Caucasus is located in the north of the Kura Araz lowland, in the west of the Lesser Caucasus, and in the southeast of the Talysh Mountains. This mountainous area, which covers the eastern part of the country and the territory of Nakhchivan, is very rich in volcanic rocks, unlike the Greater Caucasus. The Lesser Caucasus Mountains stretch from north to south in the western part of the country. Located in the western part of the country and part of the Lesser Caucasus, the Nakhchivan enclave is surrounded by mountain ranges from the northern and eastern parts. The south-eastern part of the country is occupied by the Talysh mountains. The highest peaks of this mountain massif, consisting of Talysh, Peshtasar, and Burovar ranges, are Gomurgoy (2493 m) and Gizyurdu (2433 m).The south-eastern part of the country is occupied by the Talysh mountains. The highest peaks of this mountain massif, consisting of Talysh, Peshtasar, and Burovar ranges, are Gomurgoy (2493 m) and Gizyurdu (2433 m).

Fig. 5.1. View of Shahdag peak from the west side[21]

[21] Photo: Rovshan Abbasov

5.1.2. Human-Nature Relationships in mountain areas

Mountain people in Azerbaijan have a unique approach to nature, valuing the benefits of both material and intangible aspects of their environment. They view springs as a source of water and a source of cultural, social, and spiritual values. The mountain population's attitudes towards nature, their direct interaction with nature, and their use of ecosystems are influenced by their worldviews and pastoral life. They also rely on the natural resources of forests, rivers, lakes, mountain ecosystems, and land to support their daily lives and improve living conditions. The therapeutic value of these ecosystems is not only related to the area's nature but also to the mountain people's yaylak life and nomadic lifestyle. These cultural features are relicts of world culture, preserving these elements only in certain mountain areas of Azerbaijan.

Table 5.1. Natural values associated with traditional life in mountain areas

TOTAL NATURAL VALUE		**Water**	**Fresh air, springs, rivers in the village, yaylaks and kishlaks**	**Direct use of springs, waterfalls, and rivers**
	USE VALUES	Pastures	Grazing areas for sheep Habitat for wild goats, bears, birds etc.	Direct use of pastures, use of animal manure as a heating source
		Plants and mushrooms	Medicinal and food plants Gathering of mushrooms and wild berries	Use of plants and mushrooms as a food and medicinal remedies; use of plants for making colors in carpetmaking
		Subalpine grasslands	Grassland and plants	Haymaking, production of plant-based colors
		Wild animals	Hunting of East Caucasian tur (Capra cylindricornis), mountain goat	Game meat, use of leather
		Rocks and stones	Construction materials, clays	Construction of houses, fences, colors from rocks, household use of clays
		Inspiration	Reflection of natural monuments in local traditions	Worship in Qırkhabdal and Gari caves, local beleifs in Caucasian snowsock, Fire temples, Muchos forested place etc.
		Bequest value	Preservation of existing natural resources and the way of life associated with these resources for future generations (e.g. preservation of pastoral lyfestyle, protecton of summer pastures, wild animals, plants etc.	Although hunting for Caucasian tur is allowed, the sale of its meat is prohibited in the community; Hunting Caucasian hawks is a taboo, and this species are not hunted; Forested areas are strictly protected
	NON-USE VALUES	Option value	The value that is placed on private willingness to contribute for maintaining or preserving an environment even if there is no likelihood of the individual ever using it.	Recognition by people of the great importance of Khinalig culture for the country and world.
		Existence value	The value associated with existence of traditional lifestyle, natural environment, wild species.	Protection of local forest fragments, turs, Caucasian snowcock
		Altruistic value	Contributing to the protection of the natural environment without expecting anything in return	Readiness of people to spend their time and material resources to preserve the culture of mountains
		Spiritual value	Indigenous beliefs about nature and the benefits of these beliefs	The belief of the mountain people in fire, soil and animals and birds

Landforms, watersheds, geological processes, forest fragments, climatic features are also of educational importance. For example, in addition to being fed by glacial waters, the Shahnabad River is located in an area where past glaciers have spread, and a study of the river basin would help to study past climatic history of the mountains. Alpine and subalpine meadows (grasslands) of mountain areas have high value with regard to cultural services. Studies confirm that number of tourists visiting the area closely depend on mountain landscapes that include forests and grasslands. As can be seen from the table (Table 5.1), the natural monuments in the mountains can be considered unusual and unique for several reasons. First of all, it should be noted that the nature of the area has a high aesthetic value. The mountains, waterfalls and glaciers, rocks and natural fires that exist in this area are aesthetically unique and unparalelled. In addition, it is noteworthy that there are many natural monuments in the area, which are places of worship, and this is of particular importance. Alpine and subalpine meadows (grasslands) of mountain places have high value with regard to cultural services. Hiking, hunting, gathering and other touristic activities can be considered as the high economic values. For example, if the productivity of summer pastures decreases as a result of climate change or overgrazing, then the values based on the existence of those pastures gradually lose their significance. The table shows the natural values that support the traditional lifestyle of the mountain the people.

