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TOWARDS SUSTAINABLE DAM AND HYDROPOWER IN THE SOUTH CAUCASUS

NORWEGIAN MINISTRY OF FOREIGN AFFAIRS

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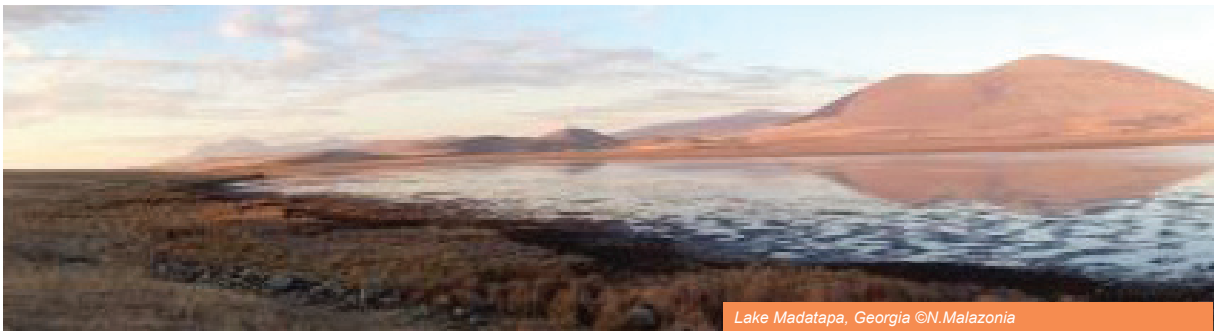
ABBREVIATIONS

BAU	Business as Usual
BMZ	German Federal Ministry for Economic Cooperation and Development
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESS	Ecosystem Services
GIS	Geographic Information System
ha	Hectare
HPP	Hydropower Plant
IFC	International Finance Corporation
IHA	International Hydropower Association
IRBM	Integrated River Basin Management
IRP	Integrated Resource Plan
IUCN	International Union for the Conservation of Nature
KBA	Key Biodiversity Area
KfW	KfW Development Bank
MCA	Multi-Criteria Analysis
MW	Megawatt
NGO	Non-Governmental Organisation
RSAT	Rapid Basin-Wide Hydropower Sustainability Assessment Tool
SEA	Strategic Environmental Assessment
SEM	Sustainable Ecosystem Management
TNC	The Nature Conservancy
TSA	Target Scenario Analysis
TWh	Terawatt Hour
UNECE	United Nations Economic Commission for Europe
WCD	World Commission on Dams
WWF	World Wide Fund for Nature



Lake Madatapa, Georgia ©N.Malazonia

FOREWORD

The Caucasus Biodiversity Hotspot is rich in natural and cultural heritage with a diverse range of ecosystems from steppes to high mountain habitats. The Caucasus Biodiversity Hotspot has been inhabited by humans for many thousands of years and human activities have left their traces almost everywhere in the area. Although bringing higher diversity, this modification has obviously also placed great pressures on wildlife and natural areas. In consequence, biodiversity loss is a challenge in the Caucasus today but large areas with little human impact still exist: many rivers are unregulated and there are still many valuable wetlands of national and global importance. Sustainable use of our wider environment, including freshwater and hydropower resources, is a major challenge while conserving biodiversity and maintaining ecosystem services. The results and recommendations of the research presented in this report can help us to respond to that challenge.

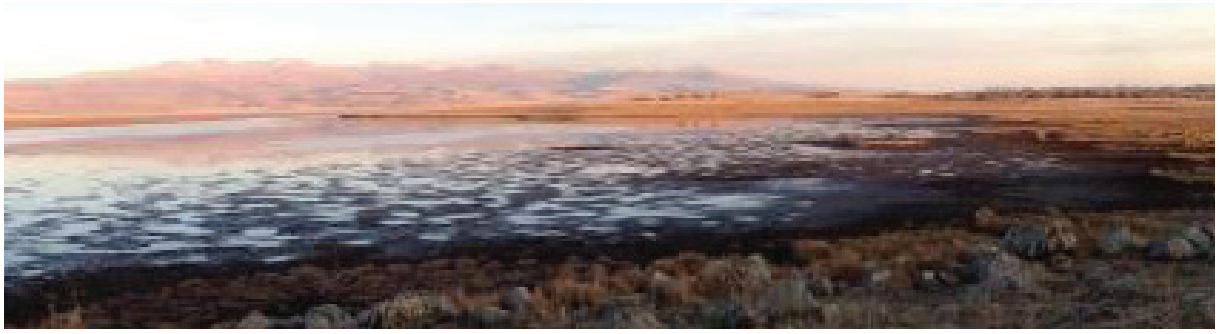
Often the use of freshwater resources takes place with little information about the importance of those resources for biodiversity. The IUCN Red List and National Red Lists - important tools for scientifically assessing and communicating the conservation status of species - usually give only a vague idea where sites critical for threatened species are situated. These so called freshwater Key Biodiversity Areas (critical sites for threatened freshwater biodiversity) are defined within the Caucasus Biodiversity Hotspot for the first time and integrate all data of globally and nationally threatened species.

There are other tools that can help in the challenge of balancing the use of freshwater resources for hydropower with the conservation of freshwater biodiversity. Better approaches to planning the development of the energy sector at national, regional or river basin scale would steer projects away from sites that are critical for freshwater biodiversity. Better procedures for permitting and licensing projects and better standards for aspects of their design, construction and operation would mitigate the impacts of individual projects on freshwater ecosystems and biodiversity. There are many examples from around the world of how such approaches have helped to balance people's need for development with their concern for the environment.

Sustainable water use, including hydropower generation, depends on healthy ecosystems. The valuation of ecosystem services to human is a relatively new science that helps us to understand and communicate the costs that we may face when ecosystems are degraded or destroyed. This report shows that unsustainable forest management, causing increased soil erosion and siltation of rivers and reservoirs, can result in high additional maintenance costs to hydropower companies and reduce significantly the operating life of dams.

I hope that the freshwater Key Biodiversity Areas presented in this report, the recommendations for strengthening sustainable planning and assessment of hydropower resources and projects, and the valuation of freshwater ecosystem services to the hydropower sector will help planners, developers, investors and operators to make more informed and better decisions in the South Caucasus for the fact that efforts aimed at halting the loss of biodiversity need a major boost in the coming years.

Dr. Giorgi Sanadiradze
Director, WWF Caucasus Programme Office



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The identification of freshwater Key Biodiversity Areas relied on the collective knowledge, expertise and contribution of leading experts in the region. Conducting this kind of study would not have been possible without their dedicated work and commitment to the whole process. We would like to thank Dr. Jörg Freyhof, Regional Chair of the IUCN/SSC Freshwater Fish Specialist Group, who greatly facilitated the study in the region and provided substantial scientific guidance and advice.

We express our sincere thanks to Dr. Joerg Hartmann, who wrote the report "Sustainable Hydropower Assessment and Planning: International State of the Art and Methodological Framework for the South Caucasus".

We also would like to thank authors of the national reports and regional summary on "Assessment of Freshwater Ecosystem Services to the Hydropower Sector in the South Caucasus" – Mr. Marlon Flores (International Consultant), Ms. Ani Haykuni (National Consultant, Armenia), Mr. Rovshan Abbasov (National Consultant, Azerbaijan) and Mr. Irakli Macharashvili (National Consultant, Georgia).

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Lake Khanchali, Georgia ©N.Malazonia

Lake Kartsakhi, Georgia ©N.Malazonia

1. INTRODUCTION

Freshwater ecosystems cover less than one percent of the planet yet are among the most diverse and threatened systems in the world (Strayer & Dudgeon, 2010). A tenth of all animal species (Poff et al., 2012) including almost half the world's known fish species (Carrizo et al., 2013) live in freshwater. Freshwater species and habitats are of high value to people's livelihoods as a food resource and serve important functions such as water purification and flood regulation (UNEP, 2010). Subject to intense anthropogenic activities, freshwater ecosystems are increasingly threatened, more than terrestrial or marine ecosystems (Malmqvist & Rundle, 2002; Dudgeon et al., 2006), and have not yet been afford-ed the conservation focus as required (Darwall et al., 2009). More than 29% of the 25,007 freshwater species assessed on the IUCN Red List of Threat-ened Species are globally threatened with extinction (IUCN, 2013).

Freshwater ecosystems contain some of the most threatened habitats in the Caucasus Ecoregion. Threat sources stem mainly from unsustainable dam/hydropower development and urban water use, industry, infrastructural projects and agriculture. Unsustainable development of dams (hydropower, water security, irrigation), disrupting environmental flows at river-basin-scale, can be considered as one of the major threats to freshwater ecosystems. The negative impacts of such threats ultimately lead to decreased landscape integrity and biodiversity as well as to degradation of key ecosystem services providing benefits to people.

Threats to freshwater biodiversity are caused by a variety of factors, in particular:

- Lack of comprehensive and standardised knowledge about the spatial distribution of the most important areas for threatened freshwater biodiversity in the South Caucasus, as a result of which most threatened freshwater biodiversity is not considered in planning;

- Weaknesses in planning for the expansion of hydropower (how much additional capacity is needed and where should the additional capacity be located) and in the standards and procedures that apply to the design, permitting, licensing and operation of individual projects;

- Lack of awareness of the value of ecosystem services to sustainable economic development and therefore of the costs to industry and to human welfare of development that degrades and destroys ecosystems.

The studies presented in this report address those three issues. **Chapter 3** presents the first ever desk study of the freshwater biodiversity of the Kura-Ara(k)s River Basin (Armenia, Azerbaijan, Georgia) and the Black Sea Catchment Basin (Georgia) with a specific focus on identification of freshwater Key Biodiversity Areas in the South Caucasus. **Chapter4** presents an analysis of the current procedures for planning the development of the hydropower sector and assessing, permitting, licensing and operating individual projects compared with international best practices and proposes a methodological framework for the assessment and planning of sustainable hydropower in the South Caucasus. **Chapter 5** presents the results of a study on assessing freshwater ecosystem services to the hydropower sector in the South Caucasus. We draw together the main points from these three studies in an afterword at the end of the report.

2. CAUCASUS BIODIVERSITY OVERVIEW

2.1 The Caucasus Biodiversity Hotspot

The Biodiversity Hotspot concept serves to prioritize geographical regions of high conservation value (Mittermeier et al. 1999). The Caucasus Ecoregion is one of 34 biodiversity hotspots in the world.

The hotspot spans 580,000 km² between the Black and Caspian Seas and includes all of Armenia, Azerbaijan and Georgia, the North Caucasus portion of the Russian Federation, north-eastern Turkey and part of north-western Iran (Map 1).

The Ecoregion extends along 1,765 km of the coast of the Black Sea and Sea of Azov and along 1,960 km of the Caspian Sea coast. These parts of the Ecoregion include marine and coastal habitats that support numerous species of fish, birds and marine invertebrates (Zazanashvili et al. 2012).

The unique geology and terrain, consisting of three major mountain chains separated by valleys and plains, permit a variety of different microclimate, soil and vegetative conditions, resulting in a broad range of landscapes and unusually high levels of species diversity for the Temperate Zone. Climatic conditions are very diverse, with precipitation ranging from more than 4,000 mm per year in the south-western Caucasus to less than 200 mm a year in deserts in the eastern Caucasus. The Caucasus biodiversity hotspot has the greatest biological diversity of any temperate forest region in the world. Its forests, high mountains, wetlands, steppes and semideserts contain more than twice the plant and animal diversity found in adjacent regions of Europe and Asia (Williams et al. 2006).

About 7,000 species of vascular plants occur in the Caucasus and at least 25% are found nowhere else

Map 1 The Caucasus Biodiversity Hotspot / Caucasus Ecoregion

in the world – this is the highest level of plant endemism in the temperate zone of the northern hemisphere. Around 700 species of vascular plants, five species of lichens and 11 species of fungi are listed in the National Red Lists. Around 153 species of mammals, 400 species of birds, 87 species of reptiles, 17 species of amphibians and 130 species of fish are found in the Caucasus Ecoregion. About one fifth of mammals, four bird species and 28 reptile species are endemic to the Ecoregion. More than 70 fish species occur in the Caucasus lakes and rivers and nearly 14 are endemic to the Ecoregion (Zazanashvili et al., 2012).

2.2 Caucasus Freshwater Ecosystems and Biodiversity

White water-lily (Nymphaea alba) ©G.Fayvush

Freshwater ecosystems cover around 8.5 percent of the Caucasus Ecoregion. The most abundant types of freshwater habitats in the Ecoregion include rivers, lakes, and marshes. The largest concentration of freshwater ecosystems is within the Kura River Basin with approximately 1,020,000 ha of freshwater habitats. The river systems of the Caucasus Ecoregion feed three seas: the Kura, Ara(k)s, Terek, Kuma, and Samur rivers flow into the Caspian Sea while the Rioni, Enguri (Inguri), Kodori, Chorokhi and Bzyb rivers belong to the Black Sea Basin. The Kuban River and its tributaries are part of the Azov Sea Basin. The Kura River is the longest in the Ecoregion – 1,515 km. A large number of the Ecoregion`s freshwater lakes are located in the South Caucasus. These lakes are either natural, semi-natural or artificially created and they contribute significantly to the region's rich biodiversiy. The largest lake in the ecoregion is Lake Sevan in Armenia with a surface area of 1,262 km2 and a maximum depth of 83 meters. The high mountains of the western and central parts of the Greater Caucasus are dotted with glacial and karst lakes. Diversity of mountain lakes and wetlands is also a feature of the Javakheti-Lake Sevan area which extends across the Armenian-Georgian border. Swamp alder forests and unique lowland peat bogs are found in the lower reaches of the Rioni River in the Kolkheti Lowland around Lake Paliastomi. Large, low-lying mires are situated within the Kura-Ara(k)s valley along main rivers and irrigation channels. The most significant marshes areas are reed and cattail-covered swamps near the lakes Aggyol and Sarysu in Azerbaijan (Williams et al. 2006; Zazanashvili et al. 2012).

Freshwater habitats are crucial for migrating and nesting birds, spawning fish as well as providing water for human needs. Freshwater habitats in the Caucasus provide migration stopovers and nesting sites for over 150 bird species including globally threatened birds such as Dalmatian pelican *(Pelecanus crispus)*, corn crake *(Crex crex)*, lesser white-fronted goose *(Anser erythropus)*, ferruginous duck *(Aythya nyroca)*, red-breasted goose *(Branta ruficollis)*, black-winged pratincole (*Glareola nordmanni*), white-tailed eagle (*Haliaeetus albicilla*), slender-billed curlew (*Numenius tenuirostris*) and sociable lapwing (*Vanellus gregarius*). Great and little egrets (*Egretta alba, E. garzetta*), night and grey herons *(Nycticorax nycticorax, Ardea cinerea)*, black stork *(Ciconia nigra)*, various terns and stints, diving ducks, and divers are also quite common in marshes. Three species of harriers *(Circus spp.)* are found around marshes. Large lakes and rivers provide habitat for the otter *(Lutra lutra)*. The most abundant amphibians and reptiles are lake frogs *(Rana ridibunda)*, grass snakes *(Natrix natrix, Natrix tessellata)*, European marsh turtle *(Emys orbicularis)*, and Caspian terrapin *(Mauremys caspica)* and this latter is found only in lowlands (Williams et al. 2006; Zazanashvili et al. 2012).

Freshwater habitats of the Caucasus host a number of endemic fish and invertebrate species. More than 70 fish species occur in lakes and rivers and nearly 14 are endemic to the Caucasus. Trout *(Salmo spp.)* is the most common fish in the mountains. An endemic Sevan trout *(Salmo ischchan)* lives in Lake Sevan. Two species of crayfish - Pyltsov's crayfish *(Pontastacus pylzovi)* and Colchic crayfish *(Astacus colchicus)* - are relics and local endemics. Sturgeon, shads, and various species of carps and trouts migrate from the Caspian and Black seas into rivers to spawn. There are seven species of sturgeon in the Caucasus Ecoregion: beluga *(Huso huso)*, Russian sturgeon *(Acipenser gueldenstaedtii)*, stellate sturgeon *(Acipenser stellatus)*, ship sturgeon *(Acipenser nudiventris)*, Atlantic sturgeon *(Acipenser sturio)*, Persian sturgeon *(Acipenser persicus)*[1] and sterlet *(Acipenser ruthenus)*. Sterlet has been assessed by the IUCN as Vulnerable while all other six species occurring in the South Caucasus have been assessed as Critically Endangered. The Rioni River in Georgia is one of no more than five still functioning sturgeon rivers in Europe, the Black Sea and Caspian Sea basins.

1. Recent studies split the Persian sturgeon (Acipenser persicus) occurring in the Caspian basin from the Colchic sturgeon (Acipenser colchicus) occurring in the Black Sea basin.

Box 1. The Kura-Ara(k)s River Basin

The basin of the Kura and Ara(k)s rivers covers the territory of Armenia, Azerbaijan, Georgia, Iran and Turkey. The total area of the Kura-Ara(k)s Basin is around 188,400 km2 and it covers the greater part of the South Caucasus (Map 2).

The Kura is the longest river and the main artery of the Caucasus. The length of the river is 1,515 km, and its catchment area is around 188,000 km2. It originates at a height of 2,700 m in the Anatolian Highland of northeastern Turkey in the Kizil-Giadik mountain range, flowing through mountainous regions in Turkey, Georgia and Azerbaijan into the Caspian Sea. It is fed by snow (36%), ice melt water from glaciers (14%), underground sources (30%) and rain (20%). The major transboundary tributaries include the following rivers: Araks/Aras, Iori/Gabirri, Alazani/Ganyh, Debed/Debeda, Agstev/Agstafachai, Potskhovi/Posof and Ktsia-Khrami.

The Ara(k)s river is the main transboundary tributary of the Kura. The Ara(k)s River originates at 2,200–2,700 m above sea level in eastern Turkey. The length of the river is 1,072 km and its catchment area is around 102,000 km2. The sub-basin of the Ara(k)s River is shared by Armenia, Azerbaijan, Iran and Turkey. It flows along the Turkey-Armenia border, the Iran-Armenia border, and the Iran-Azerbaijan border, before flowing into Azerbaijan where it joins the Kura near the Caspian Sea. The Ara(k)s divides just before meeting the Kura, and one branch flows directly into the Caspian. The major transboundary tributaries to the Ara(k)s River include the rivers Akhuryan/Arpaçay, Agstev, Arpa, Kotur/Qotur, Voghji/Ohchu and Vorotan/Bargushad.

The Kura-Ara(k)s rivers contribute about 66% and 34% respectively to the total runoff in the region. The water regime is characterized by high spring flows from snow melt and low flows during the autumn and winter period. In the plains, the river meanders and the water of the Kura are characterized by high turbidity as the result of mobilization of erosion products along the bank, exacerbated by deforestation and flooding.

Sources: UNECE (2011); UNDP (2007); WWF and TNC (2014)

Box 2. The Rioni River

The Rioni river is the second largest river of Georgia and the largest river of the Georgian Black Sea Basin. It represents the principal water artery for the western part of the country. The length of the river is 327 km and the area of the entire catchment is around 13,500 km2. It originates from glaciers of the Greater Caucasus in the region of Racha and flows west to the Black Sea. Over half of the Rioni drainage area is situated in a mountain region. In the upper section up to the city of Kutaisi the river flows along a wild, nearly inaccessible rift and downstream from Kutaisi it flows in a lowland with extensive swamps, marshes and floodplain areas. Although the Rioni Basin area is around 1/14 the size of the Kura Basin, the average annual water discharge of the Rioni is 430 m3/sec, only slightly lower than that of Kura. The Rioni River drains approximately 20% of the country's total land area and around 40% of the western part of Georgia.

Global importance of the Rioni river for sturgeon conservation: All the following six species of sturgeons native to Georgia are globally Critically Endangered, making them the most threatened group of an-imals present in Georgia: Beluga *(Huso huso)*, Russian sturgeon *(Acipenser gueldenstaedtii)*, Stellate sturgeon *(Acipenser stellatus)*, Ship sturgeon *(Acipenser nudiventris)*, Atlantic sturgeon *(Acipenser sturio)* and Persian sturgeon *(Acipenser persicus)*.

Indeed, the conservation status of all migratory sturgeons is critical. In the Caspian Basin, small numbers of sturgeons migrate mostly to the Volga, Ural, Terek, Sulak and Kura to spawn. The actual status and numbers of spawning individuals in the Kura are virtually unknown, but all populations have drastically declined in the past decades and are still going down.

Historically, all six species of sturgeons spawned in the Rioni. Four species – Beluga, Stellate sturgeon, Russian sturgeon and Persian/Colchic sturgeon – still spawn each year in considerable numbers in the Rioni river. The Colchic sturgeon is endemic to the Rioni river today. Ship and Atlantic sturgeons have not been found in recent years and might be very rare or already extirpated. Taking into account the limited capacities of scientific sturgeon monitoring, there is a real chance that these species do still spawn in the Rioni.

In the Black Sea Basin, the Rioni and the Danube are the last functional sturgeon rivers, but sturgeon popula-tions are in a fast decline in the Danube. Survival in the immediate future depends on dedicated conservation projects in the last active spawning rivers. Still, the Rioni holds quite large sturgeon populations and might actually be the most important sturgeon river in the Black Sea Basin. Therefore, the conservation of sturgeons in the Rioni is of major importance for the global survival of sturgeons and this gives to Georgia a top global responsibility for sturgeon conservation.

Sources: Black Sea Basin Joint Operational Programme (2013); WWF (2015); WWF and TNC (2014)

Box 3. Some key lakes and reservoirs of the Kura-Ara(k)s River Basin in the South Caucasus

- Lakes: Arpi (AM), Sevan (AM), Gilli (AM), Kaputan (AM), Gazana (AM), Paravani (GE), Khanchali (GE), Bugdasheni (GE), Tabatskuri (GE), Madatapa (GE), Saghamo (GE), Kartsakhi/Aktas/Gölü (GE/TR).
- Reservoirs: Akhuryan (AM), Mingachevir (AZ), Shamkis (AZ), Yenikend (AZ), Barbarinsk (AZ), Agstafa (AZ), Araks Govsaghynyn (AZ), Jandari (GE), Algeti (GE), Sioni Reservoir (GE), Tbilisi Reservoir (GE), Tsalka Reservoir (GE).

Many lakes in the region have been poorly studied for their biodiversity but it is known that lakes that have suffered little anthropogenic impact hold important populations of native fishes, bird and invertebrates and act as major stop-over sites for migratory birds. Some lakes have been integrated within the protected area system as they are inhabited at least seasonally by high numbers of water birds. Several lakes are part of Important Bird Areas (IBAs) identified by BirdLife International, and the IBAs holding freshwater species are included in the set of freshwater Key Biodiversity Areas presented in the given study.

Man-made lakes, such as fish ponds and reservoirs, can become important sites for freshwater biodiversity if they are managed appropriately and contain reeds and submerged vegetation with little fluctuation in water level.

Sources: UNECE (2011); WWF (2013)

Box 4. Lake Sevan

Lake Sevan located in the central part of Armenia is the largest natural lake in the Caucasus and one of the largest high-altitude lakes in the world. Its altitude is 1,900 m above sea level, with a surface area of 1,262 km2, and a maximum depth of 83 meters, inflowing 28 rivers and outflowing to the Hrazdan River. The lake is part of Sevan National Park and included in the Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar Convention) as a Ramsar site. Lake Sevan and associated marshes of the basin are significant breeding, resting, foraging and wintering areas for migratory waterfowl. It is also inhabited by endemic fish species. Lake Sevan is the most important source of fresh water and freshwater fish for Armenia, as well as the main source of irrigation water, low-cost electricity, recreation and tourism. Intense interventions to its regime to meet the increasing demand on fresh water have led to a dramatic shrinkage of water surface. Because of the overuse of Lake Sevan it gradually loses its role in preservation of freshwater biodiversity. The species occurring inside or near the lake are highly threatened despite their protection within the Lake Sevan National Park.

Sources: Grid Arendal (2011); Zazanashvili et al (2012)

Box 5. Javakheti-Arpi Area

Numerous lakes are presented in the transboundary Javakheti-Arpi area between Armenia and Georgia which makes this territory very special and unique in the region. These lakes are connected by rivers and groundwater, making the whole system an ecological entity. Adjacent marshes and wet meadows, as well as floodplains, represent important wetland ecosystems. Some lakes are of great importance to conserve the biodiversity of this region, such as the Lake Arpi (2,120 ha) in Armenia, the high mountain freshwater lakes of Madatapa (870 ha), Khanchali (590 ha), and Bugdasheni (30 ha) in Georgia, and the Lake Kartsakhi/Aktaş/Gölü (2,660 ha) shared by Georgia and Turkey. These lakes are significant sources of drinking and irrigation water, fishing and cattle watering. Adjacent meadows are traditionally used for mowing and cattle and sheep grazing.

Javakheti-Arpi wetland ecosystem supports numerous endemic and threatened species. One of the main bird migration routes in the Caucasus region crosses the Javakheti-Arpi Plateau with the lakes Arpi (the second largest lake in Armenia), Madatapa, Bugdasheni and Khanchali as the locally most important water bodies for migratory birds. In Georgia alone, the lakes receive about 30,000–40,000 migratory birds each year. The lakes provide important feeding, resting and breeding habitats for grebes, pelicans, herons, geese, ducks, waders, gulls, terns and other waterfowl, as well as for birds of prey, including the IUCN-listed globally threatened species such as the Dalmatian pelican, imperial eagle and greater spotted eagle. Many species are also protected through the Agreement on the Conservation of African-Eurasian Migratory Waterbirds and the National Red Lists.

Due to financial support provided by the German Government (BMZ/KFW), protected areas were created in both Armenia and Georgia with a total area of 37,389.42 ha: Lake Arpi National Park in Armenia (21,180 ha) and Javakheti National Park (13,498.02 ha), Kartsakhi Managed Reserve (157,5 ha), Sulda Managed Reserve (309,3 ha), Khanchali Managed Reserve (727,3 ha), Bugdasheni Managed Reserve (119,3 ha) and Madatapa Managed Reserve (1,398 ha) in Georgia.

