

AT THE CROSSROADS BETWEEN EAST AND WEST
IN THREE HOSPITABLE COUNTRIES
AGRICULTURE AND BREEDING WERE DEVELOPED SINCE THE NEOLITHIC
COPING WITH THE RHYTHMS OF THE SEASON
A TREASURY OF GENETIC RESOURCES IS MAINTAINED IN GARDENS
TO MAKE BREAD, CHEESE AND WINE

RURAL PEOPLE KNOW AND USE WILD PLANTS AND ANIMALS

COMBINING BIODIVERSITY, HEALTHY ECOSYSTEMS AND SMALLHOLDERS' DEDICATION:
A PATHWAY INTO THE FUTURE

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Կənd əhalisi yabant bitkiləri və vəhşi heyvanları tanıyır
və onlardan istifadə edir

ველური მცენარეებისა და ცხოველების
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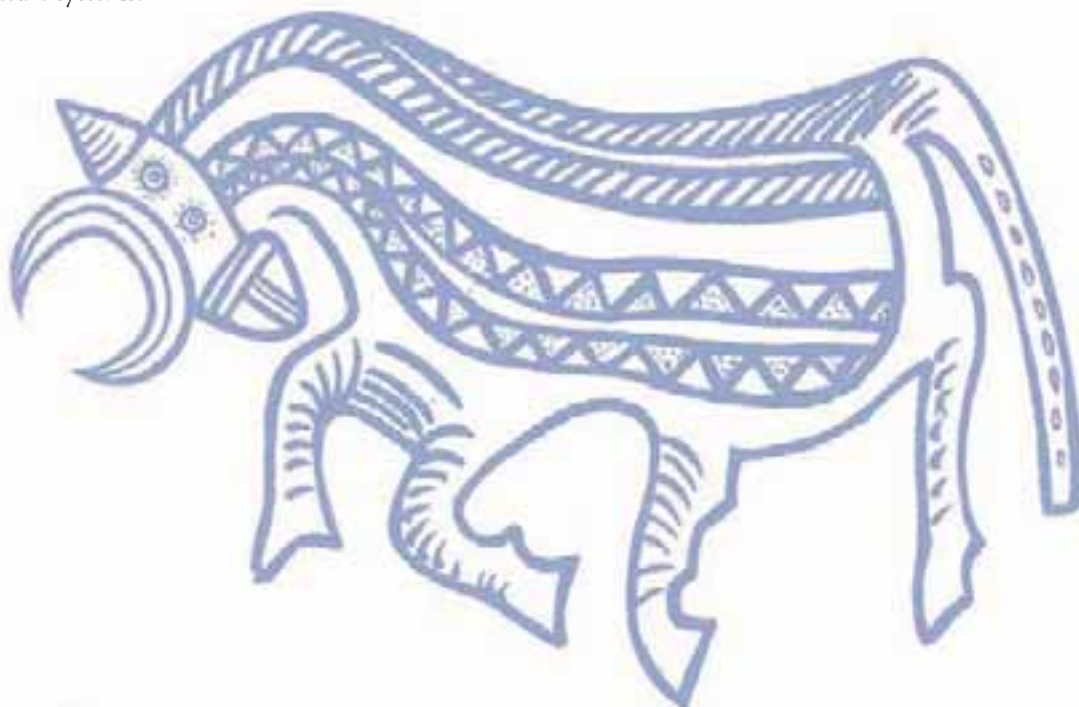
INTRODUCTION

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IN THE SOUTHERN CAUCASUS, PEOPLE STILL GATHER AND MANAGE WILD AND SEMI-WILD PLANTS AND FRUITS; THEY USE HERBS, FISH, WILDLIFE AND GRASSLANDS TO COMPLEMENT THEIR DIETS; AND THEY HAVE A BALANCED INTAKE OF ALL NECESSARY MACRO- AND MICRONUTRIENTS FOR HEALTHY AND QUALITY NUTRITION. EVEN SMALL QUANTITIES OF PLANT COMPOUNDS CAN INFLUENCE THE OVERALL QUALITY OF THE DIET, AND AFFECT METABOLISM AND HEALTH. HOWEVER, PEOPLE DO NOT DEPEND ON WILD AND SEMI-WILD PLANTS TO SURVIVE, AND WILD PLANTS DO NOT FULLY DEPEND ON HUMAN MANAGEMENT.

People collect plants to complement their diets and increase their incomes, for recreational purposes and as sources of food security. Farmers also use plants, as they have done since the Neolithic, to feed their animals. Some people cultivate these plants (such as carrots, berries and herbs for teas and saffron), while others collect them in the wild. Some catch wild animals and fish, while others raise them in ranches and aquaculture systems.

Some protect and care for their forest trees, while others do not respect regulations. Rural people in the Southern Caucasus know how and when to find these resources, their seasonality and plant and animal physiology and behaviour, and they know how to manage and use them. They will be able to continue to do so, if supported by enabling policies, education programmes, technologies and financial mechanisms.





There is a close relationship between rural people and wild and semi-wild plants. People use them as a complement for a healthy and diversified diet, and by responsibly doing so they contribute to the preservation of genetic resources and the environment

THE MANY FUNCTIONS OF GENETIC RESOURCES

There is often a faint border between what farmers collect for food and what they collect for medicinal use. Wild or semi-domesticated plants are often consumed as food but their contribution to people's health is recognized by traditional knowledge and, today, is increasingly confirmed by the science studying the chemical composition of wild plants.

The multiple roles of wild plants (mostly maintained in natural grasslands and forests) in addition to food and medicine production include maintenance of soil structure,

water infiltration capacity, air quality, habitat for wild and domesticated animals and recreation. In short, they serve as a basis for all human activities. The state of the world economy and human welfare and health significantly depend on these resources. Wild plants form a bridge between agriculture, animal production and nature conservation, protection and sustainable management, and deserve greater attention in the context of future agricultural programmes on food security and climate change adaptation, energy saving, degradation control and sustainable use of water resources.



Terterian Haykaz, head of Lusarat village, with wild asparagus. Below: redcurrant berries. >>Right: fresh and preserved wild vegetables sold along roadsides



Micro-organisms also have an important role in the large majority of ecosystems and, although once considered a source of harm, now enable progress to be made in the production of foodstuffs. Modern medical science shows serious interest in genetic resources to find new remedies for the treatment of diseases. At present, 40 percent of sedative drugs used in medicine come from substances derived from wild plants. Genetic resources are used in studies on biotechnology, genetics and for industrial purposes.

Wild ancestors and relatives of genetic resources are used in gene engineering as a source of resistance to biotic and abiotic factors and as a source of quality traits. In genetics, wild species of biodiversity are used to detect the origin of cultivated crop genotypes and in hybridization for valuable traits.