5.1.3. Ecosystem services of mountains

Plants, animals and microorganisms living in any area are formed as a result of the interaction of climate and soil factors in that area and interact with each other and with the environment. For example, all trees and animals in forest ecosystems have adapted to living in the forest environment and formed under the influence of local geological and climatic conditions. Ecosystems are the only sources of natural resources, which are very important to human well-being and survival. The provision of human beings with various natural products, protection from natural hazards, and the cultural values created by natural beauties all belong to ecosystem services. Water, healthy food, recreational and tourism resources, all the values associated with nature in the human mind are part of ecosystem services. Ecosystem services are the conversion of natural products and resources into useful products such as wood, water, moral values, protection from natural hazards. The nature of mountains include all the ecosystem contributions that are important for the longevity of the culture, customs and traditions of community. The provision of human beings with various natural products, protection from natural hazards, the spiritual and cultural values created by natural beauties all belong to the ecosystem services of mountain areas. Water, valuable food, recreational and tourism resources, and all the values associated with nature are part of the ecosystem services. In the mountainous regions of Azerbaijan, ecosystem services penetrate into all spheres of life and leave indelible marks on people's lives.

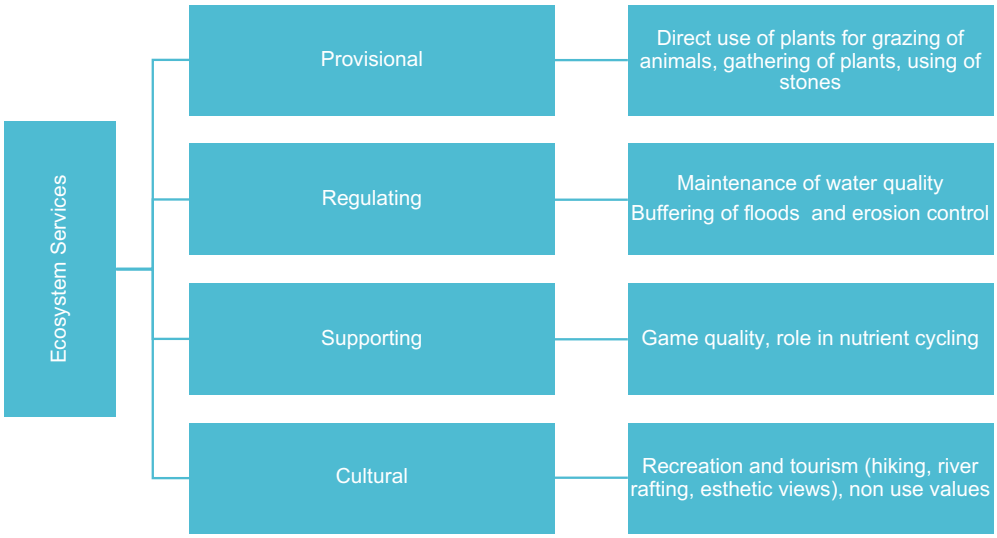

Fig. 5.2. Ecosystem Services of mountain areas of Azerbaijan[22]

[22] Abbasov, R., Karimov, R., & Jafarova, N. (2022). Mountain Ecosystem Values. In Ecosystem Services in Azerbaijan: Value and Losses (pp. 29-69). Cham: Springer International Publishing.

Provisioning services (material goods of nature)

Provisioning services are the goods that can be obtained from the nature. Historically, livelihoods in mountain areas have always depended on environmentally friendly products. Water, plants, fruits and berries, clay, soil, medicinal plants, wild honey are the main products taken from the surrounding areas. These products formed the traditional lifestyle in mountain areas and at the same time became a notable part of the economic life of the local people.