Sources: UNECE (2011); WWF (2014)

Box 6. Ramsar Sites

Seven wetlands from the South Caucasus are identified under the Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar Convention). Three of them are located in Armenia (493,511 ha), two in Azerbaijan (99, 560 ha) and two in Georgia (34,480 ha):

- Armenia: Khor Virap Marsh (50 ha), Lake Arpi (3,230 ha) and Lake Sevan (490,231 ha)
- Azerbaijan: Agh-Ghol (500 ha) and Gyzylaghaj (Gizil-Agaj) (99,060 ha)
- Georgia: Ispani Mire (770 ha) and Wetlands of Central Kolkheti (33,710 ha)

Source: Ramsar Convention (2014)

2.3 The Main Threats to Freshwater Biodiversity

The main threats to freshwater biodiversity in the South Caucasus are pollution, water abstraction, alien species and hydropower and water control dams.

Pollution: Pollution continues to be a major driver of population decline and habitat loss for freshwater fish in the South Caucasus. Small and medium-sized rivers, especially below larger cities, industrial or densely settled areas, are often affected by water pol-lution. Many species, such as sturgeons, migratory shads and lampreys, trouts and a number of resident species, especially crayfish, mussels and dragonflies, are sensitive to pollution. Pollution is still a major threat caused by flows of untreated wastewater or sewage directly into water bodies. The situation is especially bad in Azerbaijan in areas where water is so limited and heavily abstracted that the only avail-able water resources are heavily polluted and no lon-ger suitable for survival of freshwater species. One fish species endemic to Azerbaijan, *Pseudophoxinus sojuchbulagi*, seems to be already extinct due to pollution within its small (former) range of occurrence.

Water abstraction: The abstraction of water from streams and rivers and underground sources leads to massive habitat loss and sometimes even drying out of rivers, streams and marshes. Water is often stored in reservoirs polluted by alien species. In summer and during droughts, very limited water flows leave almost no water for freshwater species in the channels of downstream streams and rivers. No freshwater fish, mollusc or crayfish species are able to survive without water for more than a short time. Water is abstracted for many reasons and there is no real and effective regulation to limit water abstraction, which would benefit biodiversity in the South Caucasus. Commercial use of water is usually given priority and biodiversity issues are often ignored, or awareness about threatened biodiversity is lacking. Freshwater resources are already very limited in many areas, especially in Armenia and Azerbaijan, which are rich in freshwater species, but demonstrate the evergrowing demand for water in economic development.

Vartsikhe Dam ©A. Guchmanidze

Alien species: Many freshwater species are very vulnerable to the impact of introduced species. The introduction of alien species is very difficult to control; just a few anglers or fish breeders releasing alien fishes to a small stream may wipe out a native fish population. The rapid expansion of Pseudorasbora parva, a Chinese invasive species in carp farms, from Romania throughout Europe and the Caucasus in just 40 years shows no limits for the dispersal of introduced fish species.

Artificial water bodies are routinely stocked by fish breeders with alien fish species, which widely invade the drainage basins. Impoundments offer very suitable conditions for fisheries but in the South Caucasus the commercial species that local fisheries like to harvest are naturally absent, therefore alien species are stocked. Species which are deemed profitable for breeders are particularly encouraged, but are most problematic. Breeders are well aware that alien species depress native fish communities and might even lead to the extinction of native species. This is accepted as a negative, but unavoidable side effect of improving the capacities of fish farming. Fish breeders almost always see water bodies from an agricultural point of view, where desirable fish species are introduced, undesirable pest species or predators are removed and low-value species (usually, threatened native species) are considered as useless. It is a great challenge to control the introduction of alien fish species by breeders.

Hydropower and water control dams: Freshwater species are often very sensitive to habitat alternations as many of them have complex life cycles that require long-distance migrations (anadromous species). Long-distance migratory species of freshwater biodiversity are more threatened than any other group. Every river in the South Caucasus has been affected by dams. The first dam upriver of the mouth is usually the end of the migration for most anadromous species. Hydropower and irrigation dams already exist in many areas of the South Caucasus. They often have no minimum water outflow, or the minimum outflow is not sufficient, or it is not guaranteed during exceptional droughts, thus killing all fishes, crayfish and molluscs in the downstream river during summer when the channels dry out. In many areas, the outflow from dams is managed by regular flood pulses (hydro-peaking) that cause the downstream sections to experience a flash flood every few hours or days - a situation devastating for most freshwater biodiversity. In very few cases, the barrier effect of dams can be mitigated by fish passes (also called ladders) that may allow fishes to migrate upriver. However, no rivers in the South Caucasus have been installed with well-functioning fish ladders. Even if a fish ladder is in place, migratory fishes may not reach the habitats they are heading for, as after having climbed the dam they enter impoundments with habitats totally different from the riverine ones they are adapted to spawn in. Anadromous fish species also need to travel downstream and there is no effective way known to prevent fishes from swimming into the turbines of the dams and getting killed. Construction of new dams, especially for hydropower, is a major concern for freshwater biodiversity conservation in the future. Hydropower is seen as a green technology and fish ladders are incorrectly believed to mitigate all negative side effects of dams. If hydropower generation is managed by hydropeaking, the downstream sector can become unsuitable for most fishes and other animals.


White water-lily (Nymphaea alba) ©G.Fayvush


Caucasian Salamander (Mertensiella caucasica) ©D.Tarkhnishvili


Beluga (Huso huso) ©A. Hartl


European otter (Lutra lutra),©N. Duplaix

3. FRESHWATER KEY BIODIVERSITY AREAS

CRITICAL SITES FOR THREATENED FRESHWATER BIODIVERSITY

3.1 Background

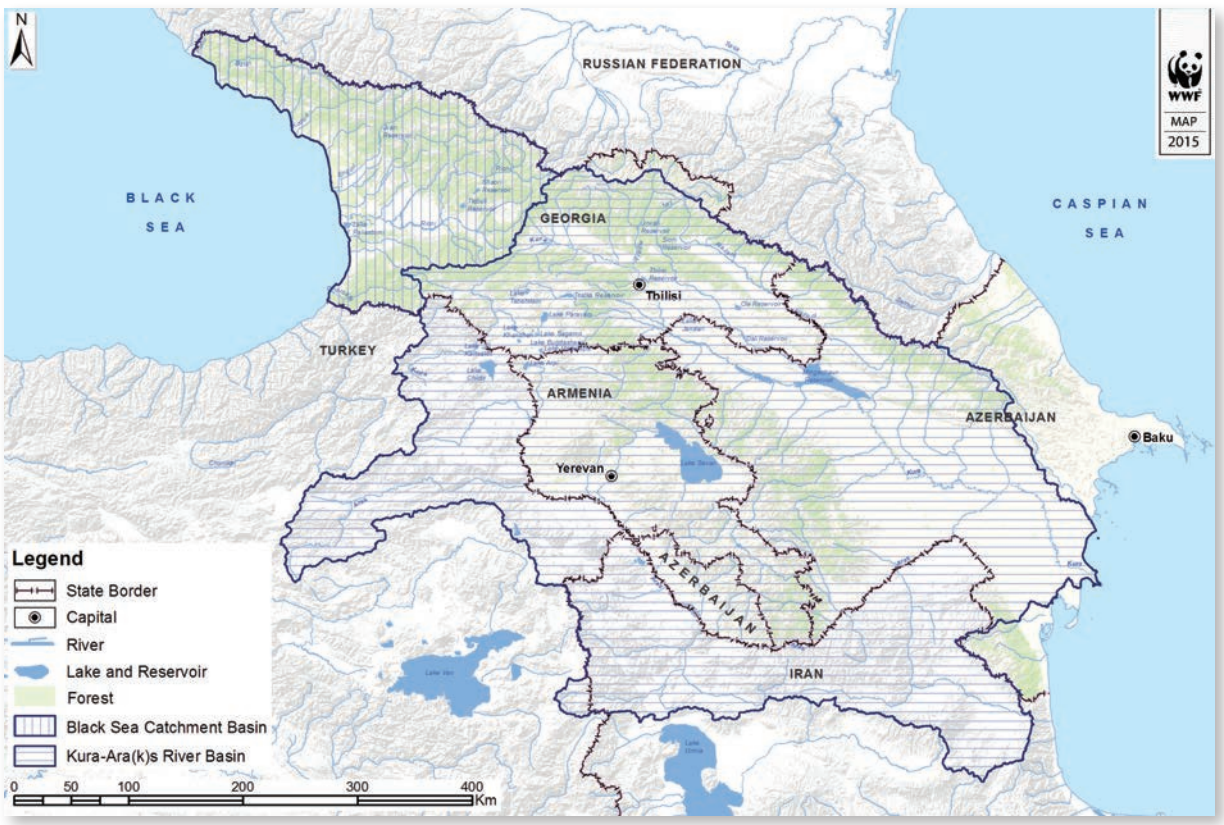
The lack of comprehensive, science-based information about the location of sites that are important for threatened freshwater biodiversity results in hydropower stations and other infrastructure being sited and designed without taking full account of their impacts. Consequently, threatened freshwater biodiversity is at serious risk from the development strategies that the countries of the South Caucasus are pursuing. A number of important sites and species that depend on them for their survival have already been significantly negatively affected

The study described in this chapter is the first to identify critical sites for threatened freshwater biodiversity in the South Caucasus. The study used the methodology elaborated by the International Union for the Conservation of Nature (IUCN) to identify globally and nationally significant areas for the persistence of biodiversity (IUCN, 2014). Those sites are known as Key Biodiversity Areas (KBAs). KBAs are identified through the standardized criteria and thresholds based on the irreplaceability and vulnerability of sites containing species of urgent conservation needs (Darwall et al., 2011, Holland et al., 2012).

The study focused on the Kura-Ara(k)s River Basin (Armenia, Azerbaijan, Georgia) and the Black Sea Catchment Basin (Georgia) within the boundaries of the South Caucasus Region (Map 2).The study takes into account all types of freshwater, including inland wetlands and aquatic habitats.

This study sets the foundations for a spatial conservation strategy for freshwater biodiversity of two major river basins in the South Caucasus. Through newly mapped sites and sub-catchment-scale species distributions for all freshwater animals and plants considered in the IUCN Red List as well as in the National Red Lists of Armenia, Azerbaijan and Georgia, the study presents the first regional scale, multi-taxonomic view of freshwater KBAs across the South Caucasus.

Map 2 The Kura-Ara(k)s River Basin and the Black Sea Catchment Basin (Georgia)



The study addresses the following key questions:

- Where are the globally significant freshwater KBAs of the South Caucasus located?
- Where are the nationally significant freshwater KBAs of the South Caucasus located?
- Are there gaps between the freshwater KBAs of the South Caucasus and the current protected areas network? If so, where are these gaps?

The study was conducted through a wide participatory approach through which leading national experts, mainly representing scientific, governmental and non-governmental sectors from all three countries, were involved in the assessment process. Overall over 50 experts from the region contributed to the study through national workshops, group work and individual consultations. The key products of the study are maps of the Kura-Ara(k)s river basin and the Black Sea catchment basin with identified freshwater KBAs.

3.2 Methodology

3.2.1 Criteria for identifying freshwater Key Biodiversity Areas

The study followed the standardized KBAs procedure to identify freshwater KBAs in the Kura-Ara(k)s River Basin (Armenia, Azerbaijan, Georgia) and the Black Sea Catchment Basin (Georgia) within the boundaries of the South Caucasus region (Box 7). The given desktop study is primarily based on Criterion 1. Criterion 2 was applied only to the limited number of species with restricted ranges.

Assessment of biome restricted species assemblages, according to the Criterion 3, requires better knowledge about the species assemblages and the distribution of non-threatened species in the region. Gathering these data was beyond the possibilities of this study and this criterion could not be applied. Criterion 4 identifying the sites important for life history stages of a species and the sites important for congregatory species is mostly relevant to migratory freshwater fishes and birds.

Box 7. KBAs Identification

KBAs are sites of national and/or global significance for biodiversity conservation. KBAs are identified through standardized criteria and thresholds based on irreplaceability and vulnerability of sites that contain species requiring urgent conservation actions (Darwall et al., 2011, Holland et al., 2012). There are four main criteria to assess sites qualifying as KBAs from which the Criterion 1 is by far often used.

Criterion 1. Sites important for one or more threatened species or other species of conservation concern.

Criterion 2. Sites important for one or more species with restricted range.

Criterion 3. Sites important for biome restricted species assemblages.

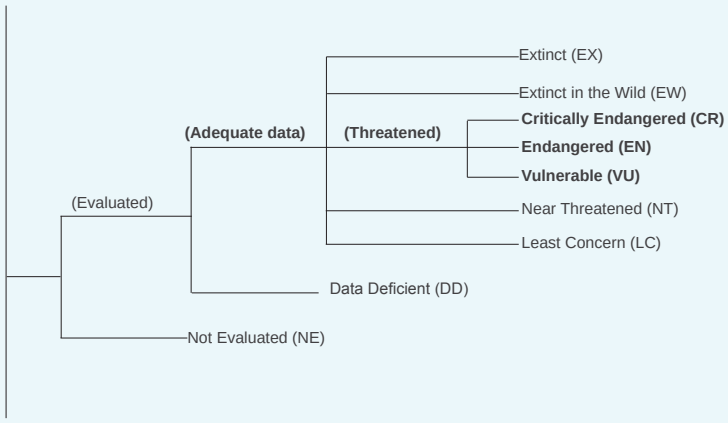
Criterion 4. 4a. Sites important for any life history stage of a species; and **4b.** Sites with more than a threshold number of individuals of a congregatory species.

3.2.2 Target species

The study includes globally and nationally threatened freshwater species (CR, EN, VU) that are listed in the IUCN Red List (Box 8) and /or in the National Red Lists of Armenia, Azerbaijan and Georgia (Criterion 1). The study uses the definition of freshwater species devised by Balian et al. (2008) (Box 9). Species assessed as Near Threatened (NT), Data Deficient (DD) or Least Concern (LC) are excluded. It should be considered that the IUCN Red List assesses the risk of a species becoming extinct in the near future within its global range. A National Red List assesses the risk of a species becoming extinct in the near future on the country's territory. In addition to the threatened species, the study considers relatively limited numbers of (i) species of conservation concern (Criterion 1); and (ii) species with restricted ranges (Criterion 2) which were proposed by national experts on biodiversity. These latter species are termed as "species of additional conservation concern" for further use in the report.

Overall, 174 target species were considered in this assessment: Amphibia – 3 species, Aves – 40 species, Crustacea – 2 species, Clitellata – 1 species, Insecta – 29 species, Mammalia – 2 species, Mollusca – 11 species, Pisces – 29 species, Reptilia – 2 species, Plantae – 55 species. From all target species, (i) 27 species are globally threatened and listed in the IUCN Red List (VU – 13 species, EN – 5 species, CR – 9 species) and 16 out of these species are also assessed by the National Red Lists as nationally threatened, (ii) 131 species are nationally threatened and listed only in the National Red Lists, and (iii) 16 species are of additional conservation concern proposed to be considered by experts (Annex 1).

Box 8.The IUCN Red List categories



Threatened species are classified into three categories: Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) based on the globally accepted quantitative criteria. Threatened species must meet one or more of the following criteria: A – reduction in population size; B- restricted geographic range; C- small population size (and decline); D – very small population size (D1) or range (D2; E – quantitative analysis (IUCN, 2012).

Box 9. Definition of freshwater species

This is the first ever effort taken to compile a list of freshwater species for the application of KBA criteria in the Caucasus. There is no very clear definition of which species are treated as freshwater species and which are not. Especially in arid areas, almost all larger animal species need access to open water but this does not qualify them as freshwater species. The study follows Balian et al. (2008) for the definition of freshwater species given below. The assessment includes non-marine aquatic species of inland waters in two categories:

1) The 'real aquatic species' accomplish all or part of their lifecycle in or on the water, such as freshwater fishes, crayfish, ducks or dragonflies.

2) The 'water-dependent' species which show close/specific dependence on aquatic habitats (e.g. for food or habitat), such as white-tailed eagles, riparian trees and beetles, and many plants restricted to wetland habitats but growing outside of the water for most of the year.

Regarding interface environments, the euryhaline species in estuaries are only included if they show a genuine tolerance to freshwater (< 3 g/L) and regularly occur in freshwater environments. In fact, these definitions are not strict enough in cases when regional ecological conditions need to be considered. The most obvious difficulties in our dataset arose from the trees such as Populus euphratica, Platanus orientalis and Pterocarya pterocarpa. These trees occur mostly in riparian forests growing along seasonally or permanently flowing streams and rivers, close to springs or in places with high groundwater levels. They qualify as freshwater species because they are restricted to riparian wetlands even though they are flooded only occasionally. Other trees, such as Quercus imeretina and Quercus pedunculiflora, are restricted to riparian habitats in the South Caucasus but can be found in quite dry habitats elsewhere. Regionally specific habitat requirements are usually related to climatic conditions that animals and plants might find optimal for their living. Here, these species are classified as freshwater species.

3.2.3 Identification of freshwater Key Biodiversity Areas

National experts on biodiversity and GIS specialists cooperated on the development of the maps of species distribution. At the first stage of the work all distribution areas of selected species were mapped manually on printed maps (scale 1: 500 000) and afterwards all data were introduced and processed in a geographic information system (GIS). A special map was developed for each species which showed its distribution as precisely as possible based on literature sources, best available expertise and knowledge of the region. Separate basic maps were also elaborated for each taxonomic group. Overlaying the ranges of target species and calculating the species richness index were used to identify freshwater KBAs. A site was identified as a freshwater KBA if it contained two or more globally and/or nationally threatened species or at least one species with restricted range found nowhere else in the South Caucasus. Furthermore, all target species needed to occur at least once in freshwater KBAs. The boundaries of identified freshwater KBAs were refined considering other spatial data such as topography, type and extent of habitats. Transboundary context was also considered. Involved experts reviewed the preliminary freshwater KBAs during several informal meetings and the KBA boundaries were perfected following their recommendations.

3.2.4 Protected areas coverage gap analysis

The protected areas coverage gap analysis was done to examine the shortfall in representation of KBAs and target freshwater species within the existing PA system. The analysis considered all categories of existing protected areas.

3.2.5 Target species, freshwater KBAs and dam/hydropower development

Existing and planned dams/ hydropower plants (HPPs) were analysed to get a general picture of cur-rent and potential impact on freshwater ecosystems, especially on freshwater KBAs. In particular, analysis was done through (i) overlaying HPP/Dam scheme and target species distribution and richness; and (ii) overlaying HPP/Dam scheme and freshwater KBAs. Since the relevant required data were more or less available only for Georgia, this approach was piloted only for this country.

3.3 Results

3.3.1 Distribution of threatened species

The study produced the maps of target species distribution and richness:

All target species: The number of target species occurring in the same area ranges from 1 to 46. Almost all rivers and larger streams are inhabited by one to five target species (Map 3).

Globally and nationally threatened species: These species are listed in the IUCN Red List and/or in the National Red Lists as Critically Endangered, Endangered or Vulnerable. There is a range of 1-46 species occurring within the same area. Almost all rivers and larger streams are inhabited by one to six globally and/or nationally threatened species (Map 4).

Globally threatened species: These species are listed in the IUCN Red List as Critically Endangered, Endangered or Vulnerable. Armenia, Azerbaijan and Georgia are in need to protect these species, which are threatened with extinction in their global range. The most important areas for these species are the Rioni river, the lowlands along the Black Sea in Georgia, lake Sevan in Armenia and some areas along the Ara(k)s and the lower Kura rivers (Map 5).

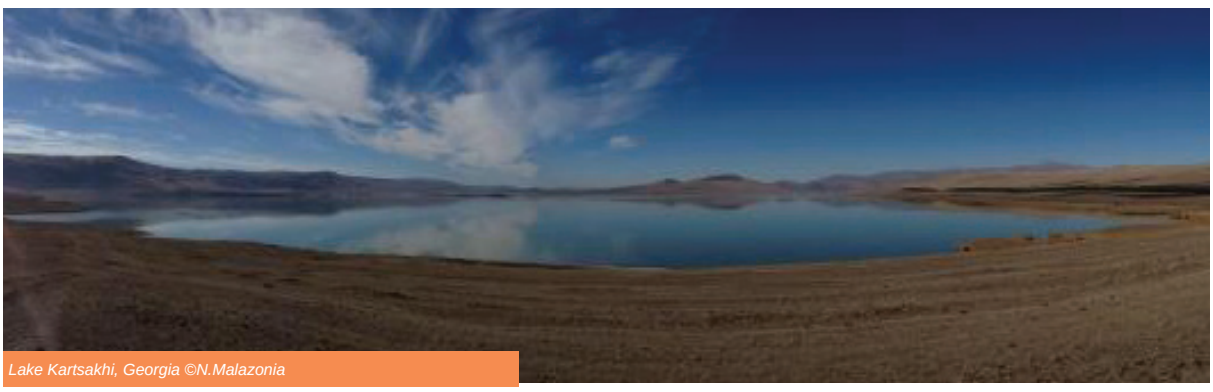
Nationally threatened species: These species are listed in the National Red Lists as Critically Endangered, Endangered or Vulnerable. Armenia, Azerbaijan and Georgia are in need to protect these species which are threatened with extinction in their national distribution areas. The most important areas for these species are the Rioni and Alazani basins in Georgia; lake Sevan, some areas along the Ara(k)s river and the lower Hrazdan river in Armenia; and the lower Kura river in Azerbaijan (Map 6).

Globally and nationally threatened species by categories: These species are listed in the IUCN Red List and/or in the National Red Lists as Critically Endangered, Endangered or Vulnerable. Distribution and richness of these species by each category of VU, EN and CR are presented in the Map 7, Map 8, and Map 9.

Globally critically endangered species: These species, categorized by the IUCN Red List as Critically Endangered in their global range, are in most critical need for protection. It became evident that the lower parts of Kura, Ara(k)s, Rioni, Enguri (Inguri) and Choroki rivers are the most important sites for the conservation of globally critically endangered freshwater biodiversity. Remarkable are also the areas of Adjara, Karachay and middle Kura holding one Critically Endangered species each. All these areas are the most important ones for globally threatened freshwater species and they are set to be the absolute priority areas for protection (Map 10).

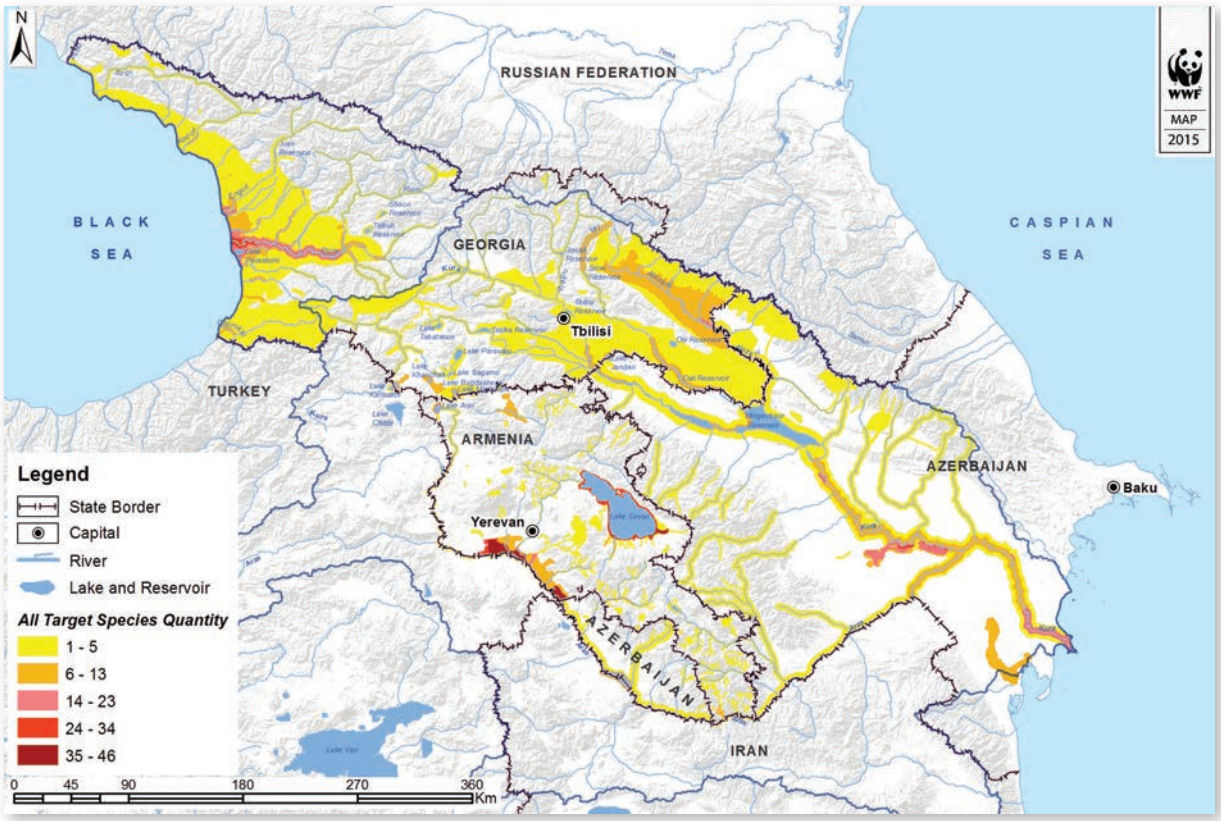
3.3.2 Freshwater Key Biodiversity Areas

Following the selection, prioritization and delineation process, 35 freshwater Key Biodiversity Areas were identified in the South Caucasus (Map 11). It should not be forgotten that threatened freshwater species occur also outside of the KBAs proposed here. Identified freshwater KBAs hold a significant number at least of two or more globally and/or nationally threatened species or at least one species with restricted range found nowhere else in the South Caucasus. Out of the identified 35 freshwater KBAs, 29 KBAs are of both global and national significance and 6 KBAs are of national importance (Table 1, Annex 2).