FOOD AND MEDICINAL PLANTS

Hundreds of species of wild vegetable crops are used by rural populations. The shoots and leaves of mallow (*Malva neglecta* Wailler), belonging to the Malvaceae family, are used in making different dishes in the Caucasus. The stalks of the ether-oil plant, cow parsnip (*Heracleum asperum* Bieb.), belonging to the (celery) Apiaceae (formerly Umbelliferae) family, are consumed after being peeled and pickled. Fresh and young shoots and leaves of knotweed (*Polygonum alpestre* C.A. Mey.), belonging to the Polygonaceae family, are used in the preparation of dishes such as *siyig*, *kete*, *plov* and *dovga* or dried and stored to use in off-season periods. These plants are also used in medicine and are increasingly defined as “nutricament” food. The young shoots and leaves of nettle (*Urtica dioica* L.), belonging to the Urticaceae family, are pickled and eaten, and used in the preparation of different dishes. The young shoots and leaves of common balm

(*Melissa officinalis* L.), which has a lemon aroma, are used in perfumery and medicine. A number of wild plants such as fennel (*Foeniculum vulgare* Mill.), bulb onion (*Allium rotundum* L.), asparagus (*Asparagus officinalis* L.), sorrel (*Rumex acetosa* L.), campion (*Silene* L.), rhubarb (*Rheum undulatum* L.), carrots, mountain mint (*Satureja montana* L.), horsemint (*Mentha piperita* L.), beaked parsley (*Anthriscus cerefolium* Hoffm.) and hill coriander (*Bifora radians* L.), are used for food and medicine. Plants available in the Caucasian flora are used in the preparation of oils with diverse composition, extracts and juices.

There are over 250 oil-bearing plants growing in different zones of Armenia. The components of revealed volatile oils are diverse and valuable, especially those with medicinal significance. These important components are carvacrol, eugenol, menthol,



Fruits of wild roses rich in vitamin C. Traditional food production and processing practices can be the starting-point for diversifying sources of income. The non-monetary value for the environment of sustainable agricultural practices could be quantified, and this value reflected in the market value of agricultural products. >>Right: sorrel is consumed fresh or dried to prepare traditional dishes

geraniol, thymol, boras camphor and many others. All of them are important elements in the metabolism of human organisms. They are active biological substances that are widely used in traditional and professional phytotherapy as an expectorant, a diuretic, an anti-inflammatory agent and for the relief of pain. These herbs are mentioned in ancient Armenian manuscripts and the works of Amirdovlat Amasiatsi, Ghevond Alishan, Gabikean and Srvandztyan, and revelation of these plants and analysis of their specific composition are of global significance from the point of view of phytotherapy. All knowledge and use of healing herbs, including manipulative treatments, methodological processes, preparation of poisons, etc. that, in the history of world medicine, are called *Cura Mediana*, are famously related to Medea, a daughter of Aeëtes, the king of Kolkheti. The earliest mention of the medical activities of Aeëtes' family is in the scholia of Homer's *Iliad* (ninth century BC). Diodore Sicilian (first century BC) in *Historic library* describes amazing sleep-inducing potions (including inhalants), prepared with herbs by Medea, as well as

her secrets for treating wounds, childlessness and psychological disorders. "It is said that Medea healed Heracles with her herbs in Thebes, while he was sick with insanity (because his children were dead)." The ancient Colchian-Iberian healing activities continued in the church centres of early feudal Georgia and old Georgian medical treatises and books are safeguarded in the Georgian State Museum. The manuscripts of these books have been kept in the families and handed down from generation to generation as a dowry or inheritance. There is currently growing recognition of the importance of extending the cultivation of medicinal plants, and moves towards certification are necessary to broaden access to European markets. A number of plants from Azerbaijan have attracted foreign business people, and some valuable plants are exported, including cultivated liquorice (*Glycyrrhiza glabra*), linden (*Tilia cordata*), cane (*Phragmites australis*), reed (*Arundo donax*) and nettle (*Urtica dioica*). Some examples of wild plants consumed as food, herbs and spices that have a direct influence on human metabolism are described in the following pages.

Sorrel (*Rumex* spp.)

Armenian	<i>Aveluc</i>
Azeri	<i>Avelik</i>
Georgian	<i>Mzbauna</i>

In late spring, in city markets as well as on mountain roads (near the natural habitats of sorrel), elderly women twine fresh sorrel leaves for sale. Later they dry out the plaited strands. Nineteen varieties of sorrel are known in the countries of the Southern Caucasus, but only the following are popular among local people: *Rumex acetosella* L. (sour sorrel, which grows in meadows and shrub land); *R. acetosa* L. (in mountain meadows); *R. crispus* L. (curly sorrel, which grows mainly in lowlands, in meadows of the middle mountainous zone, in river valleys and damp places); *R. alpinus* L. (alpine dock); and *R. confertus* Willd. (dense sorrel, which grows at altitudes of 1 800–2 500 m, in alpine zones and summer pastures).

Wild carrot (*Daucus carota* L.)

Armenian	<i>Gaza, Gazruc</i>
Azeri	<i>Kök, Yerkoku</i>
Georgian	<i>Pheristsvala</i>

The cultivated carrot probably originated from the crossing of wild varieties. It has succulent roots as a result of popular selection and is biannual, while wild carrots are annual and have thin, stiff roots. Local people use wild carrots particularly as an early spring herb to flavour meat and fish dishes, in marinades and for vodka. In meat and fish dishes, wild carrots retain their appearance and have a pleasant, unique flavour. They are also used in folk medicine as a diuretic, to normalize the functioning of kidneys and urethra, and stimulate menstruation. The plants grow singly or in groups as weeds on roadsides, in vineyards, vegetable gardens, forest glades, ravines and on riverbanks. It has been observed that environmental conditions have a great influence on habitat. In damp and fertile soils, the plants develop lush leafy tops on the surface and larger roots than in other conditions.



Asparagus (*Asparagus* spp.)

Armenian	<i>Tsnebec, Marazho, Tsnepbac</i>
Azeri	<i>Gulanchar, Merejuyud</i>
Georgian	<i>Satatsuri</i>

The asparagus variety *Asparagus officinalis* L., to which cultivated common and pharmaceutical types belong, grows in shrub land, foothills covered by grass, gardens, and on sandy and sludgy riverbanks, i.e. practically everywhere. It has long been used for food, even before cultivation. It is a rhizome plant and propagates through cross-pollination. The roots are used as a diuretic and a cordial, and are also useful to treat kidney complaints. The young stems are prescribed for liver and back pains. Patients eat them during the spring or dried in winter. Local people pick the young stems of asparagus in the fields, use them as food or sell them in large city markets. At the end of summer, mature stems with small fruits are used by florists to make bouquets. Other varieties are typical of drier climate conditions and grow on sandy seashores. *A. caspius* Hohen grows in Azerbaijan and Georgia. *A. littoralis* Stev. grows only in Georgia on the sunny shores of the Black Sea, whereas the variety *A. ledebourii* Misch. may be found on the sandy shores of the Caspian Sea. These varieties adapted to dry climatic conditions have not yet been studied, but they have value for deriving new varieties. Many other mountain varieties have not yet been fully studied, although they have great selective value for obtaining new types.