Sand, clay and stone

The local materials in mountain areas were used in the construction of houses, public buildings, and stables. River stone, sand and local clay with special adhesive were used in the construction of all types of buildings. River stones are the main building materials used in mountain areas. In mountainous areas, eroded stones come from the river polished and are used by the locals as a very valuable building material in the construction of houses. During the construction processes, the stones of the rivers with indentations are used to increase their adhesion and makes the masonry stronger. Instead of cement, special clay is used to fasten the stones in the masonry. Old watermill constructed from local construction materials in Khinalig village of Azerbaijan. These clay minerals are composed of kaolinite. Kaolinite is a clay mineral, with the chemical composition $Al2Si2O5(OH)4$. During the construction of earth-based ovens (tandirs), the mountain people brought kaolinite clay from the gorge of the Gizaz River, a tributary of the Khinalig River (the locals call it the Dayirman River), and made a tandir with it. Kaolinite was a type of clay used instead of soap for clothes and head washing as well. The tandir is a local oven used for baking bread, which is made of clay. During the preparation of the tandir, the kaoline clay, which is locally called "jub", is mixed with goat hair, various solid crumbs and wool crumbs, resulting in a very strong viscous mud. Then a tandir was made from the prepared mud mass. Clay is also used as a bleach by the people of mountain villages. Bleaching clays are used by locals to whiten houses, bars, and public buildings.

Plants

Plants are widely used in local cuisine and household in mountainous regions of Azerbaijan, with 1547 out of 4500 species identified as medicinal plants. These plants support traditional livelihoods and tourism development.

Water

Mountain ecosystems in Azerbaijan primarily provide water for consumptive use, such as withdrawn from rivers and springs without return to a source. Non-consumptive water use includes water not consumed directly, such as waterfalls. The number of springs in mountainous areas varies from 4600 to 8000, with most fed by groundwater. Tajlik water, a 5 km long water line, brings water from Sheki to the city's Ganjali neighborhood. The creation of Tajlik Water is primarily due to forests around Sheki, which are deforested to prevent flooding. Protecting water sources from pollution saves money on treatment costs, making Tajlik Water a valuable example.

Cultural ecosystem services and spiritual significance of nature

An ordinary spring in mountain areas holds cultural values and serves as a source of water. Mountain communities have long valued nonuse values of nature, such as banning certain activities like tree cutting, hunting Caucasian vultures, and certain bird species during sitt on eggs. These values connect mountain communities with the environment and can be considered cultural services. The belief in natural sites and their features is widespread, with signs of idolatry related to nature. The emergence of these beliefs was primarily driven by the desire to seek answers to natural phenomena. The shrine of Hazrat Baba on Babadag mount is considered sacred for mountain people and Azerbaijan.

Bequest values

The bequest value implies the transmission of all the special qualities of natural heritage to future generations. The bequest value comes from the satisfaction of preserving the natural environment, rivers and lakes, land, forests, plants and animals for future people. People are happy to preserve these values for future generations. Protect the forest of pine trees by local people, and the cutting of trees here is not acceptable by the community members. Thus, local custom in this case is aimed at preserving the bequest value. In this study, we note that the mountain way of life is economically independent, that all means of livelihood are developed only within the community, and that it is possible to live for a long time without obtaining anything from outside. This knowledge and experience applies to all areas of life, including the production of food and clothing, the construction of houses, and protection from natural disasters . At the same time, forests, rivers, alpine meadows, and anything else that may belong to the environment in the area have a special bequest value.

The existence values

The existence value is the value that arises from the existence of any water source, lake, spring, river or well and people's readiness to protect them. People in mountain areas value these natural monuments not only because of their usability, but also because of their exsistance. Like the bequest value, the value of an asset gradually disappears with the loss of beliefs or loss of the natural monuments itself. The option value has the value of the mountain ecosystems as a potential source of all types of benefits that can be taken in the future. Over the last 20 years, society of Azerbaijan started to give more importance to existence values of valuable species. Existence value can be valuated as willingness to pay of the society for protection of natural assets. Like the value of inheritance, the value of an asset gradually disappears with the contamination or loss of a water source. In economics, the term option value refers to the value that is placed on private willingness to pay for maintaining or preserving a public asset or service even if there is little or no likelihood of the individual actually ever using it.

Regulatory services

Ecological values refer to the ecological functions of natural objects, ie forests, trees and gardens. Regulatory services refer to the natural regulation of ecosystem processes. Such regulations play an important role both in protecting the local population from natural hazards and in providing them with quality water. For example, natural filtration by plants and soil significantly improves water quality in rivers and plays a major role in providing the population with quality water. It is also believed that forests and dense vegetation prevent floods, reduce the risk of natural hazards in the area, and significantly increase the rate of eclipses, keeping a larger percentage of rainfall in the basin. Increased destruction of dense vegetation as a result of overgrazing in mountain areas leads to the drying up of springs and accelerates the process of floods. Summer pastures (grasslands) in mountain areas provide a broad range of ecosystem services and goods. Dense plant cover of summer pastures purify water, regulate streamflows, and reduce disaster (flood and drought) risks. Grasslands provide a broad range of regulating, supporting and cultural services as well. Recreation, soil protection and cultural peculiarities of summer pastures are the most important ecosystem services that they provide. In addition, dense grasslands enable to provide water for all long-lasting dry periods. On one hand, storing water in grounds, these ecosystems buffer floods and droughts, on the other hand water storing increase groundwater discharges during dry seasons creating additional economic value.