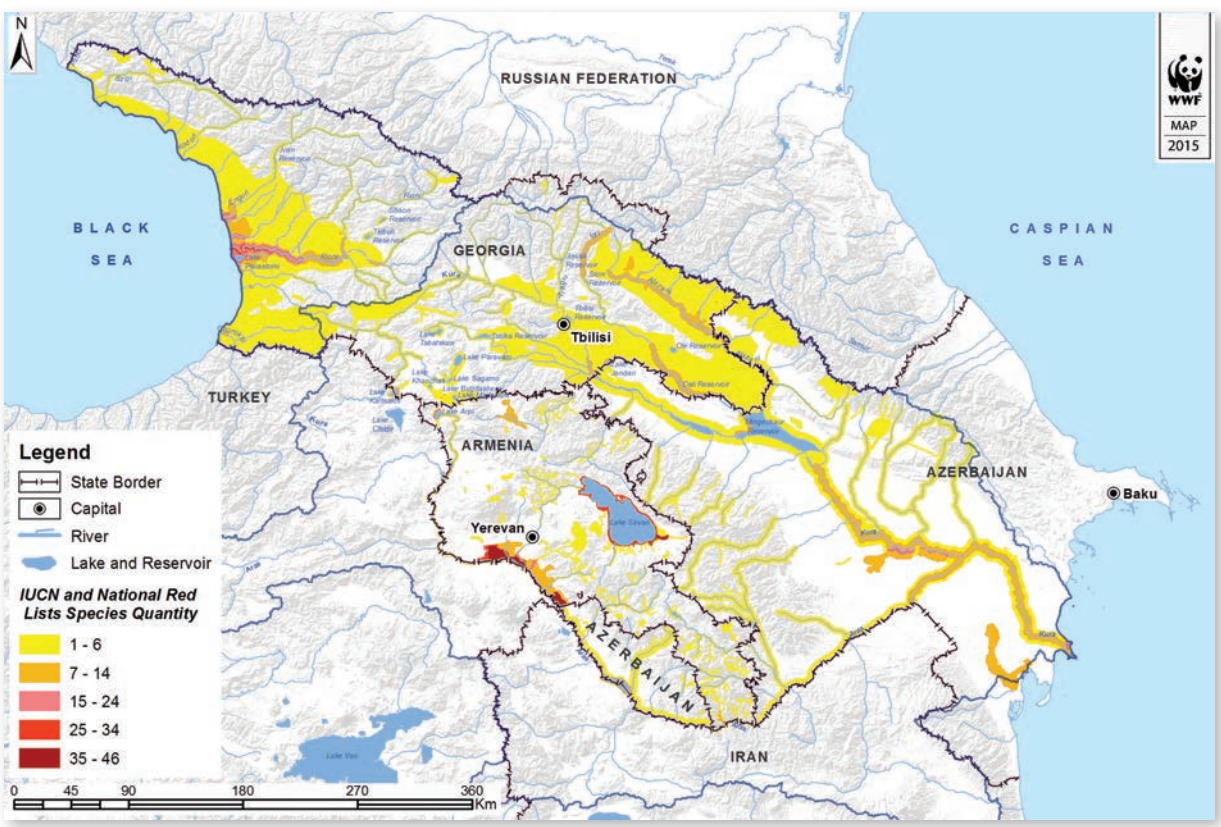


Lake Kartsakhi, Georgia ©N.Malazonia

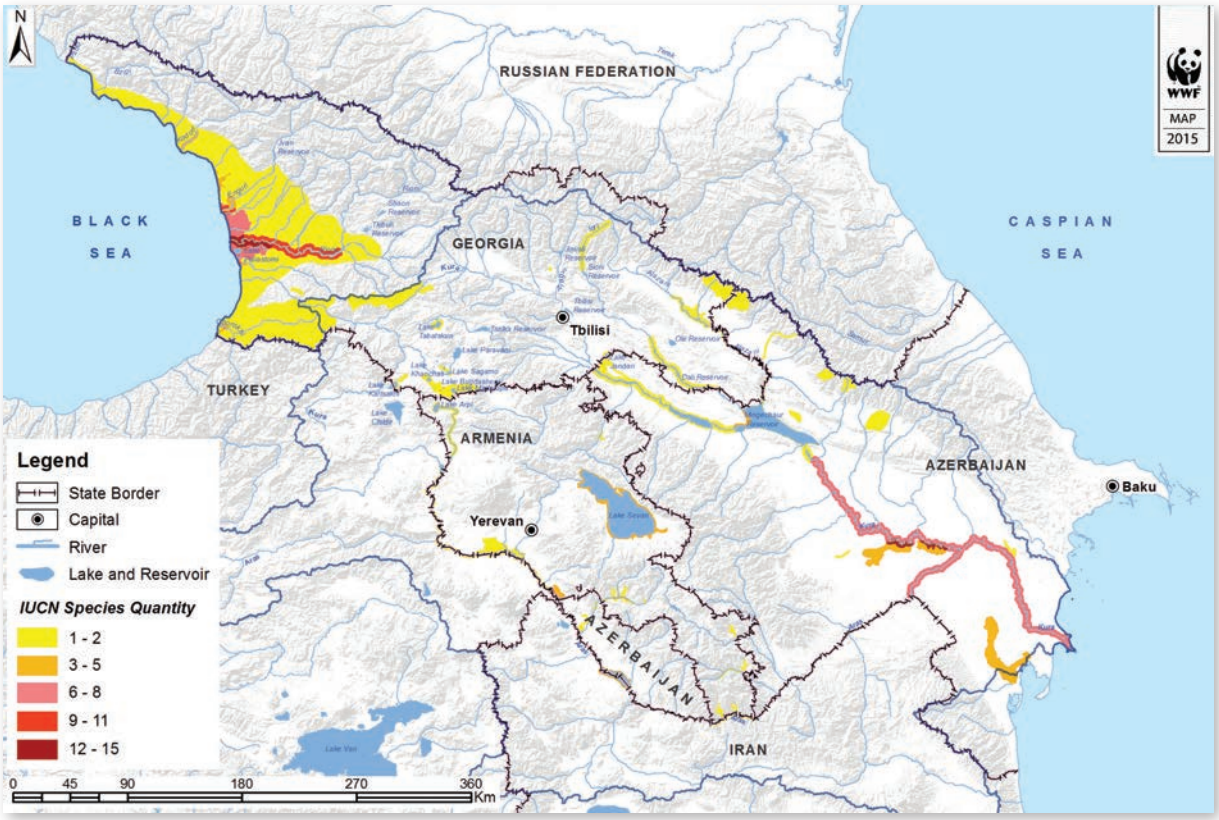
Map 3 Distribution and richness of all target species



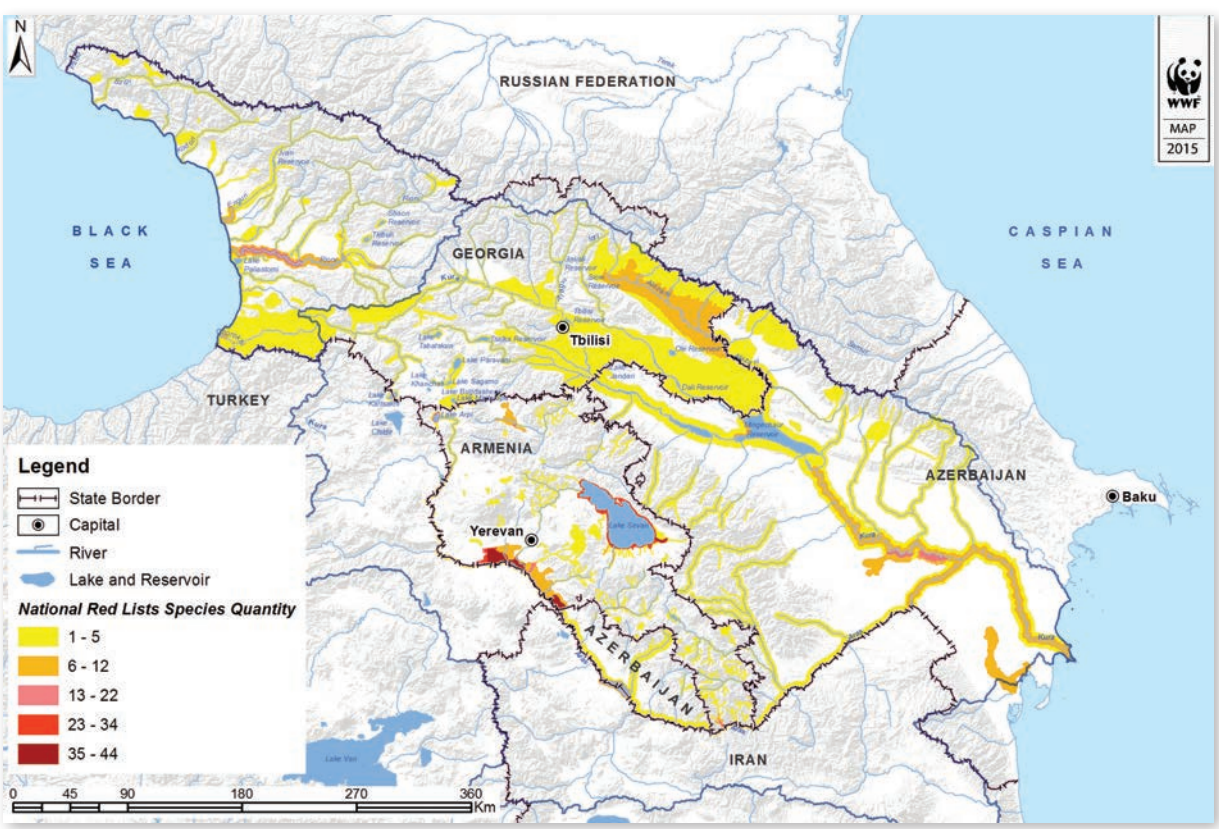
Map 4 Distribution and richness of globally and nationally threatened species



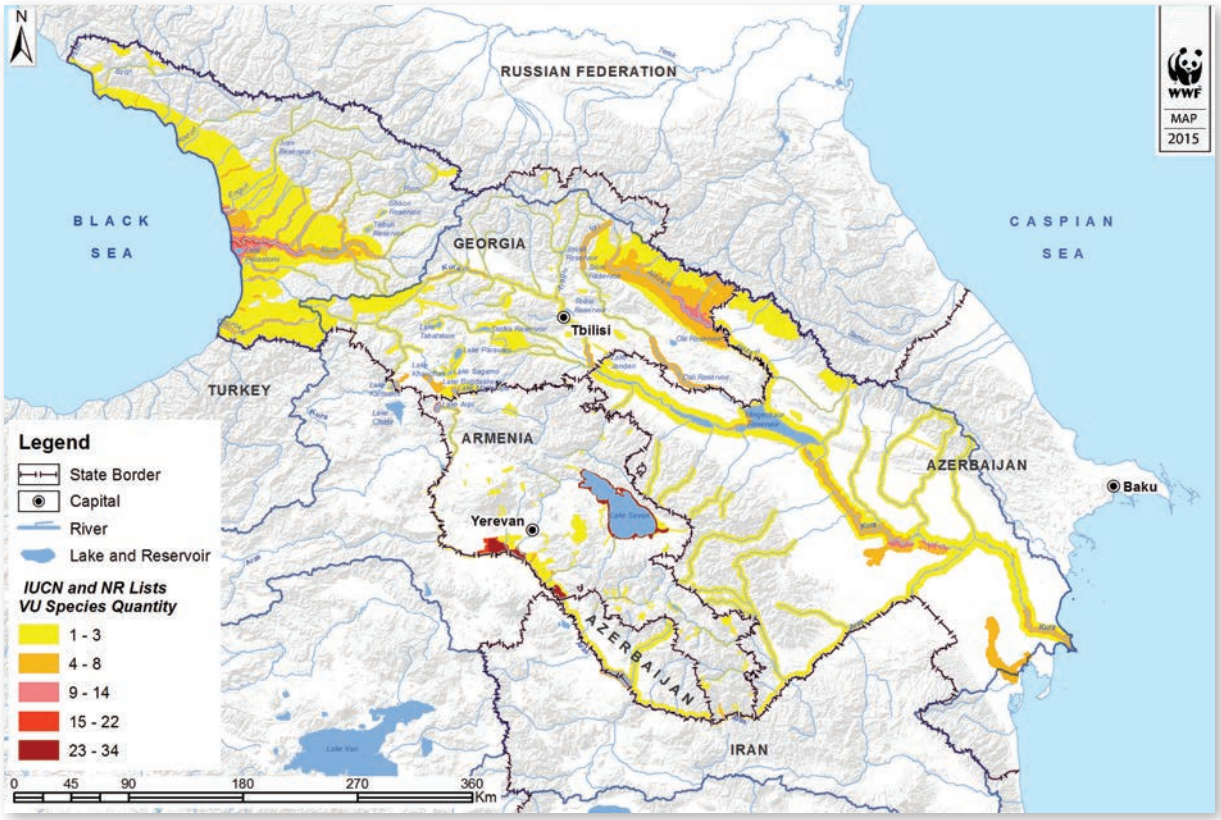
Map 5 Distribution and richness of globally threatened species



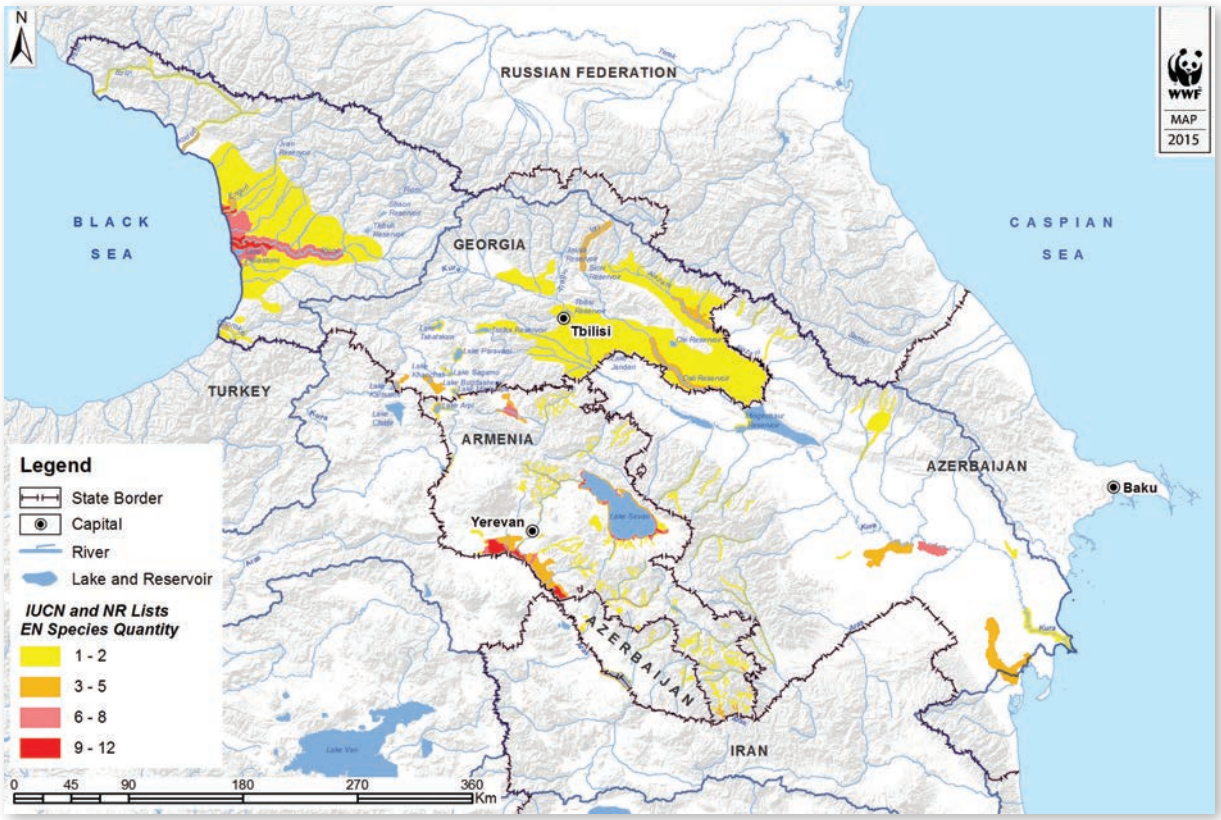
Map 6 Distribution and richness of nationally threatened species



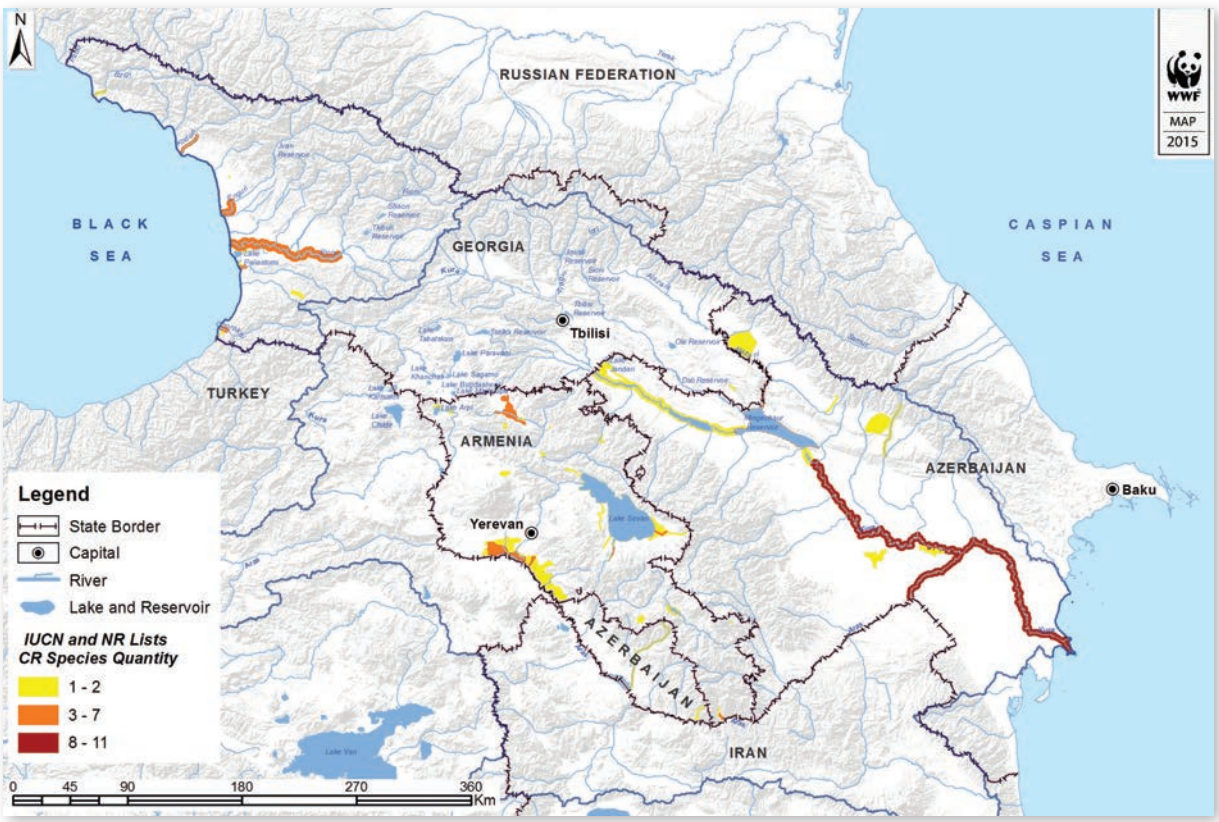
Map 7 Distribution and richness of globally and nationally vulnerable species



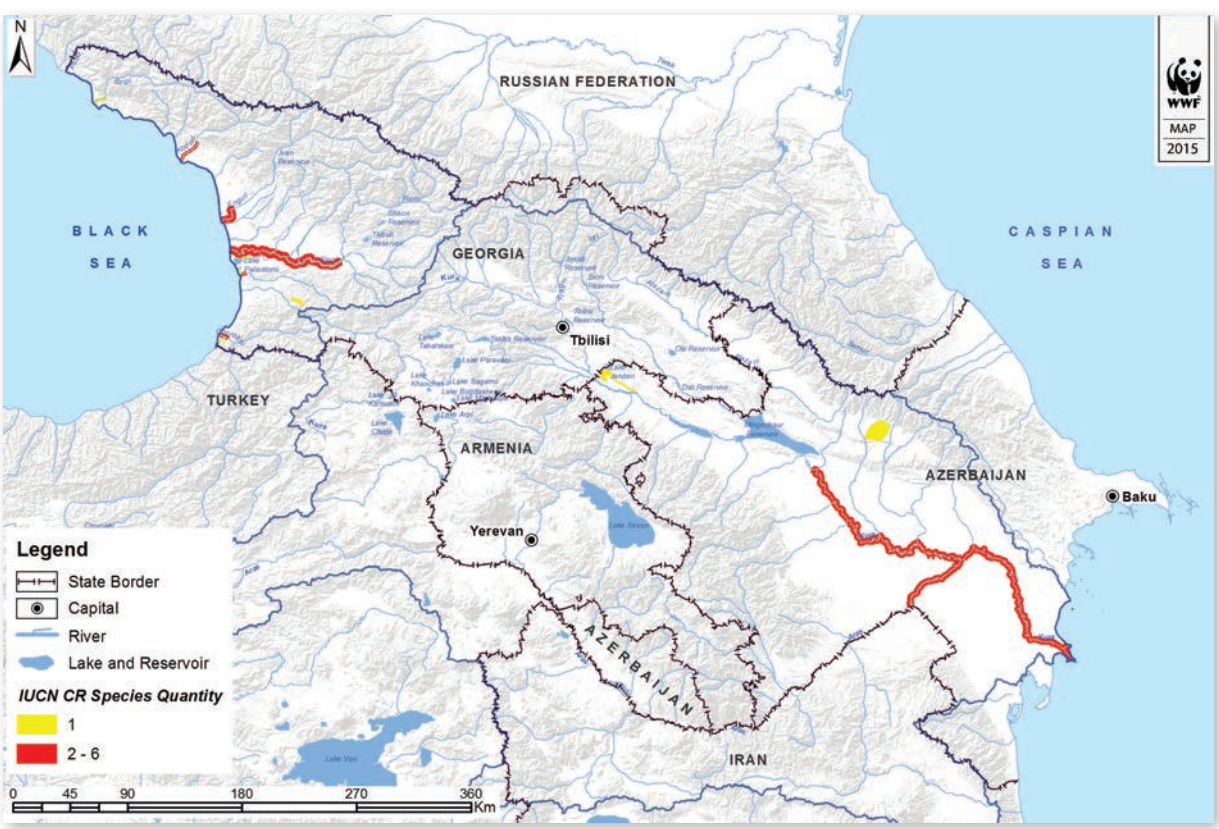
Map 8 Distribution and richness of globally and nationally endangered species



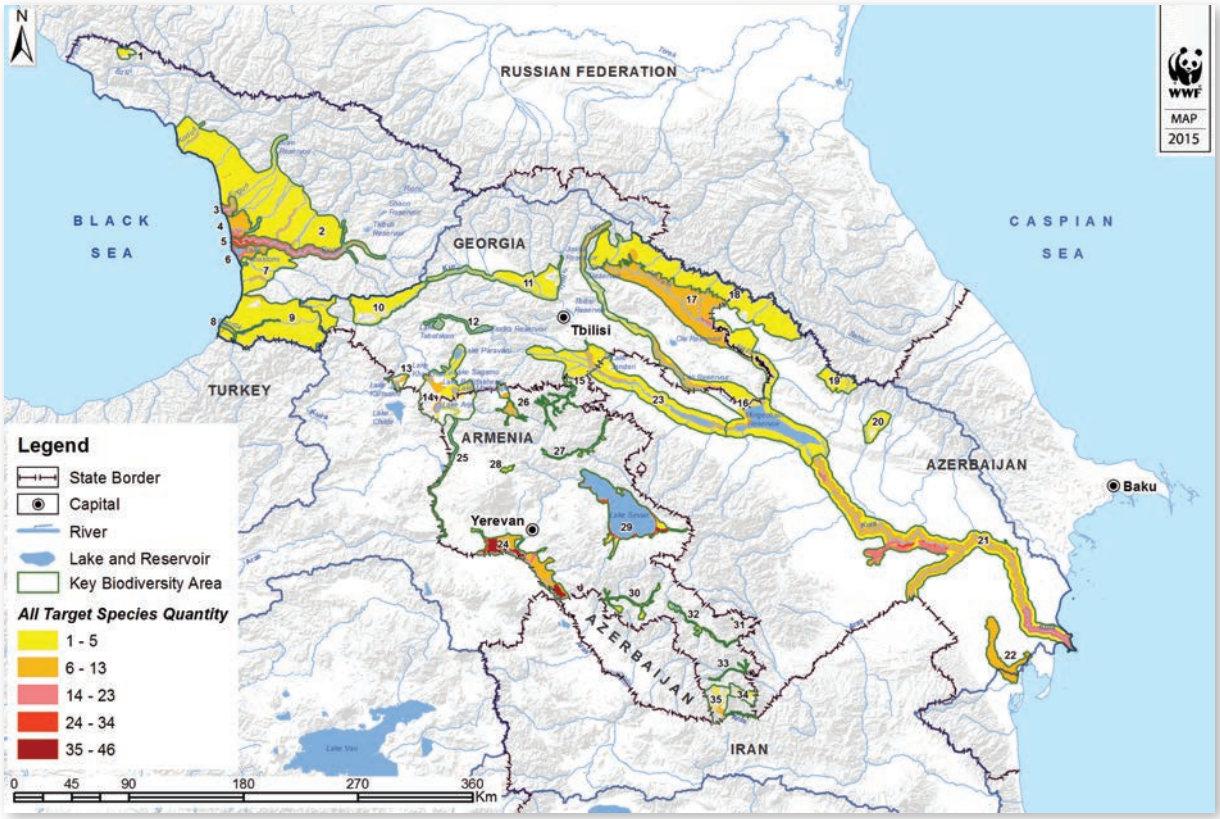
Map 9 Distribution and richness of globally and nationally critically endangered species