Photo by Z. Aparov



Saffron (*Crocus sativus* L.)

Armenian	Zafran, Shafran
Azeri	Zeferan
Georgian	Zaphrana

Saffron has been cultivated since time immemorial and is a fundamental element of Caucasian cuisine. Many Azeri national dishes and sweets could not be envisaged without saffron: Azerbaijan pilaf with chicken, dried apricots and chestnuts; *piti*; *kifta-bozbash*; Azerbaijan *paklava*; *tendir chorek*, glazed with an egg yolk, saffron and sesame. Kamenetsky mentions the names of 19 villages in Apsheron where, by 1886, more than 300 ha of saffron were grown. Moreover, he complains that land under saffron on the Apsheron peninsula was much reduced through the impact of the nascent petroleum industry. He stressed that up to 1886 the territory was much more extensive. Saffron in Azerbaijan is unsurpassed as the king of spices – an important food and medicinal crop. It has been to date the subject of a great deal of important scientific research.

Sea buckthorn (*Hippophae rhamnoides* L.)

Armenian	Cicciban
Azeri	Çaytikani
Georgian	Hazvi, Chardela, Jacudla

Sea buckthorn has many uses – for medicine, various fields of production, decorative gardening, soil erosion control, in protective fencing and in green hedges, animal feeding, tanning of skins and energy production. The fruits contain vitamins C, P, E, B1, B2, K and up to 15 microelements. In modern medicine, sea buckthorn oil is used in the treatment of anaemia, cordial ischaemia, hypertonia, eczema and other disorders.

In addition to its medical use, the significance of this plant in soil protection from water erosion and its recultivation is extreme, because sea buckthorn usually grows on the upper layer of the soil, branches strongly and has a multistorey root system as well as root tubers that absorb free nitrogen from the air. This means that it can grow in soils without humus, in infertile areas, even where they have been degraded by mining activities. The use of sea buckthorn as a phytomeliorant (pioneer species) increases the biological productivity of soil and returns it to the agricultural cycle.

The Genetic Resources Institute of Azerbaijan established *in situ* conservation, selected the most promising varieties and distributed the more productive and pest-resistant varieties to farmers. Newly originated varieties, wild and hybrid forms of sea buckthorn are maintained in *ex situ* conditions in research bases of the Institute, where they are observed, their height and growth characteristics investigated, and biological research indexes compared.

A sea buckthorn variety recently created is *shefa*, obtained by selection from natural sea buckthorn grown in the Shinchay basin of the Sheki region. It has no thorns and is late maturing. Sea buckthorn also thrives in Armenia around Lake Sevan.



Dr Qabil Imamaliev of the Genetic Resources Institute of Azerbaijan in Baku with a branch of sea buckthorn. This plant is highly prized for the nutraceutical value of its fruits. It is also a pioneer plant used to rehabilitate degraded soil and to prevent erosion.
Below: wild sea buckthorn along the shores of Lake Sevan





In the Southern Caucasus, a rich diversity of plants is used for multiple purposes, managed by rural people

From top left to right: Juniperus oblonga, Galium cruciata, Foeniculum vulgare, Cichorium intybus, Rumex crispus, Filipendula hexapetala, Atropa caucasica, Thymus rariflorus, Papaver somniferum, Datura stramonium.



From top left to right: *Digitalis nervosa*, *Althaea officinalis*, *Glycyrrhiza glabra*, *Sambucus nigra*, *Aconitum nasutum*, *Capsella bursa-pastoris*, *Vaccinium myrtillus*, *Artemisia absinthium*, *Urtica dioica*, *Humulus lupulus* [Source: ТРОССГЕЙМ, А.А. 1952. РАСТИТЕЛЬНЫЕ БОГАТСТВА КАВКАЗА. МОСКОВСКОЕ ОБЩЕСТВО ИСПЫТАТЕЛЕЙ ПРИРОДЫ. МОСКВА.]



Mushrooms

In the Southern Caucasus, the best known mushrooms are champignons (*Agaricus*) and saffron milk caps (*Lactarius deliciosus*) found in areas rich in coniferous forests; they form communities with pine trees and firs. There are 4 200 species of mushrooms known in Armenia. They are an important functional element in the ecosystem and play a significant role in the processes of decay of organic leftovers and soil origination.

In Azerbaijan, local populations collect and use *Guzugarni* – *Morchella conica*, *M. esculenta* (Gabala and Goychay regions), *Donbalan* – *Terfezia leonis* (Garabagh and Gobustan) and *Kilkeli peyner* – *Coprinus comatus* (Balakan). People who know about mushrooms collect *Boletus*, *Cantharellus*, *Lactarius* and *Russula* genera from forests.

Nearly 1 200 types of macro fungi (Macromycetes) have been identified in Georgia. According to the literature, 300 types are edible, but the local population consumes only 30 types and the rest are considered suspect. In almost all regions of Georgia, winter *Armillaria* is collected in forests, then dried or pickled.

In the last 30 years mushroom cultivation has become an important agrobusiness for smallholders. Today, despite the increasing mushroom production, Georgia cannot meet the demand. Only three cultivated types of mushroom are produced in the region: champignon (*Agaricus bisporus*); oyster mushroom (*Pleurotus ostreatus*); and small amounts of the Japanese mushroom *shiitake*. Cultivating mushrooms needs little outlay. They are mostly farmed on agricultural debris: husks, sunflower skins, vine wood, maize skins, sawdust, etc. Spawn is imported from France, Israel, Ukraine and the Russian Federation.



Infusions and tea production

For over thousands of years the tradition of collecting and blending wild herbs and flowers to produce tea has been an integral part of the daily lives of Southern Caucasus people. Black, green or herbal tea always accompanies formal meetings and business gathering, short breaks and family celebrations.

The cultivation of tea in Georgia decreased from 58 000 ha in 1992 to 6 500 ha in 2008 and a similar drop was observed in Azerbaijan where 8 500 ha were cultivated in 1992 and only 1 004 ha in 2008. However, the tradition of consuming tea has remained unchanged.

Special traditional methods coupled with modern technologies and scientific knowledge must be blended together to produce the best tea.

In the Southern Caucasus, farmers and rural people know the best harvesting time for the various tea species, they manage the different drying processes required to produce tea of the best quality, they know how to select leaves and flowers, how to grade, sort and categorize them, and how to produce different blends.

Maintaining and valorizing these farmers' knowledge by supporting production, processing and trading of local wild and cultivated tea can contribute to raising income, maintaining local biodiversity and promoting preservation of a culture of hospitality.