Traditional lifestyle

The nomadic lifestyle in mountain villages has been dominated by the movement of pastoral populations between summer and winter pastures. Summer pastures, called yaylaks, are used for grazing sheep and cows, crop collection, haymaking, and hunting. The main products produced in mountain villages include meat, dairy products, woolen clothes, carpets, and palaz. The nomadic lifestyle allows mountain villages to be less dependent on other communities, allowing them to live independently and have a stable food supply. The delay in the köç process is beneficial for livestock owners, as it allows more time for grass to grow in summer pastures. The mountain lifestyle is based on a deep connection with nature, providing essential products like food, clothing, tea, food, dye, and medicine.

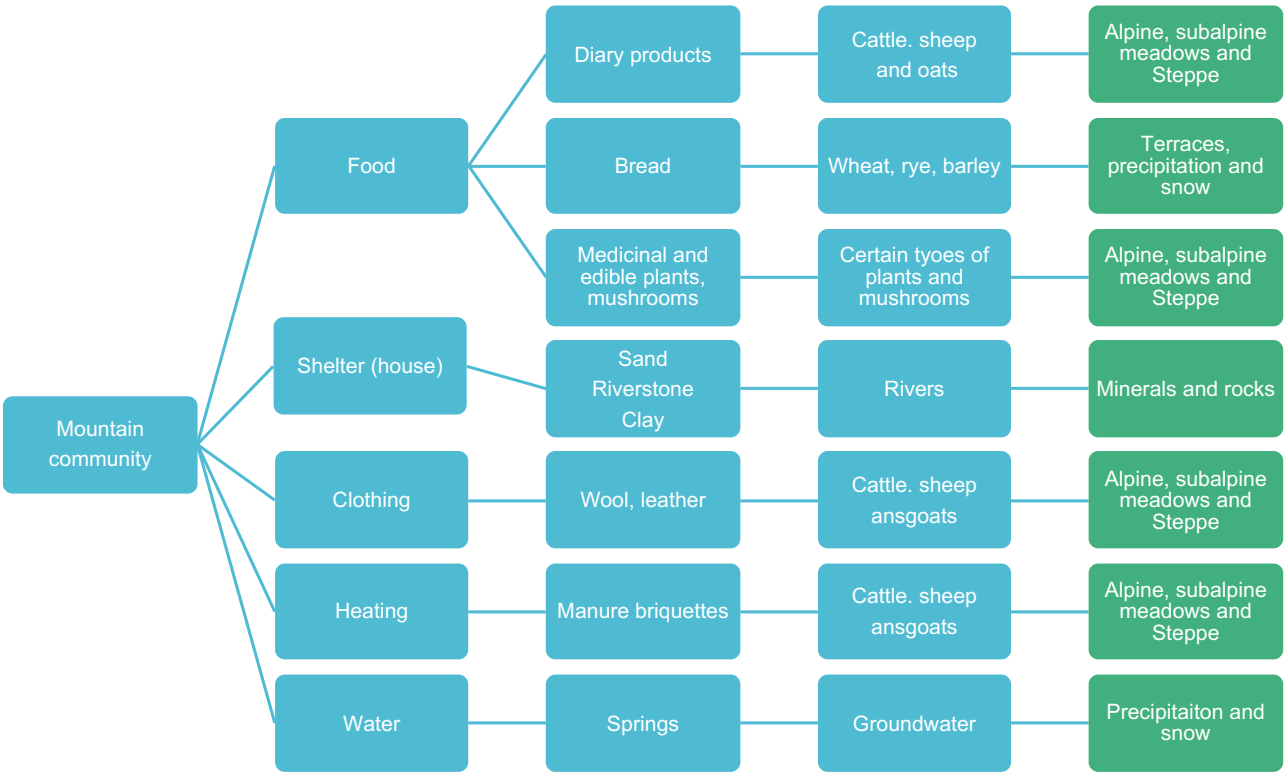

Fig. 5.3. Peculiarities of human-nature relationship in mountain areas of Azerbaijan[23]

[23] Abbasov, R., Karimov, R., & Jafarova, N. (2022). Mountain Ecosystem Values. In Ecosystem Services in Azerbaijan: Value and Losses (pp. 29-69). Cham: Springer International Publishing.