Map 10 Distribution and richness of globally critically endangered species



Map 11 Freshwater KBAs and their species richness



Lake Arpi, Armenia ©A. Khoyetsyan

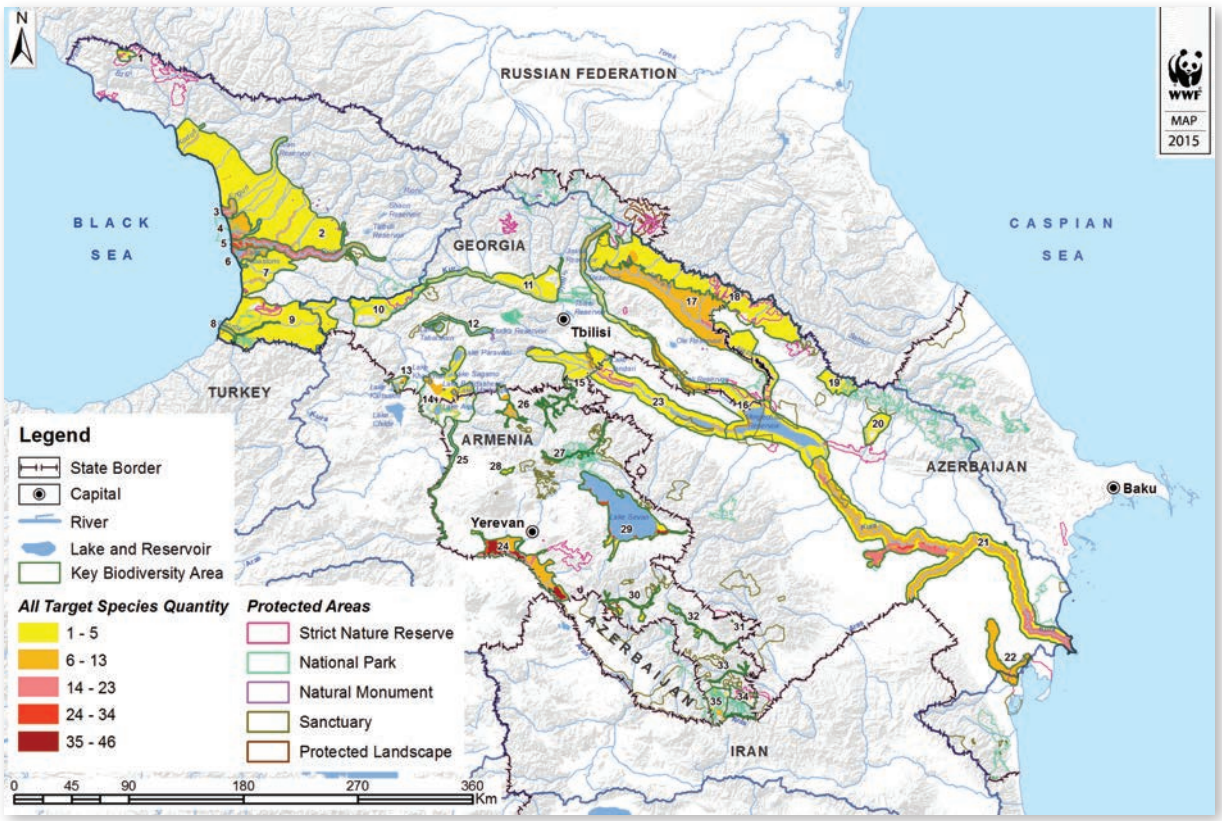
Table 1. Freshwater KBA's and species richness

#	KBA Name	Country(ies)	Total number of target species	Number of IUCN Red List species	Number of National Red List species	Number of IUCN and National Red Lists species	Number of species of additional conservation concern
1	Ritsa	Georgia	2		2		
2	Kolkheti 1	Georgia	24	5	12	3	4
3	Enguri	Georgia	19	3	8	7	1
4	Khobi	Georgia	25	3	12	7	3
5	Rioni	Georgia	38	5	17	10	6
6	Paliastomi	Georgia	31	6	11	7	7
7	Kolkheti 2	Georgia	15	2	11		2
8	Chorokhi-Ajaristskali	Georgia	21	2	10	6	3
9	Adjara	Georgia	26	4	13	4	5
10	Borjomi	Georgia	9		7	1	1
11	Kura-Ksani	Georgia	7	1	6		
12	Tabatskuri-Tsalka	Georgia	5		4	1	
13	Kartsakhi	Georgia	7		5	2	
14	Javakheti-Arpi	Georgia-Armenia	33	2	27	4	
15	Khrami-Debeda-Marts	Georgia-Armenia	16		14	2	
16	Iori-Mingechauri	Georgia - Azerbaijan	29		19	7	3
17	Alazani	Georgia-Azerbaijan	24	1	19	3	1
18	East Greater Caucasus	Georgia-Azerbaijan	13	2	10	1	
19	Sheki	Azerbaijan	3	1	2		
20	Karachay	Azerbaijan	3	1	2		
21	Kura-Ara(k)s	Azerbaijan	33	3	17	9	4
22	Gyzylaghaj	Azerbaijan	10		5	5	
23	Kura	Azerbaijan	11	1	5	2	3
24	Ara(k)s-Hrazdan	Armenia	59	2	52	5	
25	Akhurian	Armenia	12	2	10		
26	Dzoraget-Tashir	Armenia	19		19		
27	Agstev	Armenia	8		7	1	
28	Chilli	Armenia	2		2		
29	Sevan	Armenia	44		40	4	
30	Arpa	Armenia	15	2	12	1	
31	Lake Jan	Armenia	1		1		
32	Vorotan	Armenia	9		9		
33	Voghji	Armenia	5		4	1	
34	Tsav	Armenia	4		4		
35	Ara(k)s-Meghri	Armenia	19	2	16	1	

3.3.3 Protected areas coverage gap analysis

Protected areas gap analysis was done through overlaying freshwater KBAs and actual protected areas in the region (Map 12). The analysis showed that the overall congruence between them is very low, since only around 16.5% of freshwater KBAs are included in at least one category of protected areas. While some freshwater KBAs are well protected, e.g. lake Sevan in Armenia, most freshwater KBAs including those of major importance, such as the Rioni river in Georgia, are largely unprotected (Table 2, Annex 3). None of the KBAs is completely covered by a protected area. The best protected KBAs are Ritsa (90%) and Sevan (86%). Three more KBAs are by at least 50% covered by protected areas: Paliastomi (57%), Borjomi (50%) and Tzav (54%). The other 30 KBAs are less than 50% covered by protected areas and there is an urgent need to consider these KBAs in further development of the protected area system in the region.

Map 12 **Overlaying of freshwater KBAs and existing protected areas**



Kura River ©A. Bukhnikashvili

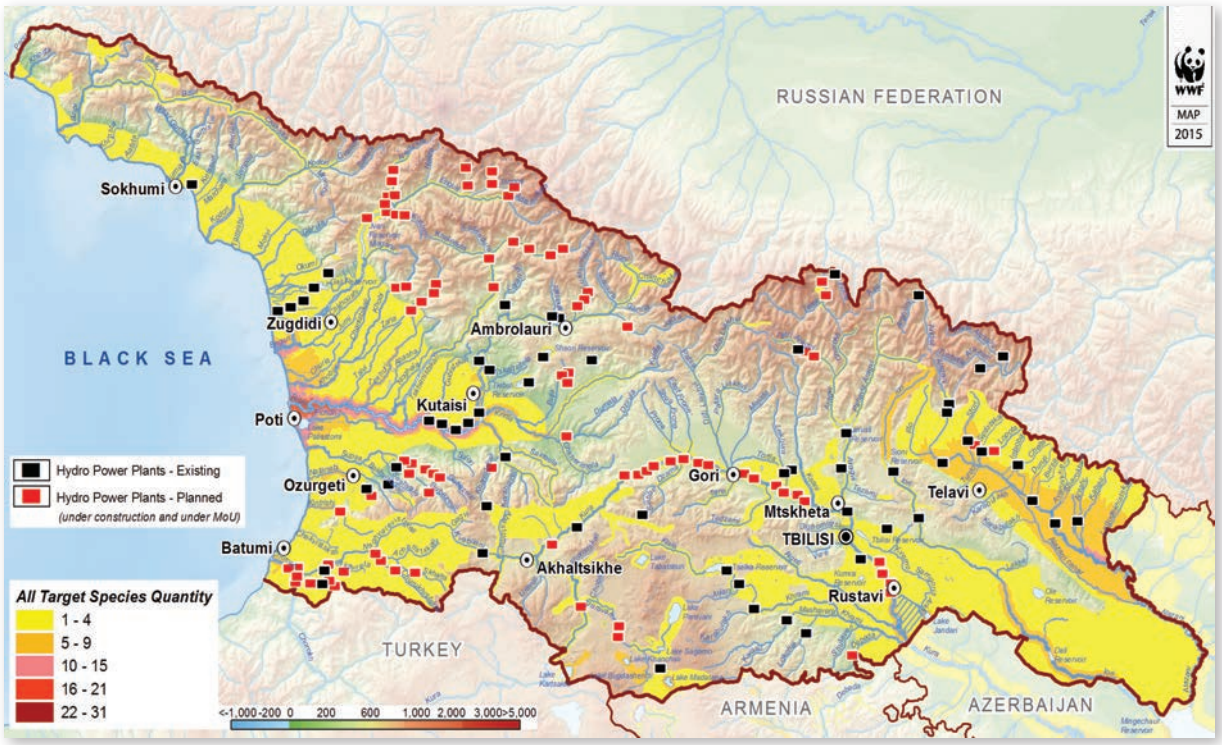
Table 2: Actual protection of freshwater KBAs

#	Freshwater KBA Name	Area of Freshwater KBA (ha)	Country(ies) of KBA	Area of Protected Freshwater KBA (ha)	Percentage of Protected Freshwater KBAs
1	Ritsa	9,077	Georgia	8,189	90.2%
2	Kolkheti 1	505,063	Georgia	396	0.1%
3	Enguri	11,992	Georgia	0	0.0%
4	Khobi	31,091	Georgia	7,421	23.9%
5	Rioni	82,862	Georgia	9,251	11.2%
6	Paliastomi	23,832	Georgia	13,673	57.4%
7	Kolkheti 2	84,980	Georgia	771	0.9%
8	Chorokhi-Ajaristskali	9,032	Georgia	54	0.6%
9	Adjara	265,435	Georgia	37,749	14.2%
10	Borjomi	90,577	Georgia	45,625	50.4%
11	Kura-Ksani	100,698	Georgia	74	0.1%
12	Tabatskuri-Tsalka	20,056	Georgia	8,563	42.7%
13	Kartsakhi	11,139	Georgia	4,061	36.5%
14	Javakheti-Arpi	153,051	Georgia-Armenia	26,187	17.1%
15	Khrami-Debeda-Marts	106,872	Georgia-Armenia	3,474	3.3%
16	Iori-Mingechauri	328,763	Georgia-Azerbaijan	73,028	22.2%
17	Alazani	284,763	Georgia-Azerbaijan	6,788	2.4%
18	East Greater Caucasus	314,950	Georgia-Azerbaijan	86,163	27.4%
19	Sheki	36,149	Azerbaijan	5,883	16.3%
20	Karachay	30,506	Azerbaijan	415	1.4%
21	Kura-Ara(k)s	427,712	Azerbaijan	28,628	6.7%
22	Gyzylaghaj	51,346	Azerbaijan	14,679	28.6%
23	Kura	154,058	Azerbaijan	24,601	16.0%
24	Ara(k)s-Hrazdan	89,001	Armenia	354	0.4%
25	Akhurian	18,908	Armenia	0	0.0%
26	Dzoraget-Tashir	20,811	Armenia	0	0.0%
27	Agstev	11,619	Armenia	3,312	28.5%
28	Chilli	3,198	Armenia	0	0.0%
29	Sevan	164,475	Armenia	141,060	85.8%
30	Arpa	15,748	Armenia	1,662	10.6%
31	Lake Jan	115	Armenia	0	0.0%
32	Vorotan	13,873	Armenia	406	2.9%
33	Voghji	5,227	Armenia	0	0.0%
34	Tsav	18,690	Armenia	10,101	54.0%
35	Ara(k)s-Meghri	41,268	Armenia	19,187	46.5%
	TOTAL	**3,536,936**		**581,755**	**16.5%**

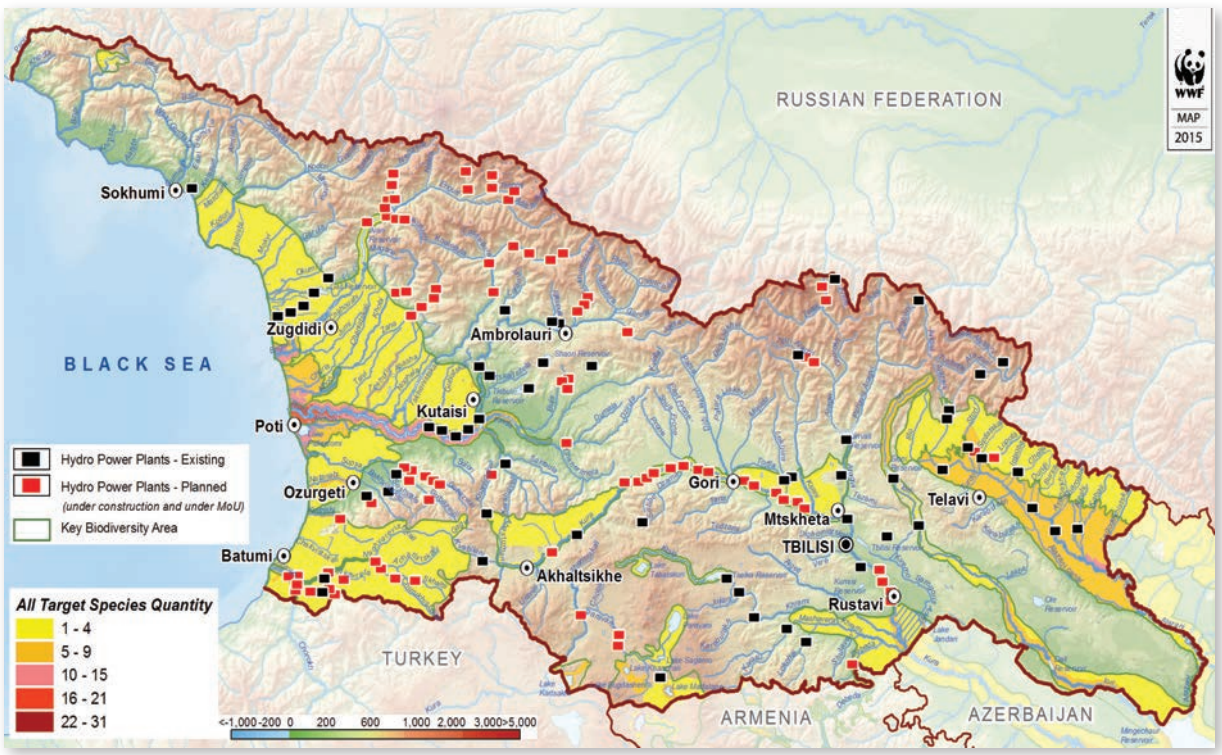
3.3.4 Target species, freshwater KBAs and dam/hydropower development

Results of overlaying HPP/Dam scheme in Georgia with target species distribution and richness are presented in Map 13. Results of overlaying HPP/Dam scheme in Georgia with freshwater KBAs are presented in Map 14.

Map 13 HPP/Dam schemes and target species distribution and richness in Georgia



Map 14 HPP/Dam schemes and freshwater KBAs in Georgia



3.4 Uses of KBAs to Strengthen Biodiversity Protection

The outputs from the study can be used in a number of ways to protect threatened species of freshwater biodiversity:

Expanding the system of protected areas: In this assessment and for the very first time, all 174 threatened freshwater species known to occur in the South Caucasus have been considered to delineate 35 freshwater Key Biodiversity Areas. These areas hold the majority of but not all populations of threatened freshwater species in the South Caucasus. The identification of these areas gives the countries - Armenia, Azerbaijan and Georgia - a sound scientific background to expand their system of protected areas to cover critical habitats of threatened species of national and global relevance and importance. Doing so would help governments to reach the national biodiversity conservation goals and the international targets which they have committed to, in particular the Aichi Targets of the Convention on Biological Diversity. Also, for Georgia in particular, expansion of the protected areas network to cover freshwater KBAs would be an important step towards adapting national actions to the provisions of the EU's Wild Birds Directive and Habitats Directive. Expansion of protected area networks would safeguard freshwater biodiversity and vital ecosystem services for future generations.

Funding for research, conservation and restoration activities: It is highly recommended to increase funding and direct research efforts towards freshwater biodiversity in order to increase knowledge on trends, distribution areas and threats for further effective conservation planning. National and international funding available for conservation and habitat restoration should be focussed on the identified freshwater KBAs to optimize the cost-efficiency and effectiveness of investments. Resources for restoration could also come from activities that are required to balance biodiversity loss in adjacent areas, including the off-sets made by projects which are expected to cause unavoidable negative impacts on biodiversity.

Background data for planning: The exploitation of hydropower resources and other development activities usually conflicts with the conservation and sustainable use of biodiversity. This study detects the areas of high sensitivity for biodiversity and serves as an important source of information for all parties aiming at sustainable development, including hydropower schemes, in the countries of the South Caucasus. All freshwater KBAs are vulnerable to hydropower development and great care must be given to all habitat changes within the KBAs. It is highly recommended to exclude the freshwater KBAs from the hydropower development planning in Armenia, Azerbaijan and Georgia. As a result of dams and hydropower plants constructed in some freshwater KBAs many species have been listed in the global and national Red Lists of threatened species. Constructing additional hydropower plants without due consideration of biodiversity will result in the further decline and eventual extinction of threatened species.

The opportunities to apply the results of this study are immediate and substantial. However, the data that go into such a study are not always up to date and might only partly reflect the reality in the field. This study on identification of freshwater KBAs has confirmed a significant lack of information and current data on freshwater biodiversity in the South Caucasus which mostly stems from limited field research. Biodiversity capacities are not optimally developed within the universities and other organisations in the countries of the region and the erosion of this knowledge will lead to considerable challenges in the near future. Given the limited resources and data available to the study for analysis and identification of KBAs, additional field work is strongly recommended. This study does not and cannot replace in-depth local studies at each site proposed for the development of hydropower production or other activities. It should be additionally considered that populations of threatened species also occur outside the designated freshwater KBAs and the boundaries of these populations might also be relevant for planning. Great care should be given in each development project to avoid unnecessary biodiversity loss. As the delineation of the freshwater KBAs is based on expert knowledge and the KBA identification and delineation process is iterative, the boundaries of these areas can be modified and built up with new freshwater KBAs over time as long as new data on freshwater biodiversity becomes available. In that regard, the boundary of each KBA identified in the study would need to be defined more precisely in consultation with national and local stakeholders before adding it to a protected areas network.

4. PLANNING AND ASSESSMENT OF SUSTAINABLE HYDROPOWER

4.1 Introduction

Over the past 15 years, there has been an extensive global discussion of sustainable hydropower development. Many new tools and frameworks have been developed and either integrated into national planning and regulatory systems or offered as voluntary frameworks. Even though the variety of approaches may seem confusing, and continuing debates and conflicts over hydropower may suggest that they are not compatible with each other, there is actually strong convergence among professionals in the field. It is now accepted that the key to better hydropower projects is application of the mitigation hierarchy: problems should be best avoided; those that cannot be avoided should be minimized and mitigated; and any residual impacts should be compensated for, with the objective of leaving the project area better off socially and environmentally than without the project. There is also agreement that sustainability is not limited to social and environmental issues: it includes the financial sustainability of the developer, the economic sustainability from the point of view of the country, and the technical sustainability of the project. Where there are trade-offs between these objectives, the outcome has to be balanced. Without good corporate and public sector governance, sustainability is difficult to achieve.

Sustainability needs to be addressed at the system as well as at the project level. As a consequence of deregulation, or because of capacity gaps in government agencies, many countries - including those in the South Caucasus - have moved away from comprehensive planning of their power sectors. Projects are being developed by individual companies, and have to demonstrate their compliance with national frameworks when they apply for permits and licenses.

Enguri (Inguri) Dam, Georgia ©A. Guchmanidze

4.2 International State of The Art

4.2.1 Sustainable hydropower planning tools

There are many ways to improve outcomes by planning at a system scale (nation, region, river basin, or power grid), and in that way to avoid unnecessary impacts - the first step in the mitigation hierarchy.

4.2.1.1 Hydropower potential and master plans

Methods to plan electricity development range from national hydropower master plans and electricity sector investment programmes, to plans for hydropower cascades and to utility-scale integrated resource plans (IRPs).

Investment programme planning was widespread until a few decades ago when support waned for systematic, central planning of investments. Many master plans from that period, which exclusively applied technical and least-cost criteria, still exist and are used by default. Modern master plans, which could use a broader array of criteria, rarely exist and many of the planning approaches for multiple projects are not yet being systematically applied.

At the country level, Norway and Iceland provide the best examples of hydropower master plans which fully incorporate environmental and social aspects, in response to increasing problems with public acceptance. In both countries, the plans are approved by the Parliament. In the 1980s, Norway ranked 542 potential projects by two criteria, the cost of energy and the potential for conflicts, and 16 sub-criteria. As a result, a significant share of its remaining potential was declared off-limits, another part was reserved for future consideration, and a third part was made available for development. According to the latest version of the master plan, out of a total potential of approx. 186 TWh 63 % have already been developed, 23% are protected (off-limits), and 14% are in the master plan, either as available for licensing or with reserve status.

In Iceland, master planning for hydropower has been going on since the 1990s and has now been prescribed by law to be updated every four years. The planning is done jointly with geothermal energy.

A similar process to Norway's ensures that multiple criteria are used and that projects are placed into various categories. A multi-stakeholder steering committee oversees the process.

General power sector plans that include hydropower and address the various roles it can play in power systems, typically exist in two kinds of countries: where power sectors are expanding quickly and plans are largely based on least-cost criteria, or where there are high expectations regarding sustainability and plans include multiple criteria. Most plans use or reference least-cost planning methodologies. However, there are a number of countries which have more strategic-level planning, sometimes for the broader energy sector (not just for electricity), and leave the identification of least-cost projects to the private sector. Besides cost, the issue of most interest is climate change mitigation, and many plans argue for an expansion of renewables. A few even value the mitigation of climate change, as an avoided negative environmental externality, in the least-cost model.

Lake Bugdasheni, Georgia ©N.Malazonia

4.2.1.2 Integrated river basin and water resources plans

In most basins, a hydropower project is only one of several water users. Hydro-economic modelling generally predicts large potential economic and social gains from coordinated planning and operations within a basin, and this potential for broader benefits underpins approaches such as integrated river basin management (IRBM) and integrated water resources management (IWRM) While these concepts have both been broadly accepted in principle, they have proven difficult to institutionalize. However, some elements are now being tested, including watershed management through payments for watershed services, multiple-use reservoir management, and water re-allocation between sectors such as irrigation, hydropower and the environment.

A limitation of integrated basin management approaches is that they often focus on a range of water sectors, but not on the full range of water values. Environmental water needs are rarely given the same status as traditional water uses and issues of aquatic biodiversity, fragmentation and connectivity are often disregarded in IRBM or IWRM plans. These plans also often do not address sediment transport and geomorphology, other than emphasizing soil protection in upper watersheds. Within these plans, hydropower is generally regarded as a non-consumptive user, even though water can be lost to evaporation from reservoirs, less water may be available in by-pass stretches, environmental flow patterns altered, and water quality impaired.

4.2.1.3 Conservation plans

Originally developed for terrestrial ecosystems and for the design of protected area systems, conservation planning methods have been adapted and applied globally to freshwater systems, and promoted to support infrastructure planning decisions. Challenges include accounting for the dynamics and ecosystem services of rivers, particularly at the scales of large basins.

Conservation planning is able to identify what would be necessary or desirable to protect, and sometimes the most efficient manner to protect it - for example, defining the minimum amount and most closely connected components of freshwater habitats and ecosystem processes required to maintain biodiversity. However, in practice it has often been quite separate from, unaware of, or not effectively linked to development decision processes.

Only in most recent times have attempts been made to understand the linkages and translate freshwater conservation planning outcomes into reality on the ground, by influencing hydropower planning. In principle, for example, hydro-economic models could include environmental flows either as a boundary condition (absolute constraint) or as one of several values to be included in the optimization algorithm. Criteria in hydropower master-planning could be framed to result in a more environmentally conscious configuration of projects. Biodiversity offsetting requirements at the project level could lead to the protection of other river segments from development, and conservation planners could identify priority segments for offsets.

4.2.1.4 Offsets

Offsets are one of the most promising developments in recent years, and may in some cases provide a boost to conservation planning and the designation of no-go areas. Originally, offsets were introduced to compensate for local disturbances (for example, wetland losses from housing development in the US, or fisheries impacts from road crossings in Canada). More recently, offsets have become part of development bank safeguards. For example, when the IFC or an Equator Principles bank is involved, the following applies: "For the protection and conservation of biodiversity, the mitigation hierarchy includes biodiversity offsets, which may be considered only after appropriate avoidance, minimization, and restoration measures have been applied. A biodiversity offset should be designed and implemented to achieve measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity; however, a net gain is required in critical habitats. The design of a biodiversity offset must adhere to the "like-for-like or better" principle and must be carried out in alignment with best available information and current practices."

4.2.2 Sustainable hydropower assessment tools

Plans for hydropower projects and programmes are often assessed by third parties for their environmental and social implications. Such assessments can be an integral part of planning, or they can happen as a formal review after planning documents have been presented. In some cases, the assessment goes beyond environmental and social issues and looks more holistically at project and programme quality, including technical, financial, economic and governance criteria; such assessments are sometimes called sustainability assessments.

4.2.2.1 Project-level environmental and social impact assessments

The past 15 years have seen a proliferation of project-level recommendations, standards, and guidelines. These diverse sources range from the broadest and most generic environmental and social impact assessment (ESIA) and management methodologies, and bank safeguards, to work specific to dams or hydropower.

Environmental impact assessments (EIAs) have a central role in this regard. Without understanding impacts, it is impossible for developers to design mitigation measures and for regulators and banks to determine whether a project complies with requirements and should receive a license. Current regulatory tools are most developed for, and most widely applied at, the scale of the individual project. Most countries now require reviews of the environmental, and often social, impacts from a project or various alternatives to a project.

In practice, project-level environmental review has significant limitations that have been well-documented (Brismar 2004). The primary weakness of project-level review is that the review generally takes place after most decisions about the project have already been made. Often significant investments in the project have already occurred, or momentum and support for the project are well developed. These conditions place significant pressure on the review process to not reject the project or move its location. Indeed, reviews of EIAs have found that they rarely result in the rejection of a project (Sadler et al. 2000), and that both regulators and project sponsors see them as a formality. The EIA process is unlikely to instigate significant modifications or re-siting of projects, except in unusual cases, and instead it generally results in minor changes and a set of mitigation strategies.

Kolhoff et al (2013) have presented a framework to compare how ambitious EIA legislation is across countries (Table 3).