Two images of the samovar, symbol of good tea quality and hospitality
<<Left: *Russula* mushrooms on sale along the road, a very common sight in forest areas during autumn. Wild and cultivated mushrooms represent a source of income for smallholders





TRADITION OF ARMENIAN HERBAL TEA CULTURE

by Armen Mehrabyan

Herbal teas are an essential part of a varied and healthy diet in Armenian culture. Wherever and whenever there has been a social gathering, herbal teas are brewed to share with family and friends. These herbal teas are characterized by a pleasant taste and aroma, by rich quantities of microbodies, vitamins, oils and other valuable components. These components play a special role in our life and food values, and also have a positive influence on our gastrointestinal tracts and health. Because of these valuable features, technological systems have gradually been developed for herb collecting, drying and other necessary procedures.

The criteria used in choosing herbs for tea preparation are: first, flavour; second, premium quality; and last, the ability of the herbs to enhance the overall enjoyment of a fine meal.

Among 15 rehabilitated herbal teas, the "Mediterranean Mint" herbal blend is a striking example of a recipe revival from ancient Armenian herbal tea culture, where the main components are carefully harvested – wild crafted thyme, wild mint and Armenian wild oregano.

Armenian people love wild thyme but often unsustainable harvesting and exploitation of these resources by local people take place. Enhancing work on natural multiplication and crop improvement should be a priority for joint work among scientists, organic agriculture specialists and companies that are using wild crafted herbal crops to bring them into the spheres of ecobalance and improvement of biodiversity.

Studies on the germination of different species of *Thymus* (*T. serpyllum*, *T. vulgaris*, *T. armeniacus*, *T. kochi*) confirmed their poor germination and growing ability. The maximum percentage and speed of germination were obtained during July at a day/night regime of 22/15 °C (38 percent after seven to eight days) in the mountains (800 m above sea level) near Odzun village in the Lori region of Armenia. From the results of analyses of independent samples and the comparative analyses of test plots the following conclusions were drawn.

- The current methodology of natural multiplication and/or rejuvenation of *Thymus serpyllum* in the field is effective.
- It is important to make thyme seed collections in the year before starting natural multiplication.
- During natural multiplication, higher crop indexes were identified during the fourth year and, starting from that period, the self-rehabilitation and development of plants, without any anthropogenic factors, were registered and a natural balance with the environment achieved.
- Essential oil content does not so much depend on the multiplication or growing elevation, but more on the harvesting time of crops, which is shown in the data of essential oil analyses of *T. serpyllum* from different elevations in the Odzun area.



Thyme bags sold as a tranquillizer. <<Left: Marina Haykaz with a bunch of medicinal herbs: *Artemisia*, *Ipericum*, *Thymus*, *Achillea* and *Anthemis tinctoria*





Rural people know how to use and protect wildlife, but they may also misuse and degrade it. There is a need for a collective shift from indifference to awareness in order to maintain wild resources and benefit from them

WILDLIFE AND HUNTING

Local communities have always exploited wildlife, and this exploitation has taken place on a more or less sustainable level.

Hunting is a popular practice in the Southern Caucasus. With the exception of certain mountainous areas, hunting is a sport and a form of recreation. However, inappropriate game management practices over the last century have led to significant declines in many game species. Populations of species such as red deer (*Cervus elaphus*) and mountain goat (*Capra aegagrus*) have been severely reduced and remain only in protected areas, and the Persian gazelle (*Gazella subgutturosa*) is now extremely rare. Carnivore populations have been significantly affected by a bounty system, although this has recently been abolished.

With the exception of migratory birds, hunting is only permitted in specially designated areas called hunting farms or reserves. These may be owned by a legal entity (e.g. a registered

company or organization, either governmental or non-governmental) or by a private individual. General licences for hunting reserves are awarded by the Ministry of Environment through a competition for each potential site. Currently, in Georgia there are 29 hunting reserves covering a total area of 263 000 ha. The game species are mainly *Capreolus capreolus*, *Rupicapra rupicapra*, *Vulpes vulpes*, *Canis lupus*, *Procyon lotor*, *Sus scrofa*, *Meles meles*, *Martes martes*, *Lepus europaeus*, *Felis silvestris* and different bird species.

Hunting of migratory birds is permitted for *Coturnix coturnix*, *Columba livia*, *Streptopelia turtur*, *Gallinago gallinago*, *Columba palumbus*, *Scolopax rusticola*, *Anser anser* and *Anas platyrhynchos*. In 2005, hunting of these birds was temporarily halted to prevent the spread of the highly pathogenic avian influenza. Quotas for game species are usually set without carrying out sufficient research on game numbers and population dynamics. Poaching is still a major threat to biodiversity.



EMPOWERMENT OF RURAL PEOPLE FOR THE PROTECTION OF WILDLIFE RESOURCES

Non-regulated and illegal hunting can result in the loss of diverse species. Many people are involved in hunting, including government officials, scientists, farmers and pastoralists, urban residents and professional hunters. In addition to wildlife, practically all genetic resources managed as a common resource are today under severe threat in the Southern Caucasus. The same threats to wildlife are faced by the genetic resources of plants (in grasslands), trees (in forest lands) and fish (in rivers, lakes and seas) as their sustainable use is severely challenged by economic pressure, monocultures and the absence of positive incentives. There are poor advisory services and poor legislation and control measures to prevent illegal hunting, logging and fishing.

Since wildlife is managed by rural people for their livelihoods, they know how to use and protect it, but some are also capable of misusing and degrading it. There must be a shift in the general attitude from indifference to awareness, developing mechanisms to socially and economically reward rural people's role as guardians and managers in order to maintain these resources and benefit from the services they provide us with today and, it is hoped, in the future.

Economic investments and education programmes to understand the importance of wild genetic resources need to reach hunters, farmers, students, teachers, non-governmental organizations and national experts.



A balanced combination of agricultural land and protected areas enables wild animals to move in the ecosystem and is an effective and sustainable way of maintaining wildlife

Mayors and government officers must actively participate in the development of better infrastructure to improve rural life.

Farmers and rural people need to have access to technologies and microcredit to develop creative activities in diversification of their work and new forms of production, maintenance and transformation of wild plants, animals and fish, including ecotourism.

In addition, stronger controls and taxation systems should be developed to discourage all activities that destroy genetic resources, comprising plants, animals, forests, fish and common goods.





FISHERIES IN THE SOUTHERN CAUCASUS

by Raymon Van Anrooy

Fishing in Armenia, Azerbaijan and Georgia has long been of importance for both sport and commerce.

The Southern Caucasus has more than 125 fish species, although only about a dozen are endemic. Among the most interesting species are the three lampreys, *Caspiomyzon wagneri*, *Eudontomyzon mariae* and *Lampetra lanceolata*.

Lampreys are jawless, scaleless fish that date back 280 million years, and have the highest number of chromosomes of all vertebrates (164–174).

Another group of fish in the limelight are seven species of sturgeon, including the famous beluga sturgeon (*Huso huso*), the largest freshwater fish and the source of high-value caviar.