5.1.4. Constant motion in mountain areas

In mild winters and relatively humid winter months, vegetation grows better and the fodder base of animals is better. The altitude zone between pastures and winter pastures in mountainous areas is very rich in vegetation, which makes it possible to provide abundant fodder for livestock moving between pastures and winter pastures in spring and autumn. The historically nomadic mountain communities has always been in constant motion between summer and winter pastures. This mobility is a movement between landscapes that is favorable to both humans and animals in terms of climate and abundance of food base. Natural semi-desert meadows (grasslands), which are widespread in winter pastures, have played a special role for thousands of years as areas that produce fodder for animals, which is important in human life. The picture shows that in both summer and winter, the climate of the areas where the Khinalig community is located is similar to each other and is characterized by heavy rainfall and rich grass cover.

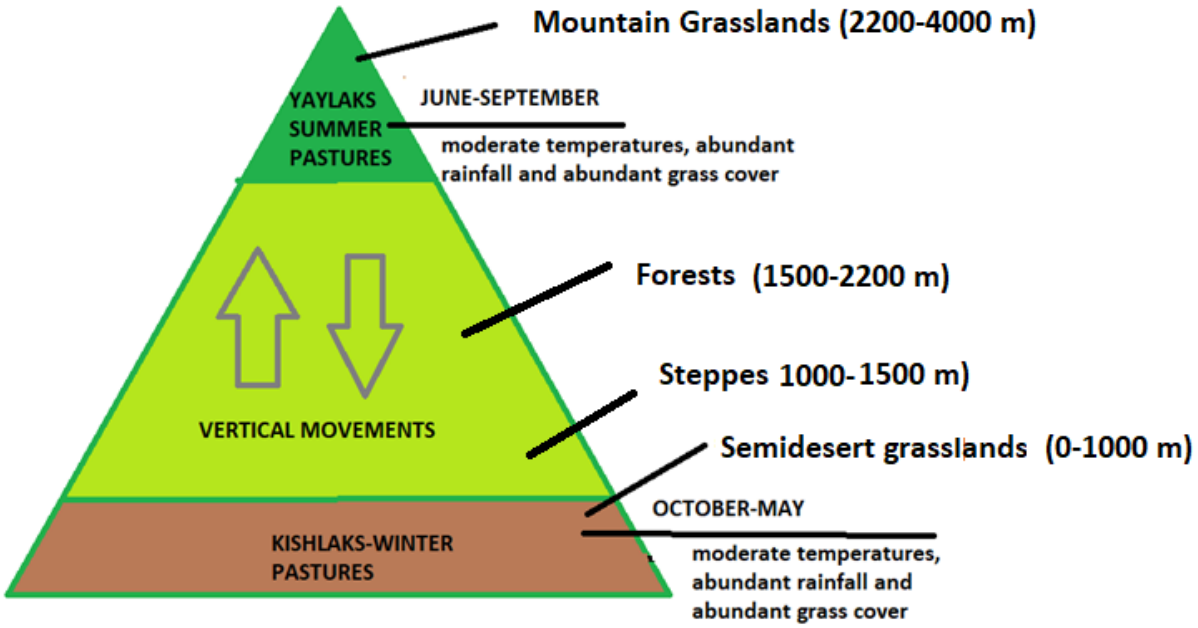

Fig. 5.4. Vertical movement and timing of mountain communities through ecosystems[24]

Formation of knowledge and skills

The interaction between nature and man, in addition to manifesting itself in culture, also leads to the emergence of specific knowledge, and this knowledge often belongs to a local community. This exceptional knowledge emerges as a product of man's interaction with nature, and often manifests itself only in one region or in a narrower space. To accept the line of hazard, the community takes defensive measures and creates a buffer between nature and itself.

[24] Abbasov, R., Karimov, R., & Jafarova, N. (2022). Mountain Ecosystem Values. In Ecosystem Services in Azerbaijan: Value and Losses (pp. 29-69). Cham: Springer International Publishing.

Buffer

This desire manifests itself in the way of life, in the design of buildings and village location (Fig. 5. 5). Earthquakes, floods and strong winds are the main threats in mountain areas. The location of the villages itself allows it to be fully protected from river floods and mudslides. For example, location in a high area of rivers, allows the communities to never be affected by floods. Thus, being in a completely horizontal position allows full protection of attics and houses during strong winds, simultaneously, the flatness of the attics also prevents snow from accumulating on these attics. As the city of Sheki is located in the flood prone area, a community-based management system has been established to protect against floods.