The more ambitious an EIA framework is, the better will be the decisions informed by it. An important part of this is whether projects are seen in isolation or whether the EIA evaluates if a project fits into its "context" (Kumar et al 2011). The report of the World Commission on Dams (WCD, 2000) emphasized the importance of high-level needs and options assessments to establish that a dam project is an appropriate response to a verified need. Such assessments should provide the context within which project-specific analysis, such as feasibility studies and EIAs, should occur. Understanding the spatial context allows the application of the full mitigation hierarchy, from avoidance through minimization, mitigation and compensation. This is particularly relevant where off-site resettlement or biodiversity offsets are planned, where critical habitats have to be identified, where altered flow and sediment patterns affect the basin as a whole and may be modified by upstream and downstream projects, and where cumulative impacts play a major role.

Ledec and Quintero (2003) emphasized that "the most effective environmental mitigation measure is good site selection" and provided an overview of potential indicators that can be used in site selection (Table 4).

If applied prior to firm siting decisions this approach can help planners avoid impacts; however it does not yet address the interaction between several projects. In that regard, cumulative impact assessment has

Table 3. Levels of ambition in EIA legislation

1. Object of Assessment

- Aspects studied in EIA (from environment only, to environment, health, economic & social aspects)
- Type of decisions subject to EIA (from projects only, to projects, programmes, plans & policies)
- Types of investors and projects subject to EIA (from private projects in some sectors only, to private and public projects in all sectors)
- Requirements for study (from environmental mitigation only, to the study of alternatives and compensation considered from environmental, social, economic perspective, and environmental management plan)

2. Quality of Information

- Scoping (from no formal scoping, to scoping by independent experts)
- Quality of consultants (from no mechanism in place, to certification of consultants and competitive market)
- Review (from only by sector authorities, to independent experts)
- Approval (from joint approval of EIA and project, to separate two-step process – technical approval of EIA, political approval of project)
- Start of EIA procedure (from no alignment to full timely alignment and integration with sector procedures)

3. Accountability of decision-making

- Stakeholders involved (from authorities only, to authorities, NGOs, experts & citizens)
- Access to information (from no provisions, to user friendly and active distribution)
- Government responsiveness (from no provision and responsibility, to justification of decisions)
- Access to justice (from no provisions, to administrative, judicial and mediation, by proponent groups and individuals, at moderate to low costs)

Rioni River, Georgia ©J.Freyhof

been one important link between projects and their regional context. The most up-to-date approach to cumulative impact assessment has been well described by the International Finance Corporation (IFC 2013). The 2013 IFC report includes several examples of hydropower cascades. Guidelines for cumulative impact assessments for hydropower in Turkey have been proposed by the World Bank (2012).

4.2.2.2 Project-level sustainability assessments

EIAs are typically rather long and complex undertakings that include descriptions of the project and the project area, detailed evaluations of anticipated impacts, as well as mitigation measures and management plans. Their scope is limited to selected environmental and social issues, as prescribed in countries' regulatory systems. They often presume that impacts are likely to be negative, and that conditions should be restored as much as possible to pre-project conditions. Opportunities to create positive impacts are unlikely to get as much attention, and trade-offs between different objectives are difficult to evaluate.

In contrast, sustainability assessments explicitly address negative as well as positive impacts across a broad range of issues. Their objective is typically not to determine compliance, but to maximize a project's contribution to sustainable development. The Hydropower Sustainability Assessment Protocol

Table 4. Indicators to guide project siting

Indicator	Notes
Reservoir surface area relative to energy produced (inundated ha/MW)	Global average is 60 ha/MW; lower reduces impact
Water retention time in the reservoir (days)	To calculate divide reservoir volume by mean river flow; generally, shorter reduces impact
Biomass flooded (tons/ha)	Water quality may decline with increasing biomass within reservoir; less is better
Length of river impounded	Shorter reduces impact
Length of river left dry	In case of a diversion; shorter reduces impact
Number of downstream tributaries	More is better, to maintain fish migration routes
Likelihood of reservoir stratification	Lower likelihood is better
Useful reservoir life	Until reservoir's storage is filled with sediment; longer is better
Access roads through forests	Shorter reduces impact and can assist where risks of deforestation are high
Persons requiring resettlement (people displaced per MW)	Fewer is better
Critical natural habitats affected (in terms of # of sites or ha)	Includes protected as well as unprotected areas of high environmental value; less reduces impacts
Fish species diversity and endemism	Sites with lower diversity and endemism are better
Cultural property affected (# of sites affected)	Fewer reduces impacts

(IHA 2010) offers such a holistic, multi-dimensional approach to sustainability, and is designed as a one-stop tool to assess project quality. By breaking all issues down to a set of similar questions and indicators, a systematic and consistent style of addressing issues is encouraged. Table 5 below shows the range of topics that are evaluated through a Protocol assessment.

It is important to realize that a Protocol assessment does not replace any of the underlying studies. For example, regarding the topic of economic viability, a Protocol assessment would evaluate the scope, quality, and results of the underlying cost benefit analysis. Where these do not meet the definitions of "good" or "best practice", gaps are identified so that the project developer can make targeted improvements.

Two key features of the Protocol are the following:

- Strong emphasis on measuring specific performance criteria: The Protocol is based on the idea that "you cannot manage what you cannot measure". While sustainability issues do not lend themselves to quantitative indicators, the Protocol defines specific and reproducible benchmarks for qualitative indicators.

- Gradational approach: In contrast to the large majority of regulatory safeguards and voluntary sustainability standards and guidelines the Protocol describes several levels of performance on each topic. It is not another standard imposed upon developers but a tool to help them improve their performance – a "sustainability ladder". Any step upwards on the ladder is recognized and welcomed.

Table 5. Hydropower sustainability topics

Technical	Evironmental	Social	Economic and Financial	Intergrative
Siting and Design	Downstream Flows	Project affected communities and livelihoods	Economic viability	Demonstrated needs and strategic fit
Hydrological resource	Erosion and Sedimentation	Resettlement	Financial viability	Communications and consultation
Reservior planning, filling and management	Water quality	Indigenous peoples	Project benefits	Governance
Infrastructure safety	Biodiversity and invasive species	Cultural heritage	Procurement	Intergrated project managment
Assent reability and efficiency	Waste, noise and air quality	Public health		Environmental and social issues management

Regarding the idea that projects should fit within their broader context the Protocol includes two sections relevant to this concept: the "early stage assessment tool", which mostly deals with the detec-tion and avoidance of risks in the project identification phase, and the "preparation stage assessment tool", which considers the quality of detailed project preparation. The Protocol states as one intent of project preparation that "siting and design are optimized as a result of an iterative and consultative process that has taken into account technical, economic, financial, environmental and social considerations".

"Good practice" for project planning includes to:

- be able to demonstrate the strategic fit of a project with needs for water and energy services, and relevant policies and plans (development, energy, water, biodiversity, climate, conservation, transboundary, land use, etc);
- engage directly affected stakeholders in the siting and design optimization process;
- respond to many sustainability considerations in the final project siting and design; and
- scope cumulative impacts during the assessment of project environmental and social impacts.

4.2.2.3 System-level environmental and social impact assessments

There are also various methods to assess hydropower programmes from an environmental and social point of view, such as strategic environmental assessments (SEA).

Hydropower development policies, programmes and plans can be informed or assessed through SEAs, which, as a category, includes a more loosely defined set of approaches compared to project-level assessments.

4.2.2.4 System-level sustainability assessments

The Rapid Basin-Wide Hydropower Sustainability Assessment Tool (RSAT) has been developed by the Mekong River Commission, the Asian Development Bank and WWF. The RSAT shares some similarity with the Hydropower Sustainability Assessment Protocol. It also addresses multiple dimensions of sustainability in cases where more projects exist or are planned in a ba-sin context. It can be used to compare different sets of projects but is not designed to come up with an average score and a clear preference for one or the other set.

If system-level assessments are supposed to result in clear recommendations, they require some kind of multi-criteria analysis (MCA) approach, which is often used to evaluate plans and to select preferred alternatives, such as configurations of projects in a basin. MCA is a rigorous approach comparing options based on more than one criterion, as opposed to, for example, cost benefit analysis which reduces all information to one criterion. It can use technical, commercial environmental and social criteria. The MCA process provides a method for assessing complex problems that involve evaluation of a range of different issues, often in situations where there is a substantial amount of information. MCA helps to inform decision makers by clarifying the differences between options and by allowing options to be prioritized in a structured, logical and transparent manner.

4.2.2.5 Conceptual planning and assessment framework for the South Caucasus

Good practices can be summarized as those that deliver sustainable hydropower projects; i.e. projects that balance all dimensions of sustainability - social, environmental, economic/ financial and technical. Good practices are comprehensive: by covering all dimensions, by integrating work at the system and at the project level, and by addressing both existing and new projects. The tools described in chapter 4.2 can be summarized as follows in Table 6.

Current practices in the South Caucasus incorporate only few elements of the "state of the art" framework presented in Table 6. This picture is not limited to the South Caucasus countries but is rather universal: very few countries could claim that they have a truly modern decision-making framework in the power sector, and that outcomes are satisfactory and balanced. Even where there is an ongoing multistakeholder master planning process, such as in Iceland, not all stakeholders are convinced of the outcomes. The International Energy Association has stated that "the world's energy system is at a crossroads. Current global trends in energy supply and consumption are patently unsustainable — environmentally, economically, socially. But that can — and must — be altered; there's still time to change the road we're on. It is not an exaggeration to claim that the future of human prosperity depends on how successfully we tackle the two central energy challenges facing us today: securing the supply of reliable and afford-able energy; and effecting a rapid transformation to a low-carbon, efficient and environmentally benign system of energy supply. What is needed is nothing short of an energy revolution" (IEA, 2008). This confirms the relevance of the problem, and the fact that Georgia, Armenia and Azerbaijan are no excep-tions in the need to reform.

The present section brings together the most import-ant components that would constitute a coherent, ideal-type planning and assessment framework. The challenge is to achieve a consensus in society over how much power is needed; which projects should supply it; how they should be developed; under what conditions; and how they can respond to an evolv-ing context. Posing the questions in this way should clarify that these are questions for the entire govern-ment, not just individual ministries. In fact, these are questions that need to be discussed not just between government authorities: they are crucial questions for societies - including all stakeholders - to address. Overcoming the so called "silo mentality", where departments and stakeholders only take responsibility for their own field, rather than looking at the public interest as a whole, is perhaps the most important challenge in reforming planning and assessment.

Table 7 details what information is needed to inform discussions and to take the necessary decisions at different stages in the project cycle, how that information can be provided, and who will generally be responsible. This framework assumes that the different government agencies cooperate well together with clearly assigned responsibilities, and that they also cooperate with non-government stakeholders. These need to be involved, in particular, in discussions and decisions regarding steps 2 and 4.

The key practical difficulty in this framework is probably how to link steps 2 and 3 – the interface between the system and the project level. Project selection requires planners to be able to compare projects. This has to be done on the basis of preliminary information. Typically, all that is available at this stage is some pre-feasibility level technical and financial information and possibly some maps showing social and environmental values. Based on this information projects can be selected which appear worth pursuing. Final investment and licensing decisions are taken much later, and if projects fall out of the plan because some flaws are discovered during detailed preparation, they can be replaced by the next project in line.

One way to visualize such an ideal-type framework has been proposed by The Nature Conservancy (Figure 1). The advantage of this visualization is that it clearly describes the sequence of steps and the inputs required for each individual step. In this case, the "system" for which planning is done is a basin. The key interest in this process is to achieve an integrated basin plan, which will identify projects to be further developed as well as rivers that will remain protected.

In this example the emphasis is on spatial planning at the basin level. "Go" and "no-go zones" are identified, "no-go zones" are protected and developers are given the green light to prepare projects in the "go" zones. This would be an appropriate planning level for a large basin with multiple water uses, and would often be the preferred approach when a water or natural resources agency leads the planning process.

It would be quite unusual for a basin actually to be assigned a "hydropower generation target", but this is not supposed to be an exact representation of the planning process. It is likely that in reality this would be a more iterative process, where the generation target is a "moving target", dependent both on the re-sults of studies and plans in the basin and on outside parameters such as fossil fuel costs. The water agen-cy may feed back to the energy agency that the initial generation target is unrealistic and needs to be re-vised downwards or that it can in fact be increased.

In other places an energy agency may lead the planning process for a nation or for an energy grid and may try to capture other water uses and their social and environmental relevance through other mechanisms. For example, the agency may first develop a least-cost expansion plan and then submit this plan to a strategic environmental assessment to modify the ranking and sequencing of projects in the expansion plan. The protection of high-value rivers would

Table 6. Elements of a comprehensive planning and assessment framework

Sustainability Dimensions	System Level		Project Level	
	Separate Tools	Integrated Tools	Separate Tools	Integrated Tools
Economic/ Financial	Generation Expansion Plans / Master Plans	Integrated Resource Plans for Power Sector	Cost-Benefit Analysis Financial Modeling	Hydropower Sustainability Assessment Protocol
Technical		Basin Level Integrated Planning (*e.g. integrated management plans for natural resources; or water resources integrated planning and management)* Modern Hydropower Master Plans	Feasibility Studies Design Studies Hydrological Studies	
Social	Strategic Environmental Assessment (covers social aspect too)	The Rapid Basin-Wide Hydropower Assessment Tool (RSAT)	Environmental and Social Impact Assessment Environmental Management Plans Licensing Processes	
Environmental	Strategic Environmental Assessment Conservation Planning Offsets Planning	Multi-Criteria Analysis		

often be considered outside the scope of an energy agency's mandate; however, the agency could cooperate with other government agencies. For example, an environment agency could protect the "no-go zones" and, when it comes to licensing the pre-selected projects, could require less documentation because through the process the highest value ecosystems have already been protected. Thus, incentives can be created for both agencies to work together.

Whether the "system" or object of planning is a basin, a nation, a regional grid or any other larger scale unit, clearly the planning and assessment tools are going to be different from those used at the project level. The weighting of the different components of the framework will differ according to the circumstances in each country. For example, siting considerations are more important in a hydro-dominated grid than in a natural gas-dominated one. Time-bound licenses are more relevant for power technologies with a long service life. Looking at other water uses is more important where water is scarce or where multiple uses of reservoirs are planned. Power demand projections are more important in fast-growing than in stable economies. The framework in Table 6 describes what needs to happen, not how it has to be done. There are multiple tools available which have been described in chapter 4.2 and which could be applied.

The Protocol, for example, can assist with several steps throughout the project cycle, but it is not the only tool that can achieve project quality improvements. More importantly, there needs to be a recognition that there are significant gaps in hydropower planning and assessment as currently applied in the South Caucasus countries.

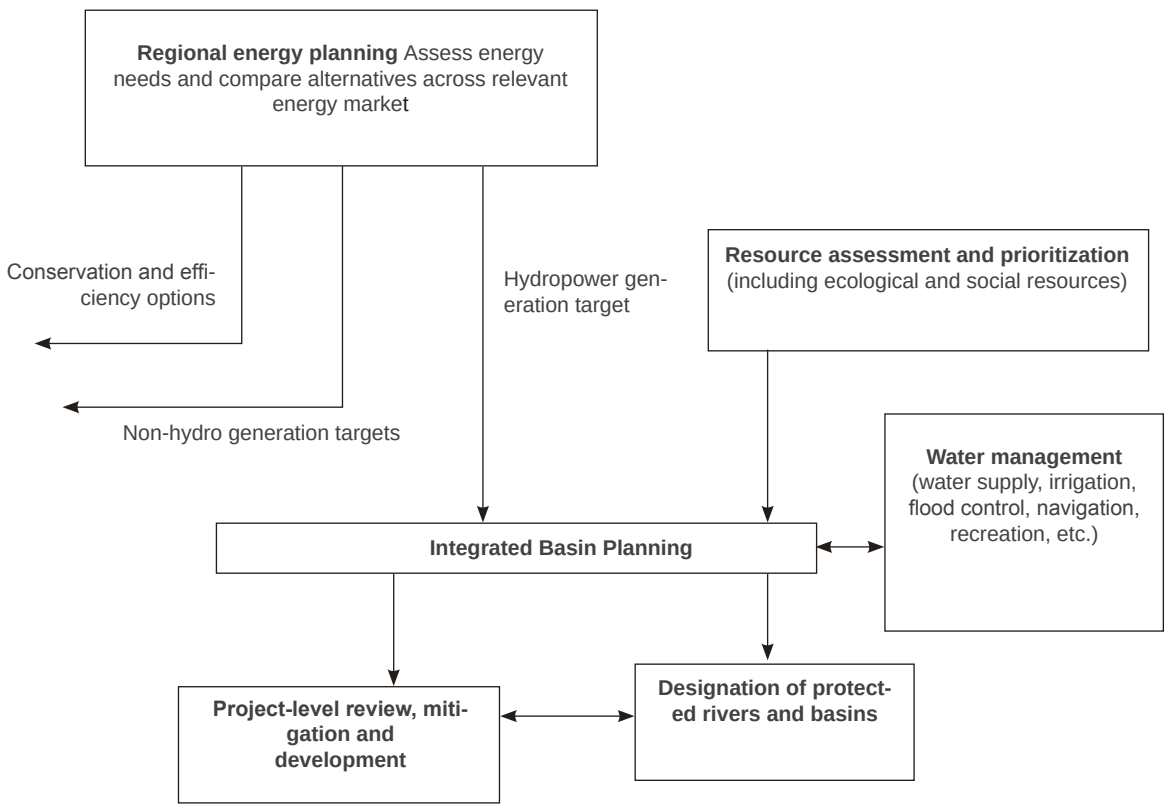
Table 7. Key steps of a comprehensive planning and assessment framework

Steps	Required Information	Key Tools	Key Institutional Responsibility
1. How much power is needed?	Electricity demand projections which recognize the potential for demand management, energy efficiency, loss reduction, and energy trading between countries	Energy/power sector plan	Government energy agencies
2. Which projects should supply it?	System-level plans, strategies, policies and regulatory frameworks which ensure that demand is satisfied, and that those power projects are ranked highest and developed first which are in the best public interest, based on multiple criteria (economic, social, environmental)	Generation expansion plan; master plan; options assessment; river basin plan; strategic environmental assessment; early stage protocol assessment	Government energy agencies, sometimes public utilities
3. How should they be developed?	Project-level siting, design and operations decisions based on detailed assessment and management of risks and impacts	Feasibility study; cost-benefit analysis; environmental and social impact assessment; preparation stage Protocol assessment	Developers
4. Under what conditions should they be licensed?	Time-bound operating licenses which incorporate issues identified in the assessment process (in cases, also agreements with financiers based on their safeguards)	Environmental and social regulations; license, Environmental management plan; resettlement plan; bank safeguards; loan agreements; implementation and operation stage Protocol assessment	Government energy and environment agencies; sometimes financiers
5. How can it be ensured that they will respond to an evolving context?	Monitoring, periodic review, and adaptive management to ensure that projects continue to operate in the best public interest, while circumstances continue to evolve	Monitoring reports; re-licensing procedures; operation stage Protocol assessment	Developers, Government energy and environment agencies

Of the steps described in Table 7, only steps 3 and 4 are currently applied, at least partially. Significant reforms are needed to introduce the other steps of the framework, and to upgrade steps 3 and 4.

Introducing the entire planning and assessment framework shown above at once is not realistic. Depending on the circumstances of each country there will be reforms which are easier to implement or are more urgent than others, and tools and approaches which fit better into existing systems than others. However, in order for reforms to be made, government, people and organisations to whom the government listens – especially investors and operators – need to be convinced that reforms are necessary.

Figure 1. Flowchart for an ideal-type hydropower development process



4.3 The Way Forward

In the past, the public interest in hydropower in the South Caucasus was defined quite narrowly: hydropower was expected to provide cheap electricity, and some jobs and taxes. Today's expectations are much broader: people also want hydropower to be socially and environmentally responsible and to contribute to regional sustainable development. To ignore this evolving perspective risks increasing conflicts. Fortunately there are ways to accommodate social and environmental concerns.

The final part of this chapter will suggest a roadmap for practical steps towards better planning and assessment. Too often, reform recommendations are given without considering the political and administrative realities. Such recommendations will inevitably fail to gain traction, and result in disappointment. It is very significant to start discussions with officials and hydropower investors, and an important part of that conversation should be not just which reforms may be necessary, but also which ones are realistic and what specifically needs to happen to make them a reality.

4.3.1 Rules for reforms

There are some general experiences under which conditions reforms are more likely to succeed:

Initiate reform when there is a powerful need and demonstrated demand for change: The need and demand for change is probably greatest in Georgia, where resistance against new hydropower projects creates uncertainty for communities, investors and government agencies, and where decisions made in the next few years will have far-reaching consequences. In contrast, relatively few new projects will be built in Armenia and Azerbaijan, and it remains to be seen whether there is enough demand for change. The strongest argument for action in Armenia and Azerbaijan may be that now is the time to assess the performance of existing projects and to anticipate which future projects will best fit into the power sector.

Involve those affected, and address their concerns with effective information: Reforms to planning and assessment systems affect multiple stakeholders. Even within government, there are different responsibilities and priorities. Quite often, ministries of energy and environment seem to work against each other rather than working towards one higher objective. To overcome a lack of integration the options are: to change the information, objectives and constraints that individual agencies take into account in their decisions; expose decisions by individual agencies to outside opinion; and - if no consensus between different sectoral agencies and sections of society can be reached - take coordination up one level or several levels, to parliament or heads of government. Investors, banks and civil society need to be brought into the discussion as well. Investors may well be concerned that reforms will bring more delays and their legitimate interests need to be taken into account. One incentive for them is that once projects are pre-selected, for example in a master plan, the burden of EIAs and EMPs could be reduced.

Develop a sequenced, prioritized list of reforms: Different components of the ideal-type planning and assessment system may need to be introduced at different times. For example, without conditions for periodic review in the operating license there is no legal mechanism for adaptive management. To establish an overall estimate of demand may be secondary if there is consensus over which projects should be built next; it is then just the timing of new projects which depends on the rate of expansion.

Pick the low-hanging fruit first - nothing succeeds like success: There are usually some simple steps which can be eye-openers, can demonstrate the value added from planning and assessment reforms, and can create appetite for further steps. One example would be a simple spatial analysis of overlaying maps with planned hydropower projects and with high conservation value areas, which can quickly show areas of potential conflicts. Surprisingly, most countries have never conducted these analyses on the basis of existing data.

Keep your eye on the ball - don't let the best become the enemy of the good: Even countries like Iceland, which (with roughly ten times the per capita income of the South Caucasus countries) can invest more in public services and which have a continuous master planning process and high sustainability performance, have ongoing methodological discussions and occasionally, conflicts. No system is perfect, and even small steps in the right direction are welcome.

No silver bullets - instruments work well only as part of a management system: A planning and assessment framework is a system of interconnected parts. For example, a master plan will usually rank some projects as 'available for development' based on high-level indicators; those indicator systems need to be improved over time as information comes in from more detailed EIAs. Neither an EIAs nor a master plan nor any other single instrument can resolve all issues by itself.

Reform is dialectic, not mechanical: There is no blueprint solution that automatically solves all problems. Partial reforms will create new tensions, some

of which will be unexpected and trigger adjustments in other parts of the system. Reforms usually create some winners and some losers and it may become necessary, for political acceptability of the reforms, to somehow compensate the losers. This could include developers who already hold a development license and have invested in project preparation but are now told to stop or to develop a different project instead. Reformers need to be willing to adapt and compromise.

Reforms must provide returns for the politicians who are willing to make changes: Reforms generally require laws, organizational changes and financial resources – in other words, political decisions. Politicians and high-level bureaucrats need to see a reason – beyond just the abstract "public interest" – to invest their time and political capital in promoting change. Getting involved in the conflicts over hydropower and promoting pragmatic solutions is not typically a high political priority unless (a) change is urgent and (b) the politician can associate his or her name with the change. Campaigns for reforms may need to identify political "champions" who can help navigate the political system.

Fundamental principles apply, but need to be adapted to the specific context: The key planning and assessment issues are different in systems with many small versus few large projects, with multiple-use reservoir versus single-purpose run-of-river projects, in countries with one monopoly generator versus countries with a competitive generation market, etc.

4.3.2 Recommended reform steps

Taking the above-discussed 'rules for reform' into account, the following regional and country-level reforms can be recommended:

Introducing generation expansion planning: All three countries should consider introducing generation expansion planning. Azerbaijan could use a system similar to Mexico, which also has one monopoly energy company (CFE) that undertakes the annually updated 15-year planning. CFE's plans are binding once approved by government. Alternatively, the US model of "integrated resource plans" could be consid-ered. Armenia and Georgia could use a system similar to Colombia's, where the planning department of the Ministry of Energy annually updates an "indicative" expansion plan.

Bringing multiple criteria into generation expansion plans: The generation expansion plans should indicate both the expansion target (expected power demand) and the most efficient way to supply it. Efficiency should be measured by simple indicators such as levelled cost of energy and environmental and social impacts. A sector-wide SEA is a good way to make environmental and social costs comparable. Vietnam can be an ex-ample for a country which has integrated SEAs into its power sector planning.

Starting with simple planning approaches: Planning should be done in a pragmatic way. At least the first iteration of plans can be very simple, based as much as possible on existing data, and donor resources can be mobilized to support it. One example for a simple approach is spatial overlay analysis. However, before starting the process, the purposes and institutional responsibilities should be clearly defined, to ensure that everyone understands the future role of planning.

Periodic updating: If annually updated energy planning is seen as too much of a resource commitment, a process such as Norway's or Iceland's master planning with updates every few years could be considered.

Providing for multiple stakeholder perspectives and coordination: Countries should consider if they can improve planning processes and acceptance of planning results by including multiple stakeholder perspectives, for example in a steering committee like the one Iceland uses for its master plan process.

Protecting "no-go"or "off-limits" areas: The countries should consider including those rivers which are defined in the master plans as "no-go" or "off-limits", in the national networks of protected areas. A gap analysis can be conducted to ensure that repre-sentative samples of all river ecosystems in the region are protected.

Reviewing environmental and social assessment and licensing systems: The environmental and social assessment and licensing systems should be reviewed in all three countries. The checklist in Table 3 can be used to establish how close to best international practices the country frameworks are. An analysis of Georgia's legislation against these criteria has already been provided by Kolhoff et al (2013) and the same approach could be extended to Armenia and Azerbaijan. Multilateral banks should be encouraged to join in this process to ensure that their safeguards are adequately reflected in the country frameworks. The advantage for them should be that they can demonstrate an impact beyond their projects, and that they have a broader menu of projects which could become eligible for financing.