In the Southern Caucasus, more than 125 fish species have been identified, about 12 of which are endemic

CURRENT THREATS TO FISH BIOMASS

Populations of all sturgeon species have been reduced through overfishing, primarily for caviar, while other threats include water pollution and damming, which restrict anadromous migrations. At present, many endemic and native representatives of agricultural biodiversity are in danger of extinction and face severe problems of genetic erosion. National policies and comprehensive measures are urgently needed to address the problem.

The negative factors influencing fish biomass and aquatic biodiversity are overfishing; use of prohibited fishing equipment (bottom-trawling, electrofishing gear); illegal catch

of those fish species that are in the Red Book or banned for catch (sturgeons, salmon, trout, sole); water pollution (e.g. oil pollution and the use of pesticides and herbicides); and water management practices (e.g. irrigation) that do not take into account the fish and their biological needs. Overexploitation of fish resources, together with pollution and the occasional introduction by accident of invasive species (e.g. jellyfish, *Mnemiopsis leidyi*) were the main reasons for catch decrease in the Black Sea in the 1990s and in this millennium also in the Caspian Sea. The number of fishing species has decreased from 26 to six.



The Caspian Sea is the largest landlocked waterbody in the world and is bordered by Azerbaijan, the Russian Federation, Kazakhstan, Turkmenistan and the Islamic Republic of Iran

However, in recent years there have been some positive changes relating to the protection of fish stocks, initiated by the Ministry of Environment in Azerbaijan.

Anthropogenic activities and inappropriate management practices have also caused deterioration in the condition of many rivers and lakes. Populations of fish species including *Acipenser sturio* and *Salmo trutta* have been significantly reduced and, in as many as 19 cases, the stocks of economically important fish species are significantly below estimated carrying capacity. Recovery of fish populations in lakes such as Jandari, Tabatskuri, Nadarbazevi, Faravani and Tsalka is unlikely to

occur without active conservation intervention. At present, fishing has been banned on the Mtkvari and Alazani Rivers for a period of four months. Fishing is prohibited in those rivers that are vital for the migration of sturgeon.

There are no modern fishery sector policies or regulatory frameworks in place in support of the sustainable development and management of the sector in the Southern Caucasus. In some cases, there are plans to update fishery laws and regulations but the limited priority given to the sector by the respective governments is constraining the efforts of the sector. Institutional frameworks in support of fishery and aquaculture



development and management are missing (Georgia), or overlap in responsibilities (Azerbaijan). Recurring conflicts among government institutions about their mandates, duties, rights and responsibilities with regard to the management of inland aquatic resources are common in all three Southern Caucasus countries.

Without proper legal, policy and institutional frameworks, the sector is unmanageable and remains in the state of paralysis in which it has been since these countries obtained independence.

THE CRISIS IN THE FISHERY SECTOR

Since 1991, the difficult economic and social situation in the countries, the wars, lack of financial resources, inflexible banking and credit policies as well as the loss of the former Soviet Union consumer market, have all had a negative impact on the fishery sector. Within the sector itself, investment in research and production facilities has been reduced to insignificant levels. While in the Soviet era the sector was a large beneficiary of state subsidies, the loss of these after independence caused a rapid collapse in fishing fleet size and capacity as well as deterioration of aquaculture hatchery systems and fish processing facilities. The absence of fishery management resulted in widespread poaching; moreover, as poverty rates were on the rise, fisheries



offered in some cases a last resort for impoverished parts of the rural population. The rapid breakdown of the old system also resulted in a “migration” of fishery and aquaculture experts, researchers and scientists out of the sector to other sectors where earnings could still be made. The corruption associated with the privatization process that was carried out in the sector in the 1990s added to the absence of proper management of inland waterbodies.

While Georgians were known in the Soviet era as good seafarers, providing admirals and other commanders to the Soviet Navy and freight fleet, the deterioration of political relationships with the Russian Federation has meant that few Georgians are acquainted with modern (fishing) vessel operations and management. Many of the best Georgian fishing vessel crews are now working on fleets of other nations. Similarly, fisheries and aquaculture experts who were working in Georgia and its neighbouring countries in the 1990s have returned to their home countries (particularly the Russian Federation) or have since retired. The ocean-going fishing fleet has largely been sold to other countries. While the Georgian fleet included 48 industrial ocean-going vessels in the period 1980 to 1990, this number was reduced dramatically after independence. Fish landings in Georgia in 1988 were over 200 000 tonnes, which decreased to 58 000 tonnes in 1991 and reached an all-time low in 1999 with 1 400 tonnes. Since then, the capture fisheries production has started to recover, largely dependent on the catch of European anchovy, which makes up about 95 percent of the landings. In 2007, the total catch (in marine and inland waters) was estimated at just over 18 000 tonnes.

The reduction in the fishing fleet caused an outflow of expertise from the sector and resulted also in the closure of supporting industries (e.g. vessel repair services, ice supply services and equipment suppliers) on the input side. Similarly, on the output post-harvest side, the rapid decrease in catches in the 1990s caused private investors to no longer invest in modern processing and marketing facilities for fish and fisheries products. Existing

processing plants closed or ran for just a few weeks per year. Recent initiatives towards the rehabilitation of the processing sector were deterred by the war between the Russian Federation and Georgia in 2008. The present non-existence of educational programmes (at vocational, school and academic level) in capture fisheries and aquaculture in Georgia, together with the weak prospects of the sector in terms of a provider of employment and of opportunities to earn a good income and develop a career, means that the present generation is not attracted by work within the sector.

BLACK SEA BASIN

With the closure a few years ago of the Georgian Marine Ecology and Fisheries Research Institute, located in Batumi, research on fish stocks, species composition and general fisheries resources and their management terminated. At present, there is limited scientific knowledge on the state of marine and inland water resources. Human and financial resources are insufficient to undertake the necessary research that would allow an assessment of fishery resources and support the development and monitoring of fishery management regimes.

There is a clear need for an effective fisheries management regime in the Black Sea basin. Efforts towards this end are being made by various Black Sea littoral countries, FAO, the General Fisheries Commission for the Mediterranean (GFCM) and the Black Sea Economic Commission (BSEC). However, progress is slow. While many are concerned about the resources and consider that fishing quotas should be established based on independent scientific studies of reproductive capacity of fish populations, in practice not much effort is being made. The establishment of national parks (e.g. Kolkheti with its Lake Paliastomi) and coastal marine protected areas near Kulevi has increased environmental awareness among fishers in the area, while at the same time reducing poaching activities. It is apparent, however, that in coastal areas alternative employment and income-generating opportunities for fishers are not widely available.