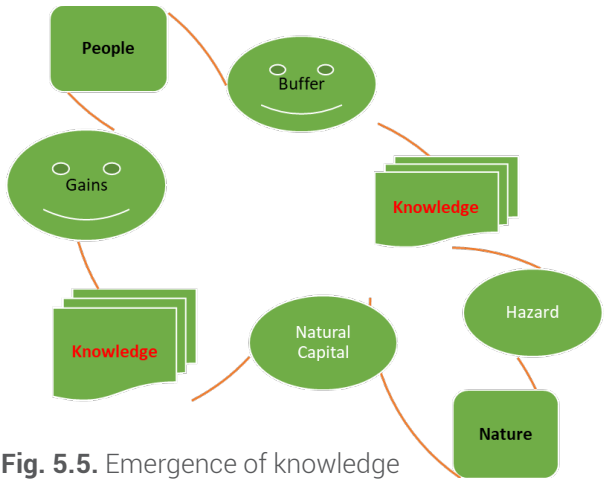

Fig. 5.5. Emergence of knowledge in connection with nature[25]

Natural capital and hazards

Natural capital means all the natural resources needed to create living and safe living conditions, as well as the production process. In this sense, we can call everything we take from nature natural capital. When we say here natural capital, we mean natural resources that are very closely involved in the whole life of the mountain communities. To take advantage of these resources, the community is constantly creating new knowledge based on established experiences. Such knowledge occupies a very large place in the life of the mountain people.

Examples of such knowledge are the use of land, the processing of natural minerals in its own way, the preparation of food, and the use of wild plants as a means of treatment.

5.1.5. Factors causing the loss of values in mountainous areas

Climate change

According to the Third National Communication of Azerbaijan to UNFCCC, global climate change will have a strong impact on the temperature and precipitation regime in the country. According to the projections of different climatic models, precipitation will generally decrease for the period 2011-2100 compared to the baseline period (1961-1990). E.g. the HADCM3 model projection confirms 20% decrease of precipitation in comparison with average values of baseline period in Nakhichivan and Small Caucasus areas for the period between 2071 and 2100. Main climatic hazards in mountain areas of Azerbaijan are heat waves, storms, extreme temperatures, heavy rains, droughts, floods, hails and landslides. For example, low mountain regions of the country are mainly prone to droughts, while high mountain areas are prone to landslides and flash floods. For example, most mountaineers claim that there is less water in springs and rivers now than there was 30-50 years ago, that dry summers are longer, and that this has negative effects on pastures and soils. Vegetation of summer pastures in Guba-Gusar region has significantly reduced and caused damage to livestock and increased risk for degradation of plan cover, which in turn, increased risks for landslides. According to the Third National Communication, droughts are likely to reduce water supply by 23% during the 2021 to 2050 period in the country. The water cycle will be affected by warmer temperatures of the climate change resulting in misbalance of evaporation and precipitation. As a result, some areas will be affected by intense droughts, led by excess evaporation, while other places by floods caused by long-term rains. Natural disasters, like floods, drought, and storms directly affect water resources to be used by different sectors, including hydropower.

[25] Abbasov, R., Karimov, R., & Jafarova, N. (2022). Mountain Ecosystem Values. In Ecosystem Services in Azerbaijan: Value and Losses (pp. 29-69). Cham: Springer International Publishing.

Land degradation

Land degradation leads to loss of productivity, economic value, and livelihoods for mountain people. It also increases risks for natural hazards and conflicts. Land use should be environmentally friendly, avoiding overstocking and overgrazing. Degraded lands are unattractive and unsuitable for tourism or economic activities.

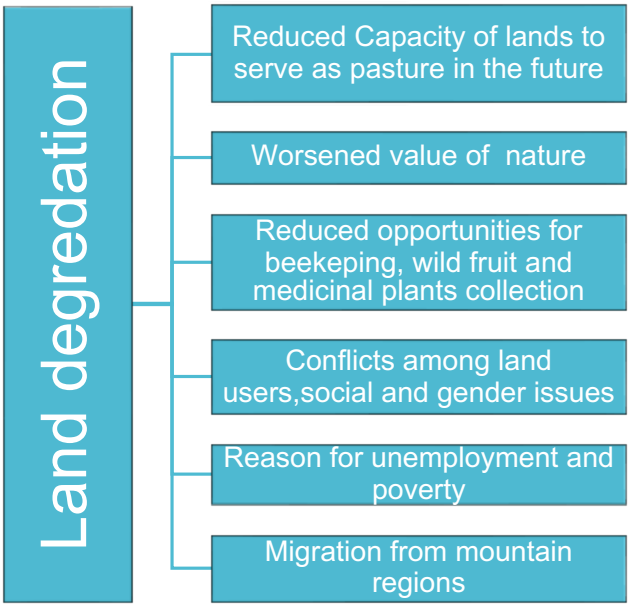

Fig. 5.6. Land degradation and its consequences[26]