Addressing priority gaps: Following the review in the previous step, countries should selectively close the most important gaps in their assessment frameworks. Among other reforms they should consider reducing documentation requirements for projects

which have resulted from master plans that have already taken environmental and social criteria into account. In general EIAs should be shorter, less descriptive and more decision-oriented. Two key aspects that should always be covered in hydropower EIAs are: (a) which siting, design and operational alternative were considered and why were they rejected; (b) what are the cumulative impacts of this project against the background of other projects in the area.

Developing guidelines for hydropower EIAs: Countries should consider issuing standard guidelines for hydropower EIAs to clearly and consistently define expectations. Peru's guidelines could serve as an example.

Developing technical standards for high-priority topics: For individual issues of high importance such as environmental flows and fish passage, simple technical standards should be developed and tested. Tools such as the Protocol and the IFC Performance Standards can help clarify expectations.

Piloting river-basin and regional-level planning and assessment: Wherever appropriate and feasible, river-basin and regional level planning and assessment efforts should be encouraged to find coordinated solutions. Pilot studies should be done in priority basins. Where mitigation of impacts is difficult to achieve, offsets should be tested to compensate for impacts. Offsets can be defined project-by-project or can consist of a defined contribution to a national environmental fund.

Using licenses to ensure good project performance: Licenses should carry clear conditions linked to the environmental management plans. New licenses should be time-bound (for example for 30 years as in the United States), and licensees should report regularly on compliance, not just during the construction but also during the operation stage.

Testing Voluntary Standards and Tools: Developers, contractors and banks should be encouraged to test voluntary standards and tools. They can consider joining international initiatives such as the UN Global Compact. Local commercial banks can sign up to the Equator Principles or apply the project screening criteria and safeguards that they see development banks using. Developers may use the Hydropower Sustainability Assessment Protocol for sustainability assessments, either internally or with external assessors. Voluntary tools may indeed have the largest positive impact in a transition phase, where upgrading the official planning and assessment framework takes time, but companies can anticipate the coming change and prepare their projects for higher future expectations.

Kura River ©A. Bukhnikashvili

European otter (Lutra lutra),©H.Scho ield

Eurasian spoonbill (Platalea leucorodia) ©H. Muller

Dodon`s fireweed (Chamaenerion dodonaei) ©G.Fayvush

5. ASSESSMENT OF FRESHWATER ECOSYSTEM SERVICES TO THE HYDROPOWER SECTOR

5.1 Introduction

This chapter summarises three separate national assessments of freshwater ecosystem services to the hydropower sectors in Armenia, Azerbaijan and Georgia. The national assessments focus primarily on the assessment of freshwater ecosystem services that support hydropower and dams/reservoirs development in the Black Sea Catchment Basin in Georgia and the Kura-Ara(k)s River Basin in Armenia, Azerbaijan and Georgia. They also consider the importance of upstream forest ecosystem services for hydropower and dams development. In addition the national studies briefly review other related sectors such as nature-based tourism, water supply, irrigated agriculture, and fishery in HPP-reservoirs.

The national assessments applied "target scenario analysis" (TSA) to the assessment of the value of ecosystem services to the hydropower sector.

The TSA approach serves multiple purposes:

1. Analyse selected HPP/Dam sector and determine the potential economic gains or losses of undertaking productive activities by comparing "business as usual" with "sustainable ecosystem management" practices.

2. Inform policy makers and businesses about the economic risks and opportunities of undertaking productive activities that affect ecosystem services.

3. Assist government and the private sector to incorporate ecosystems management policy into economic planning, corporate business plans, and investment policies at sectoral level.

4. Provide economic and social arguments to mobilize political will and to increase financial support for improving freshwater and forestry ecosystems management.

The national assessments provide evidence that healthy ecosystem services (ESS) are indispensable to achieve sustainable economic development. The assessments demonstrate that freshwater and forests ecosystems provide the most important services for sustainable development of hydropower resources and dams. The main inputs of ESS to sectoral development are illustrated in Table 8.

Table 8. Inputs of freshwater and forest ecosystems services to the development of selected sectors

Ecosystems	Inputs of ecosystem services to the development of selected sectors				
	HHP/Dams	Agriculture	Food and Products	Nature-based Tourism	Human Well-being
Freshwater	• Hydropower	• Water for irrigation • Soil fertility • Nutrient cycling	• Fish Stock	• Recreation, outdoor/adventure/ tourism	• Drinkable and domestic-use water supply • Industrial water supply
Forests	• Erosion control	• Flood control • Water cycle regulation	• Timber • Non-timber forest products (e.g. fruits, mushrooms, etc.) • Medical resources	• Recreation, outdoor/adventure tourism	• Climate and air quality • Natural hazard mitigation • Carbon sequestration

5.2 Threats to Ecosystems Supporting HPP/Dam Development

Threats to freshwater and forest ecosystems have reached global scales and require urgent actions from water managers and policy makers (Gleik et al., 2001). Deforestation and unsuitable agricultural practices are considered to be two factors that seriously threaten ecosystems of rivers and streams and these in turn affect the HPP/Dam sector productivity and the productivity of other related sectors such as water supply and irrigated agriculture.

The mass removal of forests makes slopes more vulnerable to erosion and increased erosion can negatively affect the level of electricity generation and the lifespan of HPP/Dams. The overall threats to freshwater and forest ecosystems and negative economic impacts are summarized in Table 9.

Table 9. Overall threats to freshwater and forest ecosystems and negative economic impacts

Threats	Caused by	Environmental consequences	Negative economic impact
Climate changes	Industrial, agricultural and urban air pollution, Ecosystems loss/degradation	Increased evaporation of water surfaces, reduced stream flows and water quantity and quality, habitat destruction	• Reduces production of electricity and irrigated agriculture products • Loss of productivity in sectors depending on electricity from HPPs • Reduced revenue from electricity sales • Loss of jobs • Power shortages • Reduced foreign exchange gains from electricity exports • Less tax revenue to governments • Reduction of resources for pro-poor investments • Increased negative externalities
Contamination of freshwater ecosystems	Industrial, agricultural and urban effluents and pollution	Habitat degradation, reduced quality of water, eutrophication	
Degradation of freshwater sources	Agricultural, industrial and municipal water withdrawals	Reduced flows, narrowing and extinction of migration routes for fish, habitat degradation	
Deforestation	Urbanization, agricultural development, irregular forest management practices (e.g. mass removal of forests or clear-cutting)	Erosion, landslides, riverbed sedimentation, increased turbidity, increased temperature, reduced oxygen, increased biochemical oxygen demand levels, affected biodiversity, river flows and water cycle, destructed habitats	

5.3 Methodology Overview

TSA assesses current "business as usual"(BAU) ecosystems management practices and its current value, and compares it with "sustainable ecosystems management" (SEM) practices and its potential value (Box 10). TSA may also assess potential gains (or losses) of shifting from BAU to SEM. The BAU approach is characterized by a focus on short-term gains (e.g. < 10 years), externalization of impacts and their costs, and little or no recognition of the economic value of ESS, which are typically depleted or degraded. Under the SEM approach the focus is on long-term gains (> 10 years) and the costs of impacts are internalized. SEM practices take into consideration ESS and tend to support ecosystem sustainability as a practical and cost-effective way to realize long-run profits.

In the national studies the TSA approach applied the following six steps:

1.Define the scope of the analysis (freshwater/forest and HPP/dams).

2. Define the sectors in agreement with stakeholders.

3. Assess, in collaboration and agreement with stakeholders, data availability with regard to potential indicators to be used.

4. Use the chosen indicators to define the BAU baseline and potential SEM intervention based on available information and first hand research.

5. Construct BAU and SEM scenarios and values.

6. Formulate informed policy and management recommendations.

Depending on the availability of data, different economic indicators are used to assess BAU and SEM impacts; e.g. productivity level and value, employment and income, fiscal impacts (taxes to government), foreign exchange earnings, etc. Primarily the following indicators were applied for the national assessments: sector investments (government, private sector, and international donors), damage costs as a result of BAU practices, production trends (volume and value) and avoided damages-costs as a result of SEM practices. The sector-level approach and the BAU/SEM analysis for the target region have some limitations (Box 11).

Box 10. Targeted scenario analysis (TSA)

Target scenario analysis (TSA) is an innovative analytical approach that captures and presents the value of ecosystem services to support appropriate decision-making.

The product of a TSA is a demonstration of evidence that analyses the pros and cons of continuing with business as usual (BAU) or introducing an alternative path of sustainable development through which ecosystems are more effectively managed. This alternate path is termed as sustainable ecosystem management (SEM).

The TSA is conducted for a particular productive sector (e.g. agriculture, energy) and for the specific decision-makers in the relevant sectors, primarily government officials and private sector representatives. The results of TSA can show the impact of certain policy options or management practices on specific ecosystem services or resources, to help decision-makers understand the circumstances in which maintaining ecosystems and their services may generate greater economic benefit than promoting short-gain economic processes that degrade and deplete ecosystems. If properly implemented, the TSA has the capacity to influence policy and management decisions.

The five steps of TSA are: (i) Defining the purpose and scope of the analysis; (ii) Defining the BAU baseline and SEM intervention; (ii) Selecting criteria and indicators; (iv) Constructing the BAU and SEM scenarios; and (v) Making an informed policy or management recommendation.

Source: Aplizar, F. and Bovarnick, A. (2013)

Box 11. TSA approach limitations in the region

1. The analyses draw on technical economic and ecological data from the published material available. Such date is still scarce in the South Caucasus: just a handful of studies are available.

2.The sectoral approach disaggregates the economic value of each type of ESS and fragments system-wide values to show specific sectoral inputs.

3.The integration of the overall effects of ecosystems and their services on the economy as a whole are left to the conclusions chapter.

4.Lack of national and sector-level data limits the applicability of the selected range of indicators used to assess the impact of BAU and SEM practices.

5.The available data to support the TSA was limited; therefore the estimated values presented in this study are partial.

5.4 Current Characteristics of HPP/ Dam Development in the South Caucasus

The national assessments show that hydropower and dam development as well as freshwater and forest ecosystems management in the region are characterized by unsustainable management practices/BAU; e.g. existing BAU practices include:

- Lack of sustainable hydropower development policy, including watershed/ecosystems management plans, modern integrated hydropower master plans, and related funding.
- Weak law enforcement (forest and water resources management).
- Lack of monitoring and regulation mechanisms in the hydropower sector.
- Deficient or outdated environment impact assessment approach.
- Hydrological data is outdated, deficient monitoring system, including outdated approach to assess availability of water resources (sanitary/ecological flow - 10% of available water flow).
- Development of HPPs in pristine ecosystems, including protected areas, or high risk areas.
- Deforestation and overgrazing causes erosion in upper watersheds.
- Deteriorated or obsolete infrastructure (reservoirs, intake points and water canal network, pumping stations, silting control).
- Lack of metering for domestic and industrial users, and water fees for irrigation.
- Limited institutional capacity.
- Lack of investment in maintenance and renovation.
- Absence of dam safety standards.

Despite the current conditions, ESS in the targeted upper river basins provide a range of benefits that are indispensable to sustain HPP/Dam development.

The national studies (i) discussed how ecosystem management is a critical input (other than capital) to sustain HPP/Dam development; (ii) assessed the potential loss in productivity of HPPs as a result of unsustainable management or "business as usual"/BAU practices; (iii) compared BAU with sustainable ecosystem management/SEM practices in order to assess potential gains; and (iv) provided recommendations towards sustainable ecosystems management leading to sustainable development of hydropower and dams.

5.5 Conclusions and Policy Recommendations

The significant costs and losses associated with the BAU scenarios (Figure 2a) applied in the national studies make a strong case for shifting to the SEM scenario (Figure 2b). A shift to the SEM scenario will require substantial changes in the national legislation, improvements in the administration of procedures and strengthening of compliance monitoring and enforcement. Those reforms could be addressed through a priority-based approach. Packages of recommendations for Armenia, Azerbaijan and Georgia are presented at the end of this chapter (Tables 10, 11 and 12).

There are a number of useful steps that could be taken that lie outside the scope of the reform packages proposed in Tables 10, 11 and 12:

- Address weaknesses and gaps in the existing frameworks for planning and assessing hydropower programmes and projects by implementing recommendations made in chapter 4, including improving procedures for strategic environmental assessment and environmental impact assessment.

- Transboundary management of water resources. The shift from BAU to SEM practices would be facilitated by the introduction of transboundary management of water resources; i.e., develop integrated water management policies for Armenia, Azerbaijan and Georgia. Ratification of the Espoo Convention (UNECE Convention on Environmental Impact Assessment in a Transboundary Context) by all countries of the Caucasus Region would also be a substantial step forward.

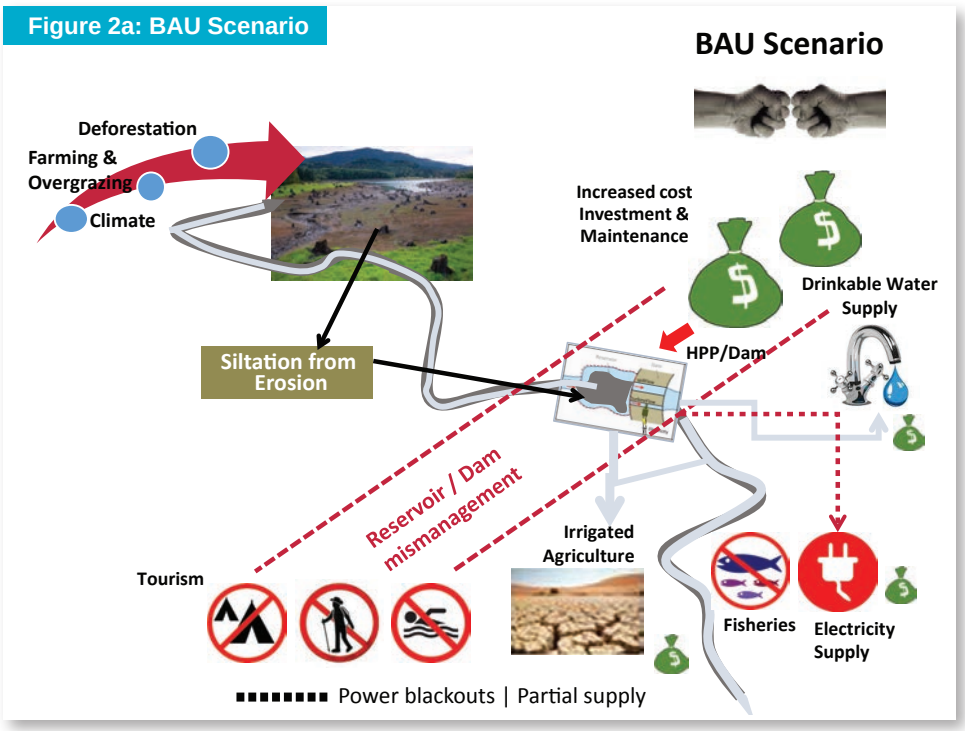
- Prepare river basin management plans. The standards and procedures for river basin management plans that are set out in the EU's Water Framework Directive have had some success in improving the ecological condition of freshwater bodies in member states. Georgia is in fact obliged by its association agreement with the EU to implement the Directive's main provisions. The process of preparing river basin management plans could help to forge agreements between the stakeholders in a basin to eliminate the negative impacts of one user's practices on another users costs and profitability, as illustrated in Figure 2. River basin planning may also be useful in providing a basis for working out incentives.

Alazani River ©H. Muller

Figure 2. Impacts of BAU and SEM scenarios in the upper river basin to HPP/Dam productivity and other linked sectors (Flores, M., 2015).

The BAU scenario in Figure 2a shows the impacts of unsustainable management practices in the upper river basin on downstream users. The sizes of the $ purses represent the amounts of, in some cases, investment and operating costs and in other cases, income.

Figure 2a: BAU Scenario



The SEM scenario in Figure 2b results in smaller $ purses for investment and operating costs and larger $ purses for income. Users are no longer negatively affected applying this scenario.

Figure 2b: SEM Scenario

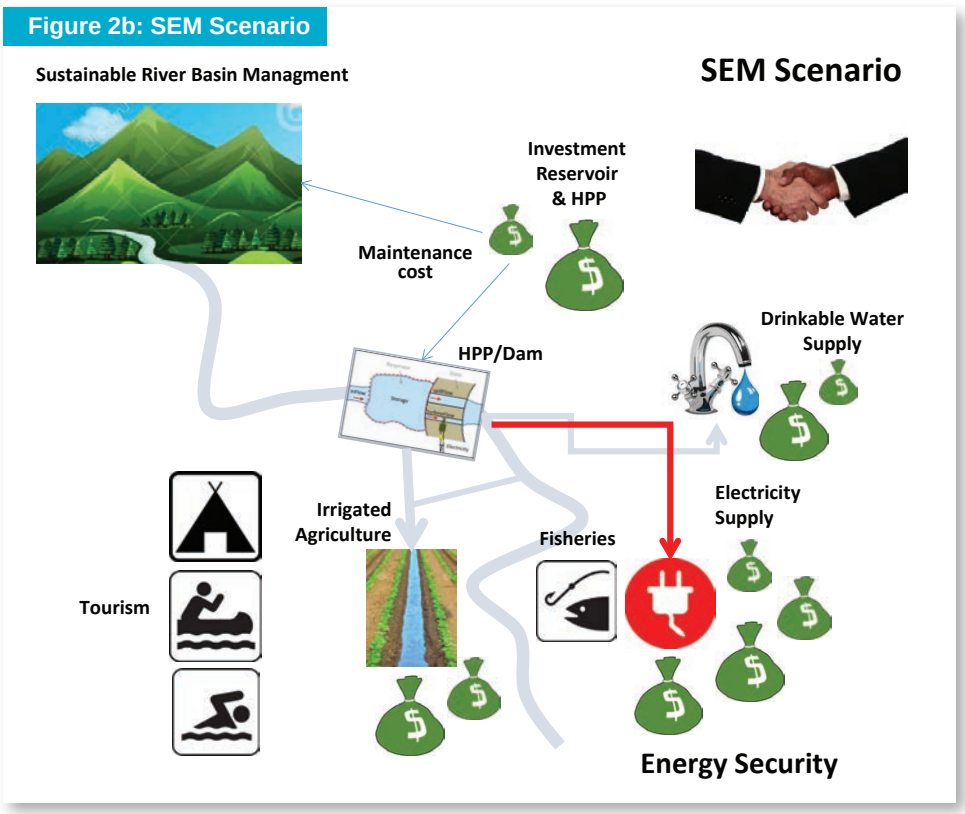


Table 10. Possible reform package for Armenia

Law/regulation/policy by sector	Critical issue or gap	Proposed amendment
Law on Energy Efficiency and Renewable Energy and related National Programme	The law does not include any provision regarding river basins/freshwater ecosystem management. Efficiency measures are not included in the law.	- Incorporate water ESS management principles. - Introduce bylaws on standards for developing river basin management plans. - Define and introduce efficiency standards and financial incentives.
Water Code	Lack of bylaws that provide guidelines on HPP/Dams development and management.	- Introduce adequate bylaws and funding mechanisms.
Agriculrure Law: Law on approval of annual and complex plans of restoration, conservation, regeneration and use of Sevan Lake ecosystem (2001)	Law permits excessive water withdraws because of inefficient irrigation systems (high waste rate and non-irrigation uses).	- Introduce bylaws to monitor water usage and efficiency, and metering. - Develop financial incentives.
Forest Code (2005) Land Use Planning Policy Agriculture Policy	Not integrated to HPP/Dams policies. Lack of standards on maintenance of water quality and quantity in upper river basins.	- Improve bylaws related to inter-sectoral collaboration and standards to support quality and quantity of water flows. - Develop fiscal incentives.
Environmental Impact Assessments (EIA) in the HPP/Dams sector	Current EIA guidelines are randomly applied and exclude ecosystems management in the upper river basins.	- Enforce rigorous EIA and expand scope of EIA to include ecosystems management in the upper and lower river basins (above and below the HPP/Dam).
Municipal Code for trash management: Law on Waste (2004) of the Republic of Armenia	Lack enforcement mechanisms to apply regulation and fines for trash disposal in rivers.	- Develop enforcement mechanisms. - Improve trash collection and disposal methods. - Assess cost of trash removal to establish high fines and mechanisms to collect fines.

Table 11. Possible reform package for Azerbaijan

Law/regulation/policy by sector	Critical issue or gap	Proposed amendment
Water Code	Lack of ecosystems vision, non-realistic goals, absence of river basin management principles and strategy. No opportunity for community participation.	- River basin management principles should be applied.
Law on Water Supply and Sewage	Low enforcement.	- Develop enforcement mechanisms, including fiscal incentives.
National Energy Action Plan for Azerbaijan	Less priority for small HPP	- Introduce bylaws to monitor water usage and efficiency, and metering. - Develop financial incentives.
Law on Environmental Protection	Law enforcement, no public ownership on natural resources, weak institutional structure.	- Better institutional structure, participatory approach.
Law on Amelioration and Irrigation	Weak participatory approach.	- Role of communities in water management should be identified. - Local communities' rights in terms of water withdrawals.
Law on Water Economy of Municipalities	Discrepancy between water code and law on water economy, no basin principles.	Municipalities' capacity to take benefits from existing law.
Nature Based Tourism Policy	No access of tourists directly to reservoirs. No encouragement for private sector participation.	- Introduce tourism strategy for reservoirs, with incentives for local governments and private sector participation.
Law on Water Economy of Municipalities	No basin principles, No private ownership on water supply, Not realistic goals.	- Role of municipalities in water management needs to be increased.
Environmental Impact Assessments (EIA) in the HPP/Dams sector	Current EIA guidelines are randomly applied and exclude ecosystems managements in the upper river basins.	- Enforce rigorous EIA and expand scope of EIA to include ecosystems management in the upper and lower river basins above and below the HPP/Dam.

Table 12. Possible reform package for Georgia

Law/regulation/policy by sector	Critical issue or gap	Proposed amendment
Spatial Planning Policy/ Legislation	Lack of spatial planning policy/legislation generates conflicts between development and conservation projects as well as between different resource-users.	- Elaboration of spatial planning policy/Legislation. - Develop implementation mechanisms.
Strategic Environmental Assessment (SEA)	Conflicting development plans of different industries. Implementation of many projects in one river basin. Absence of SEA hinders international investments.	- Elaboration of SEA policy/legislation and develop implementation mechanisms.
Energy Law	Lack of a national energy strategy and long-term planning.Tariffs are the same during all year. Owners of the dams haven't economic incentives for maintenance / cleaning of siltation of reservoirs. Conflict of interests in electricity market.	- Incorporate guidance on alternatives (including small HPPs, wind and solar energy, biomass, energy efficiency, etc.). - Differentiation of electricity tariffs: summer and winter seasonal tariffs to attract investments and economic development.
Law on Energy Efficiency and Renewable Energy	Unsustainable use of resources; energy security issues.	- Elaboration of the legislative package, including the financial action plan on renewable energy and energy efficiency with the participation of experts and the public.
EIA Law/Regulations	Deficient EIA system, poor planning increases cost of projects and conflict between developers, local population and environmental organizations. Mining is not a subject of EIA; ineffective public participation procedures; cost-benefit analysis not applied.	- Improve public participation procedures. - Introduce screening and scoping stages. - Introduce cost-benefit analysis and biodiversity compensation mechanisms. - Improve compensation schemes for affected communities.
Forest Law	Deforestation, degradation and fragmentation of forest habitats. Forests are under pressure from unsustainable logging and overgrazing and poor management practices.	- Forest zoning; Categorization according to their different values and functions; Reorganize the forest fund of Georgia; Expand forest protection categories; Elaboration of Sustainable Forest Management (SFM) Standards including forest use.
Protected Areas related legislation	Poor representativeness of area under protection -only 7,3% of the territory. Too few PA in upper Black Sea Basin. Upper river basins: Enguri (Inguri), Rioni, Tekhuri and other rivers of the Black Sea Basin are unprotected. Lack of conservation corridors. PAs network is not sufficient for adequate protection of ESS.	- Establish new protected areas in upper river basins (Enguri (Inguri), Rioni, Tekhuri, etc.). - Establish and manage ecological corridors. - Establish "Emerald network" .
Legislation on Environmental Law Enforcement	Deforestation, erosion, overgrazing due to weak law enforcement (forest and water management, etc.).	- Improve legislation/policy on law enforcement. - Capacity building of relevant institutions.
Water Law	Absence of fresh water ecosystems management plans; Outdated (Soviet) standards of water use.	- Introduce integrated watershed management system (energy, forest, agriculture, water supply sectors).
Water management; energy sector	Outdated system & methodology of calculation of bypass flow - 10% of mean monthly flow during low -water season and10% of mean annual flow for the rest of the period ("sanitary flow" - 10% of average annual water flow).	- Update a system for water availability criteria for sustainable development of HPPs, based on modern environmental standards.
Legislation related to agriculture	Overgrazing and unsustainable development of irrigation systems caused by the poor regulations. Pastures are severely degraded due to overutilization. In areas of intensive grazing erosion processes intensified. At present grazing in Georgia is carried out in a non-systematic, unorganized manner.	- Establish standards for sustainable grazing/ pasture management. - Define optimum grazing levels and enforce by relevant legal instruments.

6. AFTERWORD

The three studies presented in this report offer substantial and immediate opportunities to avoid further harm to freshwater ecosystems and biodiversity from the development of hydropower and indeed other sectors that use water and to improve the governance and management of ecosystems that provide services to water users.

The study of critical sites for threatened freshwater biodiversity presented in Chapter 3 identifies freshwater Key Biodiversity Areas/KBAs in the South Caucasus that are of crucial importance for the conservation of globally and nationally threatened species. The study provides a solid basis for more detailed assessments that would serve to identify hotspots of freshwater biodiversity that should be considered "no-go" areas for development and, as such, given protected status and included in Armenia's, Azerbaijan's and Georgia's protected areas networks. Hotspots that are less critical, but still important for biodiversity conservation, could be given special consideration in hydropower development strategies and in the planning of individual projects.