Agayeva Sulsada shows a catch of Caspian roach (*Rutilus rutilus caspicus*). << Left: national and regional regulations are needed to reduce the risk of genetic erosion



The Caspian Sea is home to seven species of sturgeon, including the famous beluga. The high market value of caviar has made sturgeon a target for illegal fishing and trade and contributed to overexploitation. The illustrations refer to *Acipenser gueldenstaedii* (1), *Acipenser nudiiventris* (2), *Huso huso* (3), *Acipenser baerii baerii* (4) [Source: FAO. 2010. FAO FishFinder. The Species Identification and Data Programme]

CASPIAN SEA BASIN

On the eastern side of the Caucasus, the Caspian Sea basin has comparable fisheries management problems. The importance of migratory species in the fishing catches of Caspian basin littoral countries urges them to work together in the management of the stocks. Before the collapse of the former Soviet Union in 1991, some measures for conservation and management of the Caspian's highly migratory fisheries were in place. For example, declines in sturgeon populations because of the impact of the damming of the Volga were addressed through large-scale hatchery programmes and state monopolies on harvesting. Since 1990, a 40-fold drop in sturgeon populations has been experienced. This is of particular concern given that sturgeon is one of the oldest species still alive, occupying a special place in the biological heritage of the Earth. It is also among the most economically valuable species.

The high-value market for unfertilized roe, i.e. caviar, has made sturgeon a target for organized illegal fishing and trade, and contributed to overexploitation.

Unfortunately, the Commission on Management of Aquatic Bioresources (CAB) of the Caspian Sea, which started to meet in 1992 to discuss and recommend total catch quotas of various commercial aquatic species, in particular sturgeon but also *kilka*, has not yet proved to be an effective fisheries management tool.

While in recent years, CAB, which also includes the Islamic Republic of Iran since 2002, determines not only the annual fishing quotas, but also collects information and advises on fishing regulation measures, the stocks of the main commercial species continue to decrease.

Caspian Sea sprat catches (which generally add up to over 80 percent of the total annual catch) of the Azeri fleet decreased from nearly 39 000 tonnes in 1990 to an estimated 2 400 tonnes in 2007. Sturgeon catches fluctuated over the same period between 108 tonnes (in 1991) and 61 tonnes (in 1998) and were estimated at 67 tonnes in 2007.



COMMERCIAL AND RECREATIONAL FISHERIES AND AQUACULTURE

Both natural and artificial inland freshwater bodies have been traditionally used for commercial fisheries purposes. Total inland capture fisheries production in Georgia was estimated at 388 tonnes in 2003. It is difficult to measure the average annual inland capture fisheries production in tonnes in the Caucasian lakes and reservoirs since poaching is a widespread practice. FAO statistical data, as provided by governments, estimate total inland (freshwater) capture fisheries production in 2007 for Armenia at 3 000 tonnes, Azerbaijan at 426 tonnes and Georgia at around 50 tonnes. The most important species caught include trout, common carp and crucian carp, which together make up some two-thirds of the catch.

The inland aquaculture production of the three Caucasus republics has focused since the mid-twentieth century mainly on the culture of common carp, silver carp and trout.

Generally, large pond culture systems are used, as were established in the Soviet era. Towards the end of the 1980s, the aquaculture production of the three republics added up to over 7 000 tonnes, which gradually decreased to just over 700 tonnes in 1998. The combined aquaculture production has increased slowly in recent years and was estimated at some 1 860 tonnes in 2007. Marine aquaculture production is insignificant in the three republics.

Also after independence, recreational fisheries remained an important hobby for the population of the Caucasus. Although some scientists argue that part of the recreational fishing conducted should be labelled subsistence fishing, fishers themselves prefer the term recreational fishing or angling. At present, the number of active recreational fishers in Azerbaijan is estimated at over 20 000.



Aquaculture can represent an important source of income generation and diversification for rural people, provided financial and technical support is granted

Their estimated annual catch is around 100 tonnes. Generally, the regulations in place allow recreational fishing in all waters, except for reserves, fish hatcheries and aquaculture farms, and in compliance with locally established rules for fishing and water management. The main targets of recreational and sport fishing are pike perch, common carp, eastern bream, roach, *vimba*, Caspian asp, *kutum*, mullet, *shemaya*, barbel, shad, *khramulya*, pike, catfish, shrimp and crayfish. Some large reservoirs in the middle stream of the River Kür are preferred in particular by recreational fishers or anglers: Mingacevir, Yenikend and Varvara, which constitute the cascade of reservoirs.

BETTER PROSPECTS FOR THE FUTURE

In summary, the fisheries sector in the Caucasus republics is slowly recovering from the crisis of the 1990s. The prospects for the sector and its opportunities for development are more and more acknowledged. As a consequence, the seeds have been planted for a sustainable growth of the sector – a growth that will need partnership developments between the public and private sector and stakeholders active in fisheries. Only jointly can the problems and constraints faced by the sector be overcome.



THE FISH BREEDER ASHOT KOCHRYAN

Not far from Harsin village near Haghartsin Monastery, Armenia, we met Ashot Kochryan who breeds *ishkhan*



fish (a kind of yellow trout) in fish basins constructed in the middle of a beautiful wood. He uses freshwater that pours out from a local source and, since the place is cool during the summer, many tourists visiting the monastery stop here to eat a freshly caught trout.

Ashot carries out most of the breeding on his own and buys feed directly from a European

company. Prices are very high, and often he cannot afford to buy feed, especially during winter, when few tourists stop by and eat fish.

Many of his fish die when he is unable to feed them properly, and he is extremely unhappy about this situation.

Ashot is very fond of his fish and looks after the forest, providing

a service to all those who stop by and rest under the trees. He is active and dedicated to his business, and has many plans to produce his own feed to cut down on expenses. He dreams about opening a nice restaurant directly linked to his fish ponds.

But he does not know how to access credit from the bank, and to set up his business he would need some microcredit.





Forests in Armenia cover 10 percent of the land. Wood is a significant source of fuel for heating and cooking and of income generation for rural people

TREES AND FOREST RESOURCES

ARMENIA

Forests and other wooded land make up only one-tenth of the land area of Armenia; the main species are oaks, beech and hornbeam, with ash, elm, lime and maple also common. About 200 species of trees and shrubs are represented. All forests in Armenia are state-owned and many of them are in protected areas. Farmers collect berries, honey and aromatic plants from forests and a logging ban has been in place in Armenia since 1996 to control illegal logging and unauthorized commercial business.

The forestry sector officially contributes a very small part of GDP (approximately 3 percent) but, as in the case of many countries, this does not really reflect the total contribution of the sector in providing environmental services such as climate change mitigation and watershed and soil erosion control. It does not take into consideration its contribution to

enhancing tourism or the daily lives of rural communities that rely on forests for the many activities complementary to their agricultural practices. Production of fuelwood is a traditional and important source of fuel for many rural communities for heating and cooking purposes.

Armenia is a member of the Joint Programme of the United Nations Economic Commission for Europe (UNECE) Timber Committee and the FAO European Forestry Commission. The Government of Armenia has signed and ratified the United Nations Conventions, including that on Biological Diversity (1992), Climate Change (1992), to Combat Desertification (1994) and the Protocol on Water and Health (1999). Commitments under these conventions are being elaborated in policies, plans and laws.



SUSTAINABLE MOUNTAIN DEVELOPMENT IN ARMENIA

by Thomas Hofer

Armenia is fully committed to implementing recommendations from the International Year of Mountains (IYM) 2002, and sustainable mountain development is a national priority.