Environmental migration from mountain regions

In various years, environmental migration of population from mountain regions in Azerbaijan has taken place due to occurrence of sudden natural disasters, as well as because of changes in the level of Caspian Sea, adverse ecological situation, challenged access to resources and reduced opportunities for nature use. Located in naturally hazard-prone areas, some regions, rural and urban settlements in Azerbaijan often are affected by floods, mudflows, landslides, earthquakes and other disasters, following which, migration of population in devastated areas takes place. Another type of natural disaster, flood, occurred up to 150 times in 1900-2003 in the rivers of Kura and Aras, hitting the settlements, destroying vital agricultural lands and resulting in out-migrations of population in Salyan, Neftchala, Sabirabad, Saatli, Imishli, Zardab and other districts. For example, in such mountain villages as Haput, Gala Khudat and Jek, located in Guba district, the natural resource potential of the local area has lost its previous capacity, as lands are degraded, landslides are intensified, water resources became scarce etc.

In this research, the emphasis is laid on four cases of migration induced by environmental factors and climate change in Azerbaijan:

- Long and ongoing migration of mountain communities in Upland Shirvan region;
- Flood migrations that happened in Kura-Aras region in 2010;
- Seasonal periodic migrations performed by nomadic Terekeme communities in central parts of the country;
- Long term migration of the of Kryz people and related disappearance of intangible cultural resources they possess – language and old customs.

The case of Upland Shirvan: migration and depopulation

Thus, though Upland Shirvan has long been considered a region with higher birth and natural increase rates in Azerbaijan, the share of the region in country's overall rural population has declined in the last 30 years, as the census data led in 1989, 1999 and 2009 years shows. Comparative analysis conducted by us shows that rural settlements that are located at higher altitudes and specialize in grain-growing, viticulture and fruit-growing, either already faced depopulation, or may see it in the upcoming years and decades in line with ongoing adverse demographic trends. Most of this group of settlements, in terms of demographic growth, lags behind foothill villages of lower altitude, although the natural increase in the villages located in foothills and mountainous areas is higher. Regarding the Upland Shirvan region it can be concluded that the risk of disappearance of settlements at high degree is present in Ismayilli district, as well as at medium level in Shamakhy and Gobustan districts.

[26] Abbasov, R., Karimov, R., & Jafarova, N. (2022). Ecosystem Services in Azerbaijan: Value and Losses. Springer.

The case of Kura-Aras lowland: flood migration

Geography of this floods encompassed 8 districts and posed damage to 97 villages, including to residential houses and farmlands of 10089 families who lived in the rural districts of Sabirabad, Saatly and Imishli. Eventually, the number of residents of Yeni Novruzlu formally reached 1.7 thousand people, of which about 55% were flood migrants. Another related problem experienced by migrants in Kura-Aras lowland was related to the number of rooms of new houses built, with taking into account that the number of children in rural families of the region is traditionally higher. For example, before the flood, residents of the Telishli village lived in houses with an area of 150-200 sq. The case of Terekeme communities: seasonal migrations of nomads For Terekeme communities, the region of Karabakh, especially its Kalbajar and Lachin parts were traditionally knowns as ideal places for pasture livestock due to the presence of large grasslands and natural forage. Eventually, the conflict caused the loss of access to these grasslands for Terekeme people and thus, broke their nomadic lifestyle since then.

5.1.6. The language of Kryz communities as an endangered cultural value

The Kryz people, on which we mainly focused in this chapter, is one of most geographically scattered ethnic minorities in Azerbaijan's Guba-Khachmaz region due to migration they have performed throughout the twentieth century. It is stated that the tribe of "her" or "er", one of 26 tribes which Strabo mentioned in his "Geography", is the ancestor of the Kryz people, living in the northeastern Guba-Khachmaz region of Azerbaijan today. In 80s of the 19th century, the number of Kryz population who migrated from mountain areas of Guba region to low plains, called Mushkur mahal, reached 5100 persons. Meanwhile, environmental migrations of the Kryz people from Guba district (highland) to Khachmaz district (low plains) continued in the Soviet period, until the end of the twentieth century.

Today, there are more than 25 villages in Khachmaz district, population of which is composed mainly of the Kryz people. In common, one of features of the Kryz people who migrated to plain areas of Khachmaz district is their high integration and mixture with other nationalities. The traditional clothing and adornments of the Kryz people living in mountain areas and low plains are significantly different.