The study of planning and assessment of sustainable hydropower presented in Chapter 4 proposes many ways of closing gaps and addressing weaknesses in the South Caucasus countries' current approaches in the field. Relatively simple and inexpensive changes have been applied successfully in other countries - better planning of the expansion of energy generation, including bringing multiple criteria into planning, providing for multiple stakeholder perspectives and coordination, and with periodic updating of expansion plans; protecting "No-Go" or "Off-Limits" areas; reviewing environmental and social assessment and licensing systems; developing guidelines for hydropower EIAs; developing technical standards for high-priority topics; piloting river-basin and regional level planning and assessment; using licenses to ensure good project performance. Applying these and other measures recommended in Chapter 4 would result in a "win-win" outcome for threatened freshwater ecosystems and biodiversity and hydropower investors.

The study of the value of ecosystem services to the hydropower sector presented in Chapter 5 turns the perspective from hydropower as a threat to hydropower being a beneficiary of good ecosystem management and therefore threatened by poor ecosystem management. The Target Scenario Approach which compares outcomes of the business as usual/BAU scenario and the sustainable ecosystem management/SEM scenario is a helpful tool for determining and demonstrating the economic, social and environmental costs of unsustainable management practices. The analysis shows that unsustainable forest management in particular can cause substantial increases in operating costs and reduce the operating life of HPPs/dams. As the study demonstrated the hydropower sector should be as concerned about the sustainable use of ecosystem services as other interest groups.

Lake Sevan, Armenia ©A. Bukhnikashvili

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Annex 1. Target species used to identify freshwater Key Biodiversity Areas

#	Country	Kingdom	Class	Order	Common Name	Latin Name	IUCN Red List Status	National Red Lists Status	Species of Additional Conservation Concern
1	Armenia	Animalia	Amphibia	Caudata	Northern banded newt	*Ommatotriton ophryticus*		CR	
2	Armenia	Animalia	Amphibia	Anura	Eastern spadefoot	*Pelobates syriacus*		VU	
3	Armenia	Animalia	Aves	Passeriformes	Paddyfield warbler	*Acrocephalus agricola*		EN	
4	Armenia	Animalia	Aves	Anseriformes	Northern shoveler	*Anas clypeata*		VU	
5	Armenia	Animalia	Aves	Anseriformes	Greater white-fronted goose	*Anser albifrons*		VU	
6	Armenia	Animalia	Aves	Anseriformes	Greylag goose	*Anser anser*		VU	
7	Armenia	Animalia	Aves	Anseriformes	Lesser white-fronted goose	*Anser erythropus*	VU	VU	
8	Armenia	Animalia	Aves	Anseriformes	Ferruginous duck	*Aythya nyroca*		VU	
9	Armenia	Animalia	Aves	Anseriformes	Red-breasted goose	*Branta ruficollis*	EN	EN	
10	Armenia	Animalia	Aves	Charadriiformes	Kentish plover	*Charadrius alexandrinus*		VU	
11	Armenia	Animalia	Aves	Charadriiformes	White-tailed lapwing	*Chettusia leucura*		VU	
12	Armenia	Animalia	Aves	Charadriiformes	Whiskered tern	*Chlidonias hybrida*		VU	
13	Armenia	Animalia	Aves	Anseriformes	Bewick's swan	*Cygnus bewickii*		VU	
14	Armenia	Animalia	Aves	Anseriformes	Whooper swan	*Cygnus cygnus*		VU	
15	Armenia	Animalia	Aves	Anseriformes	Mute swan	*Cygnus olor*		VU	
16	Armenia	Animalia	Aves	Charadriiformes	Black-winged pratincole	*Glareola nordmanni*		VU	
17	Armenia	Animalia	Aves	Charadriiformes	Collared pratincole	*Glareola pratincola*		VU	
18	Armenia	Animalia	Aves	Gruiformes	Common crane	*Grus grus*		EN	
19	Armenia	Animalia	Aves	Charadriiformes	Eurasian oystercatcher	*Haematopus ostralegus*		VU	
20	Armenia	Animalia	Aves	Charadriiformes	Black-winged stilt	*Himantopus himantopus*		VU	
21	Armenia	Animalia	Aves	Charadriiformes	Armenian gull	*Larus armenicus*		VU	
22	Armenia	Animalia	Aves	Passeriformes	Savi's warbler	*Locustella luscinioides*		EN	
23	Armenia	Animalia	Aves	Anseriformes	Marbled teal	*Marmaronetta angustirostris*	VU	EN	
24	Armenia	Animalia	Aves	Anseriformes	Velvet scoter	*Melanitta fusca*	EN	DD	
25	Armenia	Animalia	Aves	Passeriformes	Citrine wagtail	*Motacilla citreola*		VU	
26	Armenia	Animalia	Aves	Anseriformes	White-headed duck	*Oxyura leucocephala*	EN	EN	
27	Armenia	Animalia	Aves	Accipitriformes	Osprey	*Pandion haliaetus*		VU	
28	Armenia	Animalia	Aves	Pelecaniformes	Dalmatian pelican	*Pelecanus crispus*	VU	EN	
29	Armenia	Animalia	Aves	Pelecaniformes	Great white pelican	*Pelecanus onocrotalus*		VU	
30	Armenia	Animalia	Aves	Pelecaniformes	Great cormorant	*Phalacrocorax carbo*		VU	
31	Armenia	Animalia	Aves	Pelecaniformes	Pygmy cormorant	*Phalacrocorax pygmaeus*		VU	
32	Armenia	Animalia	Aves	Ciconiformes	Eurasian spoonbill	*Platalea leucorodia*		EN	
33	Armenia	Animalia	Aves	Ciconiformes	Glossy ibis	*Plegadis falcinellus*		VU	
34	Armenia	Animalia	Aves	Podicipediformes	Red-necked grebe	*Podiceps grisegena*		VU	
35	Armenia	Animalia	Aves	Charadriiformes	Pied avocet	*Recurvirostra avosetta*		VU	
36	Armenia	Animalia	Aves	Charadriiformes	Little tern	*Sterna albifrons*		VU	
37	Armenia	Animalia	Aves	Charadriiformes	Gull-billed tern	*Sterna nilotica*		VU	
38	Armenia	Animalia	Aves	Anseriformes	Ruddy shelduck	*Tadorna ferruginea*		VU	
39	Armenia	Animalia	Aves	Anseriformes	Common shelduck	*Tadorna tadorna*		VU	
40	Armenia	Animalia	Insecta	Coleoptera		*Aeoloides figuratus*		VU	
41	Armenia	Animalia	Insecta	Odonata		*Aeshna cyanea*		EN	

#	Country	Kingdom	Class	Order	Common Name	Latin Name	IUCN Red List Status	National Red Lists Status	Species of Additional Conservation Concern
42	Armenia	Animalia	Insecta	Odonata		*Aeshna serrata*		EN	
43	Armenia	Animalia	Insecta	Odonata	Norfolk damselfly	*Coenagrion armatum*		CR	
44	Armenia	Animalia	Insecta	Odonata		*Coenagrion scitulum*		EN	
45	Armenia	Animalia	Insecta	Odonata	Oriental scarlet	*Crocothemis servilia*		EN	
46	Armenia	Animalia	Insecta	Coleoptera		*Cteniopus persimilis*		EN	
47	Armenia	Animalia	Insecta	Coleoptera		*Drasterius atricapillus*		EN	
48	Armenia	Animalia	Insecta	Coleoptera		*Duvalius stepanavanensis*		CR	
49	Armenia	Animalia	Insecta	Coleoptera		*Duvalius yatsenkokhmelevskii*		CR	
50	Armenia	Animalia	Insecta	Coleoptera		*Dyschirius sevanensis*		EN	
51	Armenia	Animalia	Insecta	Odonata		*Erythromma lindeni*		CR	
52	Armenia	Animalia	Insecta	Odonata		*Gomphus ubadschii*		EN	
53	Armenia	Animalia	Insecta	Odonata	Vagrant emperor	*Hemianax ephippiger*		EN	
54	Armenia	Animalia	Insecta	Odonata		*Lestes macrostigma*		VU	
55	Armenia	Animalia	Insecta	Odonata		*Leucorrhinia pectoralis*		CR	
56	Armenia	Animalia	Insecta	Odonata	Red chaser	*Libellula pontica*		EN	
57	Armenia	Animalia	Insecta	Odonata	Dark princetail	*Onychogomphus assimilis*	VU	VU	
58	Armenia	Animalia	Insecta	Odonata	Slender skimmer	*Orthetrum sabina*		EN	
59	Armenia	Animalia	Insecta	Odonata	Blue featherleg	*Platycnemis pennipes*		EN	
60	Armenia	Animalia	Insecta	Lepidoptera	Willowherb hawkmoth	*Proserpinus proserpina*		VU	
61	Armenia	Animalia	Insecta	Odonata		*Sympecma paedisca*		VU	
62	Armenia	Animalia	Insecta	Odonata		*Sympetrum depressiusculum*		EN	
63	Armenia	Animalia	Mammalia	Carnivora	Eurasian otter	*Lutra lutra*		EN	
64	Armenia	Animalia	Mammalia	Eulipotyphla	Transcaucasian water shrew	*Neomys schelkovnikovi*		EN	
65	Armenia	Animalia	Mollusca	Gastropoda		*Bithynia troscheli*		CR	
66	Armenia	Animalia	Mollusca	Gastropoda		*Gyraulus albus*		EN	
67	Armenia	Animalia	Mollusca	Gastropoda	Smooth ram's horn snail	*Gyraulus laevis*		EN	
68	Armenia	Animalia	Mollusca	Gastropoda		*Gyraulus regularis*		CR	
69	Armenia	Animalia	Mollusca	Bivalvia		*Musculium strictum*		CR	
70	Armenia	Animalia	Mollusca	Bivalvia		*Odhneripisidium annandalei*		CR	
71	Armenia	Animalia	Mollusca	Gastropoda		*Planorbis carinatus*		CR	
72	Armenia	Animalia	Mollusca	Gastropoda		*Shadinia akramovskii*		CR	
73	Armenia	Animalia	Pisces	Cypriniformes	Sevan khramulya	*Capoeta sevangi*		VU	
74	Armenia	Animalia	Pisces	Cypriniformes	Sevan barbel	*Barbus goctschaicus*		VU	
75	Armenia	Animalia	Pisces	Cypriniformes		*Cyprinus carpio*	VU		
76	Armenia	Animalia	Pisces	Cypriniformes	Asp	*Leuciscus aspius*		VU	
77	Armenia	Animalia	Pisces	Cypriniformes		*Luciobarbus capito*	VU		
78	Armenia	Animalia	Pisces	Cypriniformes	Armenian roach	*Rutilus rutilus schelkovnikovi*		EN	
79	Armenia	Animalia	Pisces	Salmoniformes	Summer bakhtak	*Salmo ischchan aestivalis*		CR	
80	Armenia	Animalia	Pisces	Salmoniformes	Gegharkuni	*Salmo ischchan gegarkuni*		CR	
81	Armenia	Plantae	Liliopsida	Acorales	Sweet flag	*Acorus calamus*		EN	
82	Armenia	Plantae	Magnoliopsida	Caryophyllales		*Anthochlamys polygaloides*		CR	
83	Armenia	Plantae	Magnoliopsida	Lamiales	Water starwort	*Callitriche hermaphroditica*		CR	
84	Armenia	Plantae	Liliopsida	Cyperales	Bohemian sedge	*Carex bohemica*		EN	

#	Country	Kingdom	Class	Order	Common Name	Latin Name	IUCN Red List Status	National Red Lists Status	Species of Additional Conservation Concern
85	Armenia	Plantae	Magnoliopsida	Asterales	Nodding starwort	*Carpesium abrotanoides*		*EN*	
86	Armenia	Plantae	Magnoliopsida	Myrtales	Dodon's fireweed	*Chamaenerion dodonaei*		*EN*	
87	Armenia	Plantae	Magnoliopsida	Caryophyllales	Ragged Robin	*Coccyganthe flos-cuculi*		*CR*	
88	Armenia	Plantae	Liliopsida	Colchicales	Nina's meadow-saffron	*Colchicum ninae*		*EN*	
89	Armenia	Plantae	Liliopsida	Poales	Ravennagrass	*Erianthus ravennae*		*VU*	
90	Armenia	Plantae	Magnoliopsida	Apiales	Sickleweed	*Falcaria falcarioides*		*CR*	
91	Armenia	Plantae	Magnoliopsida	Fabales	Liquorice	*Glycyrrhiza echinata*		*VU*	
92	Armenia	Plantae	Liliopsida	Potamogetonaceae		*Groenlandia densa*		*EN*	
93	Armenia	Plantae	Magnoliopsida	Gentianales		*Lomatogonium carinthiacum*		*VU*	
94	Armenia	Plantae	Magnoliopsida	Gentianales	Bogbean / Buckbean	*Menyanthes trifoliata*		*VU*	
95	Armenia	Plantae	Liliopsida	Najadales	Slender naiad	*Najas minor*		*VU*	
96	Armenia	Plantae	Magnoliopsida	Nymphaeales	Yellow water-lily	*Nuphar lutea*		*CR*	
97	Armenia	Plantae	Magnoliopsida	Nymphaeales	White water-lily	*Nymphaea alba*		*EN*	
98	Armenia	Plantae	Magnoliopsida	Apiales	Water dropwort	*Oenanthe silaifolia*		*CR*	
99	Armenia	Plantae	Magnoliopsida	Hamamelidales	Oriental plane	*Platanus orientalis*		*EN*	
100	Armenia	Plantae	Magnoliopsida	Rosales	Tormentil	*Potentilla erecta*		*CR*	
101	Armenia	Plantae	Liliopsida	Poales	Grossheim's alkaligrass	*Puccinellia grossheimiana*		*EN*	
102	Armenia	Plantae	Magnoliopsida	Ranunculales	Great spearwort	*Ranunculus lingua*		*EN*	
103	Armenia	Plantae	Magnoliopsida	Brassicales	Spasskaya's yellowcress	*Rorippa spaskajae*		*CR*	
104	Armenia	Plantae	Liliopsida	Alismatales	Arrowhead (Duck potato)	*Sagittaria sagittifolia*		*CR*	
105	Armenia	Plantae	Liliopsida	Alismatales	Threeleaf arrowhead	*Sagittaria trifolia*		*CR*	
106	Armenia	Plantae	Pteridopsida	Salviniales	Floating fern	*Salvinia natans*		*CR*	
107	Armenia	Plantae	Liliopsida	Amaryllidales	Rosen's squill	*Scilla rosenii*		*EN*	
108	Armenia	Plantae	Magnoliopsida	Caryophyllales		*Tamarix octandra*		*EN*	
109	Armenia	Plantae	Pteridopsida	Polypodiales	Marsh fern	*Thelypteris palustris*		*CR*	
110	Armenia	Plantae	Magnoliopsida	Fabales		*Trigonella capitata*		*EN*	
111	Armenia	Plantae	Magnoliopsida	Lamiales	Flatleaf bladderwort	*Utricularia intermedia*		*EN*	
112	Azerbaijan	Animalia	Aves	Anseriformes	Lesser white-fronted goose	*Anser erythropus*	*VU*	*VU*	
113	Azerbaijan	Animalia	Aves	Anseriformes	Ferruginous duck	*Aythya nyroca*		*VU*	
114	Azerbaijan	Animalia	Aves	Anseriformes	Red-breasted goose	*Branta ruficollis*	*EN*	*EN*	
115	Azerbaijan	Animalia	Aves	Ciconiformes	Black stork	*Ciconia nigra*		*VU*	
116	Azerbaijan	Animalia	Aves	Anseriformes	Bewick's swan	*Cygnus bewickii*		*VU*	
117	Azerbaijan	Animalia	Aves	Anseriformes	Mute swan	*Cygnus olor*		*VU*	
118	Azerbaijan	Animalia	Aves	Anseriformes	Marbled teal	*Marmaronetta angustirostris*	*VU*	*EN*	
119	Azerbaijan	Animalia	Aves	Anseriformes	White-headed duck	*Oxyura leucocephala*	*EN*	*EN*	
120	Azerbaijan	Animalia	Aves	Pelecaniformes	Dalmatian pelican	*Pelecanus crispus*	*VU*	*VU*	
121	Azerbaijan	Animalia	Aves	Pelecaniformes	Great white pelican	*Pelecanus onocrotalus*		*VU*	
122	Azerbaijan	Animalia	Aves	Ciconiformes	Eurasian spoonbill	*Platalea leucorodia*		*EN*	
123	Azerbaijan	Animalia	Crustacea	Decapoda		*Pontastacus pylzowi*		*VU*	
124	Azerbaijan	Animalia	Insects	Coleoptera		*Ancyclocheria solomonii*		*CR*	
125	Azerbaijan	Animalia	Insects	Coleoptera		*Hemidicera fritillum*		*CR*	
126	Azerbaijan	Animalia	Insects	Coleoptera		*Megacephala euphratica*		*CR*	
127	Azerbaijan	Animalia	Insects	Coleoptera		*Rhaesus serricollis*		*VU*	

#	Country	Kingdom	Class	Order	Common Name	Latin Name	IUCN Red List Status	National Red Lists Status	Species of Additional Conservation Concern
128	Azerbaijan	Animalia	Mammalia	Carnivora	Eurasian otter	*Lutra lutra*		VU	
129	Azerbaijan	Animalia	Mollusca	Bivalvia		*Unio crassus*	EN		
130	Azerbaijan	Animalia	Pisces	Acipenseriformes	Russian sturgeon	*Acipenser gueldenstaedtii*	CR		
131	Azerbaijan	Animalia	Pisces	Acipenseriformes	Ship	*Acipenser nudiventris*	CR	CR	
132	Azerbaijan	Animalia	Pisces	Acipenseriformes	Persian sturgeon	*Acipenser persicus*	CR		
133	Azerbaijan	Animalia	Pisces	Acipenseriformes	Stellate sturgeon	*Acipenser stellatus*	CR		
134	Azerbaijan	Animalia	Pisces	Cypriniformes		*Ballerus sapa*		CR	
135	Azerbaijan	Animalia	Pisces	Cypriniformes		*Cyprinus carpio*	VU		
136	Azerbaijan	Animalia	Pisces	Acipenseriformes	Beluga	*Huso huso*	CR	CR	
137	Azerbaijan	Animalia	Pisces	Cypriniformes		*Leucaspius delineatus*			Very rarely found species in Azerbaijan.
138	Azerbaijan	Animalia	Pisces	Cypriniformes		*Luciobarbus brachycephalus*	VU	CR	
139	Azerbaijan	Animalia	Pisces	Cypriniformes		*Luciobarbus capito*	VU	CR	
140	Azerbaijan	Animalia	Pisces	Cypriniformes		*Pelecus cultratus*		CR	
141	Azerbaijan	Animalia	Pisces	Cypriniformes		*Rutilus atropatenae*	CR		
142	Azerbaijan	Animalia	Pisces	Cypriniformes		*Rutilus sojuchbulagi*	CR		
143	Azerbaijan	Animalia	Pisces	Salmoniformes		*Salmo trutta*		EN	
144	Azerbaijan	Animalia	Pisces	Salmoniformes		*Salmo trutta caspius*		CR	
145	Azerbaijan	Animalia	Reptilia	Serpentes		*Natrix megalocephala*	VU		
146	Azerbaijan	Plantae	Monocotyledons	Liliales	Paleyellow iris	*Iris pseudacorus*		VU	
147	Azerbaijan	Plantae	Dicotyledoneae	Myrtales	Hampshire - Purslane	*Ludwigia palustris*			This species has limited distribution in Azerbaijan.
148	Azerbaijan	Plantae	Monocotyledoneae	Alismatales	Brittle naiad or Brittle waternymph	*Najas minor*			This species has limited distribution in Azerbaijan.
149	Azerbaijan	Plantae	Dicotyledoneae	Nelumbonales	Caspian lotus	*Nelumbo caspica*		VU	
150	Azerbaijan	Plantae	Dicotyledoneae	Nymphaeales	European white waterlily; White lotus; White water rose; or Nenuphar	*Nymphaea alba*		VU	
151	Azerbaijan	Plantae	Dicotyledoneae	Myrtales	Pomegranate	*Punica granatum*		VU	
152	Azerbaijan	Plantae	Monocotyledoneae	Alismatales	Threeleaf arrowhead	*Sagittaria trifolia*		EN	
153	Azerbaijan	Plantae	Dicotyledoneae	Lamiales	Bbladderworts	*Urticularia vulgaris*			This species has limited distribution in Azerbaijan.
154	Georgia	Animalia	Amphibia	Caudata	Caucasian salamander	*Mertensiella caucasica*	VU	VU	
155	Georgia	Animalia	Amphibia	Anura	Syrian spadefoot	*Pelobates syriacus*		EN	
156	Georgia	Animalia	Aves	Anseriformes	Lesser white -fronted goose	*Anser erythropus*	VU	EN	
157	Georgia	Animalia	Aves	Ciconiformes	Black stork	*Ciconia nigra*		VU	
158	Georgia	Animalia	Aves	Gruiformes	Common crane	*Grus grus*		EN	
159	Georgia	Animalia	Aves	Accipitriformes	White tailed eagle	*Haliaeetus albicilla*		EN	
160	Georgia	Animalia	Aves	Anseriformes	Velvet scoter	*Melanitta fusca*	EN	EN	
161	Georgia	Animalia	Aves	Anseriformes	White-headed duck	*Oxyura leucocephala*	EN	EN	
162	Georgia	Animalia	Aves	Passeriformes	Bearded reedling	*Panurus biarmicus*		VU	
163	Georgia	Animalia	Aves	Pelecaniformes	Dalmatian pelican	*Pelecanus crispus*	VU	EN	
164	Georgia	Animalia	Aves	Pelecaniformes	Great white pelican	*Pelecanus onocrotalus*		VU	
165	Georgia	Animalia	Aves	Podicipediformes	Red-necked grebe	*Podiceps grisegena*		VU	
166	Georgia	Animalia	Aves	Anseriformes	Ruddy shelduck	*Tadorna ferruginea*		VU	
167	Georgia	Animalia	Crustacea	Decapoda	Colchic crayfish	*Astacus colchicus*		VU	
168	Georgia	Animalia	Crustacea	Decapoda	Pyltsov`s crayfish	*Pontastacus pylzovi*		VU	
169	Georgia	Animalia	Insecta	Odonata		*Calopteryx mingrelica*		VU	

#	Country	Kingdom	Class	Order	Common Name	Latin Name	IUCN Red List Status	National Red Lists Status	Species of Additional Conservation Concern
170	Georgia	Animalia	Insecta	Odonata		*Cordulegaster mzymtae*		VU	
171	Georgia	Animalia	Insecta	Odonata	Dark pincertail	*Onychogomphus assimilis*	VU	VU	
172	Georgia	Animalia	Mammalia	Carnivora	European otter	*Lutra lutra*		VU	
173	Georgia	Animalia	Mollusca	Bivalvia		*Sphaerium solidum*	VU		
174	Georgia	Animalia	Mollusca	Bivalvia	Thick shelled river mussel	*Unio crassus*	EN		
175	Georgia	Animalia	Mollusca	Gastropoda	Desmoulin's whorl snail	*Vertigo moulinsiana*	VU		
176	Georgia	Animalia	Pisces	Acipenseriformes	Russian sturgeon	*Acipenser gueldenstaedtii*	CR	EN	
177	Georgia	Animalia	Pisces	Acipenseriformes	Ship	*Acipenser nudiventris*	CR	EN	
178	Georgia	Animalia	Pisces	Acipenseriformes	Persian sturgeon	*Acipenser persicus*	CR	EN	
179	Georgia	Animalia	Pisces	Acipenseriformes	Stellate sturgeon	*Acipenser stellatus*	CR	EN	
180	Georgia	Animalia	Pisces	Acipenseriformes	Atlantic sturgeon	*Acipenser sturio*	CR	CR	
181	Georgia	Animalia	Pisces	Clupeiformes	Pontic shad	*Alosa immaculata*	VU		
182	Georgia	Animalia	Pisces	Cypriniformes	Colchic khramulya	*Capoeta banarescui*		VU	
183	Georgia	Animalia	Pisces	Acipenseriformes	Beluga	*Huso huso*	CR	EN	
184	Georgia	Animalia	Pisces	Cypriniformes	Asp	*Leuciscus aspius*		VU	
185	Georgia	Animalia	Pisces	Gobiiformes	Monkey goby	*Neogobius fluviatilis*		VU	
186	Georgia	Animalia	Pisces	Cypriniformes	Alazani loach	*Oxynoemachilus alasanicus*		VU	
187	Georgia	Animalia	Pisces	Cypriniformes	Black sea roach	*Rutilus frisii*		VU	
188	Georgia	Animalia	Pisces	Cypriniformes	Golden spined loach	*Sabanejewia aurata*		VU	
189	Georgia	Animalia	Pisces	Salmoniformes		*Salmo trutta*		VU	
190	Georgia	Animalia	Pisces	Salmoniformes	Black sea salmon	*Salmo labrax*		EN	
191	Georgia	Animalia	Reptilia	Squamata	Clarks' lizard	*Darevskia clarkorum*	EN	EN	
192	Georgia	Animalia	Clitellata	Haplotaxida		*Dendrobaena faucium*		VU	
193	Georgia	Animalia	Reptilia	Serpentes	Large-headed water snake	*Natrix megalocephala*	VU		
194	Georgia	Plantae	Magnoliopsida	Caryophyllales	Common sundew	*Drosera rotundifolia*			Rare species and currently being considered for inclusion in the Red List of Georgia (National assessment for Georgia EN / A1a).
195	Georgia	Plantae	Magnoliopsida	Ranunculales	Smirnov's gymnospermium	*Gymnospermium smirnovii*			Endemic species and currently being considered for inclusion in the Red List of Georgia (assessed as EN B1ab(ii,iii,v)+2ab(ii,iii,v)).
196	Georgia	Plantae	Magnoliopsida	Malvales	Pontic hibiscus	*Hibiscus ponticus*			Rare species and endemic to Georgia, currently being considered for inclusion in the Red List of Georgia (assessed as CR C2a(i).
197	Georgia	Plantae	Magnoliopsida	Malvales	Five-fruited kosteletzkya	*Kosteletzkya pentacarpos*			Rare species currently being considered for inclusion in the Red List of Georgia (assessed as CR / C2a(i)).
198	Georgia	Plantae	Polypodiopsida	Salviniales	Water shamrock	*Marsilea quadrifolia*			Rare species currently being considered for inclusion in the Red List of Georgia (assessed as CR / D)).
199	Georgia	Plantae	Magnoliopsida	Asterales	Bogbean / Buckbean	*Menyanthes trifoliata*			Rare species currently being considered for inclusion in the Red List of Georgia.
200	Georgia	Plantae	Magnoliopsida	Nymphaeales	Yellow water-lily	*Nuphar lutea*			Rare species currently being considered for inclusion in the Red List of Georgia. Threatened by extinction at national level. According to current obsrevations, the species is not found on the majority of its known localities.
201	Georgia	Plantae	Polypodiopsida	Osmundales	Royal fern	*Osmunda regalis*			Rare species currently being considered for inclusion in the Red List of Georgia (assessed as VU / B1ab(ii) for Georgia).
202	Georgia	Plantae	Magnoliopsida	Malpighiales	Euphratian poplar	*Populus euphratica*		CR	