Armenia established the general framework for a comprehensive approach to the economic, social, environmental and cultural recovery and development of mountain areas to face certain challenges including deterioration of economic potential, and food security problems; shrinking forest areas; soil degradation; limited access to drinking- and irrigation water; and unsustainable agricultural production and cattle breeding practices.

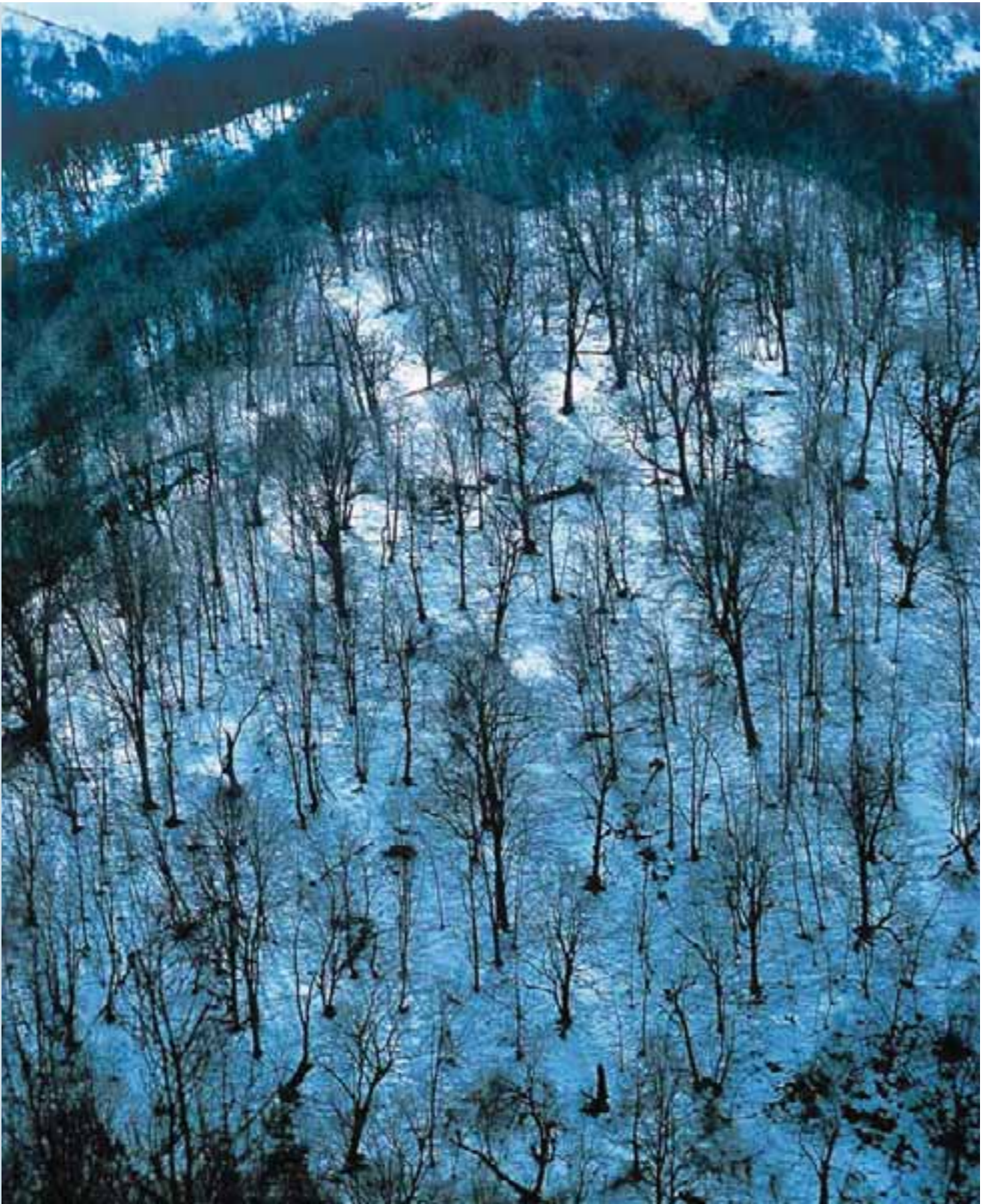
FAO, through its experience with a project in watershed management and sustainable mountain development, assisted the country in initiating pilot activities and establishing a methodology for an interdisciplinary, multistakeholder and collaborative approach to the development and implementation of such a strategy for sustainable mountain development.



In addition to the formulation of the national strategy, an investment programme was formulated to include mountain communities and agricultural development, research, education and training and public assistance to policy-makers. In the Aragats community, a multistakeholder civic action group was established to guide field-level implementation of the project.

The group evolved into a village association with neighbouring communities to improve the livelihoods of mountain people and demonstrated integrated approaches to sustainable mountain development.

A kindergarten, an art school, a public space, a machinery park and afforestation for recreation activities were accomplished. It is hoped that such grassroots institutions will continue to exist and be active in the future.







The forested areas in Azerbaijan have been reduced by more than half in the last 200 years. Ongoing reforestation programmes should be extended, especially to rehabilitate degraded forestland. *Below: Pistachio fruit (*Pistacia vera* L.). The pistachio tree is often used in reforestation programmes thanks to its capacity of growing in poor soils. A few multicentenary trees of *Pistacia mutica*, an ancestor of pistachio, can still be found in Southern Caucasus, but are at risk of extinction*

AZERBAIJAN

Around 400 species of trees and bushes are recorded in Azerbaijan (representing nearly 10 percent of the country's flora). Timber provides a source of materials for construction and furniture making. During the past 200 years, forest areas have been halved. In the eighth and ninth centuries, the present area of Azerbaijan was covered with 35 percent of forests. At present, forests in Azerbaijan constitute 934 500 ha or 11 percent of the territory, mainly state-owned, with only 54 000 ha under private or community ownership.

The northeastern slopes of the mountain chain of the Greater Caucasus are part of the vast forest areas in Azerbaijan. In the macro slope of the Greater Caucasus within the territory of the Shamakhi region, forest tracts emerge again and form continuous cover along the slopes up to the border with Georgia. The slopes of the Lesser Caucasus range also have vast forest areas. Forests cover the northern, northeastern and eastern slopes of the main foothills in the shape of single tracts.

Coniferous forests located in a smaller area of the Greater and Lesser Caucasus mainly consist of Garmagvari pine (*Pinus hamata*). On the Eldar Oyughu mountain in an area of 400 ha, Eldar pine (*Pinus eldaricas*) grows in xerofit conditions mainly in

new and humid pistachio forests consisting of *garachobra* (*Taxus baccata*) in combination with broadleaf species or in the form of small forests. Of the coniferous forests, the most widespread are those of juniper, such as Gazakh juniper (*Juniperus sabina*) and elongated juniper (*J. oblonga*). Azerbaijan forests are also famous for their non-wood resources, because there are 150 species of wild fruit plants relating to 35 taxa. These plants produce thousands of tonnes of wild fruits (walnuts, apples, pears, cornel, sour plums, medlars, persimmon, chestnuts, hazelnuts, pistachio and blackberries).