The Kryz language, a rich cultural resource in Azerbaijan, reflects the past, living conditions, customs, traditions, and way of life of the Kryz people. The Kryz people still speak their native language, making the settlement an interesting tourist destination and increasing its ecotourism potential. However, many people in low plains, particularly those aged 18-30, do not possess the Kryz language skills. The Kryz language also contains words related to geographical conditions, climate, and weather conditions. For example, the word "pashkhur" means "time of the year when nature blossoms out" and "markhal" refers to the snow-covered Kryz village in winter. The Kryz language also has some words associated with natural processes.

The Kryz communities in Azerbaijan have a rich biological resource, including thyme, beech trees, and various herbs. The Kryz language has various words for thyme, khirjidar, a thorn bush, barley plaster, and a variety of grasses. They also brew the peel of medlar and local wild herbs for tea. Some words are associated with grassland vegetation, such as "alasin," "gug," "khin," "kheen," "kheener," and "khel." Bird hunting was once a part of their activities, with bird traps called "takhtachal" and flocks of birds called "gefle." The Kryz language also features various bird species, such as mijahul, a migratory swallow that creates nests made of mud on balconies and verandas.

RECOMMENDATIONS

- Making changes to existing legislation to strengthen public and community-based management, implementing incentive solutions to expand community-based forest management

- Mainstreaming biodiversity into development plans for industries like mining, tourism, forestry, fisheries, and agriculture.

- Encouraging sustainable integrated planning and management of landscapes and seascapes

- Encouraging the use of sustainable farming methods, such as agroecology, multifunctional landscape planning, and cross-sectoral integrated management.

- Utilizing genetic resources sustainably in agriculture includes protecting species, landraces, breeds, cultivars, varieties, and gene diversity.

- Promoting the application of biodiversity-friendly management techniques in the production of crops and livestock, forestry, fisheries, and aquaculture, including the application of customary management techniques connected to local communities and Indigenous peoples when appropriate.

- Promoting natural or semi-natural habitat areas inside and outside of intensively managed production systems, as well as repairing or reuniting damaged or fragmented habitats as needed.

- Supporting multifunctional, multiuse, and multi-stakeholder approaches as well as strengthening community-based approaches to forest governance and management are crucial for achieving sustainable forest management.

- Mainstreaming climate changes into the development planning both at the national and regional levels

- Reducing transboundary pollution and transboundary water withdrawals of watercourses through tailored international bilateral agreements with upstream countries of the Kura-Araz basin

- Maintaining environmental flow needs of river ecosystems through application of EU directives or other available approaches

- Promoting environmentally friendly land use activities in agricultural sectors and urban planning

- Implementation of coercive and incentive schemes such as PES, application of grazing norms, tax exemptions to prevent overgrazing in summer and winter pastures

- Establishing a nature-based management mechanisms to reduce negative changes in forests due to climate change and other human-induced impacts

- Reducing the negative effects of unsustainable logging by combating illegal logging and improving and implementing sustainable forest management

- Integrating water resource management and landscape planning, including through increased protection and connectivity of freshwater ecosystems

- Improving transboundary water cooperation and management, addressing the impacts of fragmentation caused by dams and diversions

- Supporting collaborative water management and to foster equity between water users (while maintaining a minimum ecological flow for the aquatic ecosystems), and engaging stakeholders and using transparency to minimize environmental, economic and social conflicts

- Developing and promoting incentive structures to protect biodiversity (e.g., removing harmful incentives).

- Encouraging sustainable production and consumption by means of trade agreements, public procurement policies, circular and other economic models, corporate social responsibility, life-cycle assessments that take biodiversity into account, sustainable sourcing, resource efficiency, and reduced production impacts.

- Investigating different approaches to economic accounting, including material and energy flow accounting and accounting for natural capital, among others.

- Supporting community-based participatory water management schemes that take into consideration community interests and interests of marginalized groups.

- Supporting community-based disaster management schemes that take into consideration community interests and interests of marginalized groups.
- Institutionalizing the use ILK and promoting the use of this knowledge through different management approaches
- Protection of ILK knowledge through protection of traditional lifestyle of Indiginious and local communities in mountainous regions
- Incorporate biodiversity considerations into trade agreements, public procurement policies, and corporate social responsibility frameworks.
- Negotiate and establish bilateral agreements with upstream countries in the Kura-Araz basin to regulate transboundary pollution and water withdrawals.
- Strengthen community-based approaches to forest governance through the creation of participatory decision-making processes.
- Develop and implement programs for the conservation and restoration of natural habitats within and outside production systems.
- Facilitate the sharing of data and technologies to enhance transboundary water cooperation and address shared challenges.
- Ensure that marginalized groups and Indigenous communities actively participate in the development and implementation of these schemes.

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