Integrated watershed management contributes to water, land and biodiversity conservation and to improve livelihood of upland inhabitants and people living in downstream areas. Trees and forest can reduce the incidence of erosion, landslides and floods and the impacts of desertification. Altyaghack National Park, Xizi region

Favourable conditions also exist for the development of bee farming and, at present, more than 1 000 bee families are bred in forestry units, contributing to plant pollination and honey production.

ESTIMATED TIMBER RESOURCES IN AZERBAIJAN	
Forest type	Timber resources (m ³)
Pistachio	59 730 000
Oak	27 970 000
Beech	26 220 000
Mountain	110 920 000
Coniferous	114 850 000

GEORGIA

Georgia's forests occupy 40 percent of the country's territory and constitute a crucial element of Georgian natural environment, rural livelihood, cultural tradition and national economy. Forests in Georgia have a habitat of international importance and unique biological and landscape diversity.

Over 80 percent of the state forests are composed of broadleaves (almost 50 percent beech) and 20 percent are conifers. In terms of biodiversity, the forests contain more than 4 100 of the estimated 6 350 species in the entire Caucasus region, including 395 species of woody plants and 153 native tree species. The fauna includes some 330 bird species, 100 mammals and 59 amphibians and reptiles.

According to FAO country profiles, soil degradation and erosion (resulting from the topography, heavy rainfall and overgrazing by livestock) are serious problems in Georgia. Forests have a crucial role in soil and water conservation.

About 200 000 ha of forest areas are reportedly degraded, of which some 70 percent consist of oak and beech forests that have been harvested unsustainably for fuelwood and local construction wood. Some 60 percent of the annual forest harvest is estimated as unrecorded fuelwood.

Forests are a key resource in Georgia and are closely linked to cultural traditions, national income and livelihoods







Illegal logging, scarcity of investments and reforestation programmes, and lack of a landscape vision in agricultural development cause many problems in the sustainable use of forests. <<Left: *Zelkova* relict trees at Batsara-Babaneuri National Reserve

In Georgia, extensive logging was particularly noticeable in the first half of the twentieth century. The energy crisis in the 1990s and fuel shortages caused an increase in woodcutting to obtain firewood for heating.

In addition to official data, it was assumed that local people harvested firewood (but official estimates are not available) primarily in forests of former collective farms. During this period there was a lack of efficient control. After the Rose Revolution, the Ministry of Environmental Protection and Natural Resources (MEPNR) implemented some important reforms, including the establishment of a new Environmental Inspection Service with stronger powers and more resources to detect and prosecute illegal logging. In accordance with the law on “Licences and Permits”, forest usage in Georgia is conducted on the basis of licences, which are sold by auction. The only exception is extraction of fuelwood to serve the needs of the local population. This type of forest use is not subject to licensing.



Georgian forests, in addition to wood and their environmental functions, produce a wide range of non-wood forest products such as fruits, berries, nuts and mushrooms.



THE FORESTRY TECHNICIAN GIORGI ICHAI DZE

by Marzio Marzot

On a cold winter's day in the Akhmeta district (Kakheti, Georgia), we visited Giorgi Ichaidze and his family, his mother Elene Isotsanidze, his daughter Lela Ichaidze and his grandchild.



Mr Ichaidze, a forestry technician in charge of the protection of the Batsara-Babanuri Forest Reserve, accompanied us during our visit to the *zelkova* relict tree forest.

When we visited the forestry section under his responsibility, he explained Georgian legislation related to the conservation of forest genetic resources. He discussed with objective and clear vision the problems caused by illegal logging, by the lack of investments in infrastructures and reforestation programmes, and by the lack of a landscape vision in agricultural development programmes. He explained the importance of this relict tree area from cretaceous formation and said he was proud of his country's wealth of biodiversity.

When I approached a relict tree, I asked him its name. He indicated the species in Georgian and, when I replied that I could not understand Georgian, he said the name again in Russian. When I apologized yet again because I could not speak Russian, he spelled out the scientific (Latin) name to me. Despite the fact that Mr Ichaidze only earns USD50 per month, he speaks Georgian and Russian and knows all the scientific names, as well as the biology and history, of the trees under his care.

In addition to his profound scientific knowledge, he also loves music and literature. As per the tradition of Georgian hospitality, we were invited to his home for a wonderful candlelight dinner (electricity is very expensive in rural areas).

After dinner, his daughter, who studied the piano for over ten years, sang and played beautiful classical Georgian music, and we spent the rest of the evening discussing the agriculture, food and traditions of Georgia.

We learned about the importance that the family attributes to education, including music and artistic education.

We will never forget Mr Ichaidze's hospitality, his pride in doing socially important work, and his dedication to his occupation and the conservation and sustainable use of Georgian forest resources and landscapes, for the future of his children and grandchildren.



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TOWARDS RESOURCE EFFICIENCY

MANY WILD PLANTS, ANIMALS AND ASSOCIATED ECOSYSTEMS THAT PROVIDED GOODS AND SERVICES FOR CENTURIES TO THE HUMAN POPULATION OF THE SOUTHERN CAUCASUS HAVE BEEN OVERUSED OR MISUSED IN THE LAST CENTURY. AT PRESENT, RISING HUMAN, ECONOMIC AND CLIMATIC PRESSURE IS INCREASINGLY REDUCING THEIR RESILIENCE AND PRODUCTIVITY AND, IN MANY CASES, THEIR CAPACITY FOR SURVIVAL.

If, on the one hand, new technologies, research and investment opportunities must be developed to accelerate low carbon development and food security, on the other, microinvestment schemes must be developed to promote a wide range of diversified solutions that can make the most efficient use of local resources and energies.

Agriculture and the use of wild plants and animals are currently inefficient activities that incur waste and high energy inputs. But the traditional food habits and agricultural practices of the people of the Southern Caucasus are based on a good understanding of the physiology and behaviour of plants and animals, low availability of cash, landscape memory and love and respect for the region.

This knowledge, combined with new science and technology, can generate a more efficient form of agricultural production and develop many localized micromanagement agricultural practices that use reduced and different forms of fertilization; enable

farmers to take informed decisions on pest control measures; rely on different sources of energy input; avoid water waste; and make the best use of genetic resources resilient to local conditions.

Changes in the behaviour of consumers will also be important to ensure food security for all human beings. We will have to increase our awareness about the relationship between our food and our health, and the health of the environment that sustains our food production systems, and adapt our consumption habits to increase consumption of food that has been produced and transported more efficiently.

It is urgent for government policies and regulatory regimes to be put in place enabling this overall shift towards efficiency of food production, processing, storing and consumption systems while ensuring minimum disturbance of habitats in order to maintain ecosystems and their wild plants and animals that are the foundations of agricultural production.