#	Country	Kingdom	Class	Order	Common Name	Latin Name	IUCN Red List Status	National Red Lists Status	Species of Additional Conservation Concern
203	Georgia	Plantae	Magnoliopsida	Fagales	Caucasian wingnut	*Pterocarya pterocarpa*		VU	
204	Georgia	Plantae	Magnoliopsida	Fagales	Colchic oak	*Quercus hartwissiana*		VU	
205	Georgia	Plantae	Magnoliopsida	Fagales	Imeretian oak	*Quercus imeretina*		VU	
206	Georgia	Plantae	Magnoliopsida	Fagales	Pedunculate oak	*Quercus pedunculiflora*		VU	
207	Georgia	Plantae	Magnoliopsida	Lamiales	Medwedew's rhamphicarpa	*Rhamphicarpa medwedewii*			Rare species currently being considered for inclusion in the Red List of Georgia (assessed as EN / A1a for Georgia).
208	Georgia	Plantae	Liliopsida	Cyperales	Caucasian rhynchospora	*Rhynchospora caucasica*			Endemic to Georgia occurring at a single location (assessed as EN / B2ab(ii) for Georgia).
209	Georgia	Plantae	Magnoliopsida	Malpighiales	Kikodze's willow	*Salix kikodzeae*		EN	
210	Georgia	Plantae	Polypodiopsida	Salviniales	Floating fern	*Salvinia natans*			Rare species of freshwater fern in Georgia (assessed as CR / D for Georgia).
211	Georgia	Plantae	Magnoliopsida	Asterales	Turf goldenrod	*Solidago turfosa*			Endemic and rare species in Georgia currently being considered for inclusion in the Red List of Georgia (assessed as EN / B2ab(iii)).
212	Georgia	Plantae	Magnoliopsida	Myrtales	Colchis water - chestnut	*Trapa colchica*	CR		
213	Georgia	Plantae	Magnoliopsida	Myrtales	Maleev's water - chestnut	*Trapa maleevii*	VU		
214	Georgia	Plantae	Magnoliopsida	Rosales	Scots elm	*Ulmus glabra*		VU	
215	Georgia	Plantae	Magnoliopsida	Rosales	Caucasian zelkova	*Zelkova carpinifolia*		VU	

Annex 2. Freshwater Key Biodiversity Areas

#	KBA Name	KBA (ha)	Country(ies)	Species Richness	Species Summary Analysis by Categories	KBA Overview	KBA Landscape Subtypes and Water Bodies
1	Ritsa	9,077	Georgia	Insecta: Cordulegaster mzymtae Mammalia: Lutra lutra	Totally: 2 species - National Red List: 2 species	Lake Ritsa is located in Bzipi River basin, in a deep canyon of Lashipse-Lupshara river at 884 m. a.s.l. in the northern part of Abkhazia. The lake is transparent and one of the deepest lakes in Georgia (116 m). The KBA is one of the IBAs of Georgia. In 1930 the Ritsa Nature Reserve (162.89 km²) was established to protect the lake and the surrounding land. The lake was an important tourist attraction during the Soviet period and it is still frequented by tourists.	Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; Colchic middle-mountain landscapes with beech forests mainly with evergreen understory; Caucasian middle-mountain landscapes with beech-dark coniferous and dark coniferous (spruce-fir) forests, partly with evergreen underwood; Lake Ritsa, Lake Small Ritsa.
2	Kolkheti 1	505,063	Georgia	Clitellata: Dendrobaena faucium; Crustacea: Astacus colchicus; Mammalia: Lutra lutra; Mollusca: Vertigo moulinsiana, Unio crassus; Pisces: Salmo labrax,Huso huso, Acipenser gueldenstaedtii,Acipenser stellatus,Capoeta banarescui, Rutilus frisii,Leuciscus aspius; Reptilia: Natrix megalocephala; Plantae: Pterocarya pterocarpa, Hibiscus ponticus, Quercus hartwissiana, Quercus imeretina, Ulmus glabra,Osmunda regalis, Zelkova carpinifolia,Nuphar lutea, Rhamphicarpa medwedewii, Trapa colchica, Trapa maleevii	Totally: 24 species - IUCN Red List: 5 species - National Red List: 12 species - IUCN and National Red Lists: 3 species - Species of additional conservation concern: 4 species	The KBA covers Kolkheti National Park, which includes east coast line of Black Sea and Lake Paliastomi basin. There are coastal peat bogs between the mouths of the Supsa, Rioni, Khobi and Enguri rivers (Grigoleti, Imnati, Nabada, Churia etc.). The landscape comprise of swamp alder forests, sphagnum bogs and foothills with hornbeam-oak forest alternating with beech-chestnut, oak-Zelkova and multispecies forest with evergreen understory shrubs.	Caucasian middle-mountain landscapes with beech-dark coniferous and dark coniferous (spruce-fir) forests, partly with evergreen underwood; Colchic low-mountain landscapes with hornbeam-oak and hornbeam-beech-chestnut forests mainly with evergreen understory, partly alternating with oak-pine forests; Colchic middle-mountain landscapes with beech forests mainly with evergreen understory; Caucasian middle-mountain landscapes with beech-dark coniferous and dark coniferous (spruce-fir) forests, partly with evergreen underwood; Colchic Lowland landscapes with swamp alder forest and sphagnum bogs and foothill landscapes with hornbeam-oak forest alternating with beech-chestnut, oak-Zelkova and poly-dominant forest with evergreen under story; Rivers: Kodori, Enguri, Galidzga, Gubistskali,Tskhenistskali; Reservoir Jvari.
3	Enguri	11,992	Georgia	Aves: Haliaeetus albicilla, Anser erythropus, Melanitta fusca,Oxyura leucocephala, Tadorna ferruginea, Ciconia nigra,Panurus biarmicus, Pelecanus crispus, Pelecanus onocrotalus Mammalia: Lutra lutra Mollusca: Vertigo moulinsiana, Unio crassus Pisces: Salmo labrax, Acipenser gueldenstaedtii, Acipenser stellatus, Huso huso, Leuciscus aspius Reptilia: Natrix megalocephala Plantae: Kosteletzkya pentacarpos	Totally: 19 species - IUCN Red List: 3 species - National Red List: 8 species - IUCN and National Red Lists:7 species - Species of additional conservation concern: 1 species	The KBA landscape comprises of swamp alder forests, sphagnum bogs and foothill landscapes with hornbeam-oak forest alternating with beech-chestnut, oak-Zelkova and poly-dominant forest with evergreen understory shrubs. The Enguri River plays an important role in the Georgian energy production but has massively alternated the Enguri (Inguri) river ecosystem. Sturgeons no longer spawn in the Enguri (Inguri) river.	Colchic Lowland landscapes with swamp alder forest and sphagnum bogs and foothill landscapes with hornbeam-oak forest alternating with beech-chestnut, oak-Zelkova and poly-dominant forest with evergreen under story; River Enguri.
4	Khobi	31,091	Georgia	Aves: Haliaeetus albicilla, Anser erythropus, Melanitta fusca, Oxyura leucocephala, Tadorna ferruginea, Ciconia nigra, Panurus biarmicus, Pelecanus crispus, Pelecanus onocrotalus Clitellata: Dendrobaena faucium Crustacea: Astacus colchicus Mammalia: Lutra lutra Mollusca: Vertigo moulinsiana, Unio crassus Pisces: Acipenser gueldenstaedtii, Acipenser persicus, Huso huso Reptilia: Natrix megalocephala Plantae: Pterocarya pterocarpa, Quercus hartwissiana, Kosteletzkya pentacarpos, Nuphar lutea, Hibiscus ponticus, Quercus imeretina, Ulmus glabra	Totally: 25 species - IUCN Red List: 3 species - National Red List: 12 species - IUCN and National Red Lists: 7 species - Species of additional conservation concern: 3 species	The Khobi River basin covers an area of 1340 km2. The landscape of the KBA comprise swamp alder forests, sphagnum bogs and foothill landscapes. In 2000-2007 an oil depot for tankers was built in the village of Kulevi, near the mouth of the Khobi River.	Colchic Lowland landscapes with swamp alder forest and sphagnum bogs and foothill landscapes with hornbeam-oak forest alternating with beech-chestnut, oak-Zelkova and poly-dominant forest with evergreen under story; River Khobi.
5	Rioni	82,862	Georgia	Aves: Haliaeetus albicilla, Anser erythropus, Melanitta fusca,Oxyura leucocephala, Tadorna ferruginea, Ciconia nigra, Panurus biarmicus, Pelecanus crispus, Pelecanus onocrotalus Crustacea: Astacus colchicus Insecta: Calopteryx mingrelica Mammalia: Lutra lutra Mollusca: Vertigo moulinsiana, Unio crassus Pisces: Acipenser gueldenstaedtii, Acipenser nudiventris, Acipenser persicus, Acipenser stellatus, Alosa immaculata, Capoeta banarescui, Huso huso, Neogobius fluviatilis, Acipenser sturio, Rutilus frisii, Leuciscus aspius Reptilia: Natrix megalocephala Plantae: Pterocarya pterocarpa, Hibiscus ponticus, Quercus hartwissiana, Quercus imeretina, Ulmus glabra, Nuphar lutea, Osmunda regalis, Rhamphicarpa medwedewii, Solidago turfosa, Trapa colchica, Drosera rotundifolia, Zelkova carpinifolia	Totally: 38 species - IUCN Red List: 5 species - National Red List: 17 species - IUCN and National Red Lists: 10 species - Species of additional conservation concern: 6 species	The Rioni is the longest river which is situated completely within the territory of Georgia. Length of the river is 327 km and the drainage area around 13,400 km². The Rioni River KBA is one of the most important freshwater KBAs in the southern Caucasus holding important populations of globally threatened species of sturgeons and others. The KBA landscape forms with swamp alder forest and sphagnum bogs and foothill landscapes with hornbeam-oak forest alternating with beech-chestnut, oak-Zelkova and multispecies forest with evergreen understory shrubs. The river is mostly in a semi-natural condition, fast or moderately fast flowing with gravel and sand substrates, natural banks and moderately impacted hydrological regime and sediment flows. There are already hydropower plants (HPP) on the river: Rioni HPP (Rionhesi), Gumati I HPP (Gumathesi), Gumathesi II HPP (Gumathesi), Vartsikhe HPP (Vartsikhehesi). Power plants had also been constructed on the tributaries: Lajanuri HPP (Lajanurhesi), Shaori HPP (Shaorhesi), Tkibuli HPP (Tkibulhesi). The river is impacted by pollution especially from manganese mining.	Colchic middle-mountain landscapes with beech forests mainly with evergreen understory; Colchic low-mountain landscapes with hornbeam-oak and hornbeam-beech-chestnut forests mainly with evergreen understory, partly alternating with oak-pine forests; Lowland landscapes with wetlands; Colchic Lowland landscapes with swamp alder forest and sphagnum bogs and foothill landscapes with hornbeam-oak forest alternating with beech-chestnut, oak-Zelkova and poly-dominant forest with evergreen under story; Rivers: Rioni, Tskhenistskali, Kvirila, Gubistskali.

6	Paliastomi	23,832	Georgia	Aves: Haliaeetus albicilla, Anser erythropus, Melanitta fusca, Oxyura leucocephala, Tadorna ferruginea, Ciconia nigra, Panurus biarmicus, Pelecanus crispus, Pelecanus onocrotalus Crustacea: Astacus colchicus Insecta: Calopteryx mingrelica Mammalia: Lutra lutra Mollusca: Vertigo moulinsiana, Unio crassus Pisces: Acipenser gueldenstaedtii, Acipenser persicus, Huso huso, Leuciscus aspius, Alosa immaculata, Neogobius fluviatilis Reptilia: Natrix megalocephala Plantae: Trapa colchica, Trapa maleevii, Salvinia natans, Rhamphicarpa medwedewii, Solidago turfosa, Drosera rotundifolia, Hibiscus ponticus, Osmunda regalis, Quercus hartwissiana, Nuphar lutea	Totally: 31 species - IUCN Red List: 6 species - National Red List: 11 species - IUCN and National Red Lists: 7 species - Species of additional conservation concern: 7 species	Lake Paliastomi (area: 18.2 km², catchment area: 547 km², total volume of water: 52 mill. m³) is a shallow (maximal and mean depths: 3.2 m and 2.6 m) water body adjoining the Black Sea and located just South-East of Poti city. The lake is the focal part of the ecologically important and fragile Kolkheti wetland complex. Paliastomi apparently represents an old lagoon of the Black Sea, which was demarcated on the North by the Rioni river delta and subsequently closed off by barrier beach, formed from shifting river sediments. Once a fresh water lake with diverse plant, fish and wildlife, the cutting of a channel to the Sea (in 1924, widened substantially by storm surge in 1933) in order to reduce flooding in Poti has drastically altered the hydrological balance and productivity of the lake. Although the cutting of the channel is the significant factor, contributing to the loss of economically important freshwater fishery, some others seem also important in terms of negative impacts. Most frequently mentioned are over-fishing and poaching, peat and sapropel extraction activities and water pollution from toxins of decaying unexcavated peat layers, proximity to major urban areas of Poti, drainage of wetlands and run-offs from upstream agricultural activities.	Colchic Lowland landscapes with swamp alder forest and sphagnum bogs and foothill landscapes with hornbeam-oak forest alternating with beech-chestnut, oak-Zelkova and poly-dominant forest with evergreen under story; Lowland landscapes with wetlands; Rivers: Pichora, Supsa; Lake Paliastomi.
7	Kolkheti 2	84,980	Georgia	Crustacea: Astacus colchicus Insecta: Calopteryx mingrelica Mammalia: Lutra lutra Mollusca: Unio crassus Pisces: Capoeta banarescui, Leuciscus aspius, Salmo labrax, Salmo trutta Reptilia: Natrix megalocephala Plantae: Pterocarya pterocarpa, Quercus imeretina, Salvinia natans, Ulmus glabra, Zelkova carpinifolia, Rhynchospora caucasica	Totally: 15 species - IUCN Red List: 2 species - National Red List: 11 species - Species of additional conservation concern: 2 species	The most important parts of the KBA are wetlands, those are divided into three parts: South, North and Central wetlands. The major part of the wetlands is located in the central part and is composed by Anaklia-Churia, Chaladidi (Nabada) and Pichora-Paliastomi. The anthropogenic impact on wetlands include their draining and industrial peat mining caused the reduction of plant diversity. Natural plant communities are now rare.	Lowland landscapes with wetlands; Colchic Lowland landscapes with swamp alder forest and sphagnum bogs and foothill landscapes with hornbeam-oak forest alternating with beech-chestnut, oak-Zelkova and poly-dominant forest with evergreen under story; River Supsa.
8	Chorokhi - Ajaristskali	9,032	Georgia	Amphibia: Mertensiella caucasica Aves: Melanitta fusca, Tadorna ferruginea, Ciconia nigra, Pelecanus crispus, Pelecanus onocrotalus Crustacea: Astacus colchicus Insecta: Calopteryx mingrelica Mammalia: Lutra lutra Pisces: Acipenser gueldenstaedtii, Acipenser persicus, Huso huso, Capoeta banarescui, Salmo labrax, Salmo trutta Reptilia: Natrix megalocephala Plantae: Marsilea quadrifolia, Quercus hartwissiana, Menyanthes trifoliata, Hibiscus ponticus, Trapa colchica	Totally: 21 species - IUCN Red List: 2 species - National Red List: 10 species - IUCN and National Red Lists: 6 species - Species of additional conservation concern: 3 species	Chorokhi River comes from northeastern Turkey and 22 km of the river flows in Georgia, main tributaries in Georgia are the Acharistskali and Machakhelistskali. River Acharistsakali is 90 km long. Approximately 27 dams are build or under construction along the river Chorokhi on the territory of Turkey. Consequently, the river Chorokhi flow and solid sediment is regulated in the existing reservoirs, which significantly impacts on the hydrological regime of the river within the Georgian territory. Also in Georgia, the river catchment is massively impacted by hydropower construction. On Acharistskali River, the Acharistskali HPP is operated and also a cascade of HPPs are being constructed on Chorokhi-Acharistskali. The Chorokhi delta has received the status of an IBA, though still a lot of hunting activity is observed. The KBA landscape comprises middle-mountain landscapes with beech forests mainly with evergreen understory shrubs.	Colchic Lowland landscapes with swamp alder forest and sphagnum bogs and foothill landscapes with hornbeam-oak forest alternating with beech-chestnut, oak-Zelkova and poly-dominant forest with evergreen under story; Colchic low-mountain landscapes with hornbeam-oak and hornbeam-beech-chestnut forests mainly with evergreen understory, partly alternating with oak-pine forests; Colchic middle-mountain landscapes with beech forests mainly with evergreen understory; River Chorokhi
9	Adjara	265,435	Georgia	Amphibia: Mertensiella caucasica Aves: Melanitta fusca, Tadorna ferruginea, Ciconia nigra, Pelecanus crispus, Pelecanus onocrotalus Crustacea: Astacus colchicus Insecta: Calopteryx mingrelica Mammalia: Lutra lutra Mollusca: Unio crassus Pisces: Salmo labrax, Salmo trutta, Capoeta banarescui Reptilia: Natrix megalocephala, Darevskia clarkorum Plabtae: Marsilea quadrifolia, Quercus hartwissiana, Menyanthes trifoliata, Trapa colchica, Hibiscus ponticus, Osmunda regalis, Trapa maleevii, Nuphar lutea, Ulmus glabra, Pterocarya pterocarpa, Salix kikodseae"	Totally: 26 species - IUCN Red List: 4 species - National Red List: 13 species - IUCN and National Red Lists: 4 species - Species of additional conservation concern: 5 species	The landscape of the KBA comprise beech-dark coniferous and dark coniferous (spruce-fir) forests, partly with evergreen underwood; oak forests and secondary dry scrublands. The site holds high biodiversity level. It is one of important IBA area from Georgia.	South East Caucasian (transitional to semi-humid) low-mountain landscapes with hornbeam-oak, oak forests and secondary dry scrublands; South Caucasian (transitional to moderate-thermophitic) middle-mountain landscapes with steppes, dry shrublands and dwarf-shrub vegetation, partly with mountain semi-deserts; Colchic middle-mountain landscapes with beech forests mainly with evergreen understory; Caucasian middle-mountain landscapes with beech-dark coniferous and dark coniferous (spruce-fir) forests, partly with evergreen underwood; Colchic low-mountain landscapes with hornbeam-oak and hornbeam-beech-chestnut forests mainly with evergreen understory, partly alternating with oak-pine forests; Caucasian upper-mountain landscapes with birch and pine forests; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; Caucasian alpine landscapes with grasslands and Rhododendron thickets; Caucasian upper-mountain landscapes with birch and pine forests; Colchic Lowland landscapes with swamp alder forest and sphagnum bogs and foothill landscapes with hornbeam-oak forest alternating with beech-chestnut, oak-Zelkova and poly-dominant forest with evergreen under story.
10	Borjomi	90,577	Georgia	Amphibia: Mertensiella caucasica Insecta: Calopteryx mingrelica Pisces: Salmo trutta, Sabanejewia aurata Plantae: Menyanthes trifoliata, Quercus pedunculiflora, Quercus imeretina, Zelkova carpinifolia, Ulmus glabra	Totally: 9 species - National Red List: 7 species - IUCN and National Red Lists: 1 species - Species of additional conservation concern: 1 species	The KBA is part of Samtskhe-Javakheti region, part of Borjomi-Kharagauli National Park - one of biggest National park in Europe, belongs to the site. Borjomi mineral water is particularly well known. The landscape of KBA comprise with beech-dark coniferous and dark coniferous (spruce-fir) forests, partly with evergreen underwood.	South Caucasian (transitional to moderate-thermophitic) middle-mountain landscapes with steppes, dry shrublands and dwarf-shrub vegetation, partly with mountain semi-deserts; Caucasian middle-mountain landscapes with beech-dark coniferous and dark coniferous (spruce-fir) forests, partly with evergreen underwood; Caucasian upper-mountain landscapes with birch and pine forests; South East Caucasian middle-mountain landscapes with beech forests alternating with hormbeam-oak, partly with pine forests and secondary grasslands; South East Caucasian (transitional to semi-humid) low-mountain landscapes with hornbeam-oak, oak forests and secondary dry scrublands; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; River Mtkvari.

#	KBA Name	KBA (ha)	Country(ies)	Species Richness	Species Summary Analysis by Categories	KBA Overview	KBA Landscape Subtypes and Water Bodies
11	Kura - Ksani	100,698	Georgia	Amphibia: Pelobates syriacus Crustacea: Pontastacus pylzowi Mammalia: Lutra lutra Mollusca: Sphaerium solidum Pisces: Sabanejewia aurata Plantae: Quercus pedunculiflora, Ulmus glabra	Totally: 7 species - IUCN Red List: 1 species - National Red List: 6 species	The KBA covers part of the Kura River. The second river of KBA is Ksani River, which is a small river in central Georgia, which flowing in to the Kura River. Landscape of the site consists with middle-mountain landscapes with beech forests alternating with hornbeam-oak, partly with pine forests and secondary grasslands.	East Georgian hilly and foothill landscapes with Botriochloa and Stipa steppes, dry shrubland (shiblijak), dwarf-shrub (phrygana) vegetation and semi-desert; South East Caucasian middle-mountain landscapes with beech forests alternating with hornbeam-oak, partly with pine forests and secondary grasslands; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; Delta and floodplain landscapes with wetlands, swamp forest and grasslands and salt marshes; South-East Caucasian sub-Mediterranean (transitional to moderate-thermophitic semi-humid) foothill landscapes with hornbeam-oak forest and woodlands and Botriochloa steppes; South East Caucasian (transitional to semi-humid) low-mountain landscapes with hornbeam-oak, oak forests and secondary dry scrublands; River: Mtkvari, Ksani; Lakes: Bazaleti, Nadarbazevi.
12	Tabatskuri - Tsalka	20,056	Georgia	Aves: Melanitta fusca,Tadorna ferruginea, Grus grus, Ciconia nigra Mammalia: Lutra lutra	Totally: 5 species - National Red List: 4 species - IUCN and National Red Lists: 1 species	The site covers natural Lake Tabatskuri and Tsalka Reservoir and its surrounding. Lake Tabatskuri is the largest lake in Georgia by its volume 221 mln m³. Tsalka Reservoir is one of the largest reservoir with 33.7 km² and 312 mln m³. Lake Tabatskuri is an important IBA area. The landscape of KBA comprise with sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets.	Javakheti Plateau with steppe and meadow-steppe vegetation;Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; Lake Tabatskuri; Reservoir Tsalka.
13	Kartsakhi	11,139	Georgia	Aves: Melanitta fusca, Tadorna ferruginea, Grus grus, Panurus biarmicus, Pelecanus crispus, Pelecanus onocrotalus Mammalia: Lutra lutra	Totally: 7 species - National Red List: 5 species - IUCN and National Red Lists: 2 species	Lake Kartsakhi is transboundary lake laying on Georgian-Turkish border. It is the second largest lake in the country, covering an area of 26.6 km² at an altitude of 1799 m. The Lanscape of KBA comprise with meadows, meadows-steppes and steppes, partly with beech and hornbeam-beech forests, dry shrublands and dwarf-shrub vegetation, raspberry bushes are found near Lake Kartsakhi parts on border of Georgia-Turkey. Lake Kartsakhi belongs to Javakheti protected areas as Kartsakhi Managed Reserve / Sanctuary.	Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; Javakheti Plateau with steppe and meadow-steppe vegetation; South Caucasian middle-mountain landscapes with meadows, meadows-steppes and steppes, partly with beech and hornbeam-beech forests, dry shrublands and dwarf-shrub vegetation; Lake Kartsakhi.
14	Javakheti - Arpi	153,051	Georgia-Armenia	Georgia Aves: Tadorna ferruginea, Grus grus, Pelecanus crispus, Pelecanus onocrotalus, Melanitta fusca, Podiceps grisegena Insecta: Onychogomphus assimilis Mammalia: Lutra lutra Pisces: Salmo trutta Armenia Aves: Anas clypeata, Anser albifrons, Anser anser, Glareola pratincola, Grus grus, Himantopus himantopus, Larus armenicus, Motacilla citreola, Pelecanus crispus, Pelecanus onocrotalus, Phalacrocorax carbo, Platalea leucordia, Plegadis falcinellus, Podiceps grisegena, Tadorna ferruginea, Tadorna tadorna Insecta: Aeshna serrata, Coenagrion armatum Mammalia: Lutra lutra Pisces: Cyprinus carpio, Leuciscus aspius, Luciobarbus capito Plantae: Nuphar lutea, Scilla rosenii	Totally: 27 species - IUCN Red List: 2 species - National Red List: 22 species - IUCN and National Red Lists: 3 species Georgia: 9 species - National Red List: 6 species - IUCN and National Red Lists: 3 species Armenia: 24 species - IUCN Red List: 2 species - National Red List: 21 species - IUCN and National Red Lists: 1 species	Georgia: The upland of Javakheti is known as a lake region. In the last period attention to this region has been significantly increased because of global importance of its biodiversity. There are artificial plantation of pine stands and small fragments on natural forest. The most important natural alpine forest composed with white birch, Caucasian mountain-ash, cotoneaster, raspberry bushes are found near Lake Kartsakhi parts on border of Georgia-Turkey. The KBA includes Javakheti Protected Areas: Kartsakhi Managed Reserve, Sulda Managed Reserve, Khanchali Managed Reserve, Bugdasheni Managed Reserve and Madatapa Managed Reserve. The KBA main lakes: Khanchali, Madatapa, Paravani, Sagamo, Bugdasheni are important IBA. Armenia: In Armenia, this site includes Lake Arpi and the headwater of Akhurian River. It is part of Lake Arpi National Park which is a Ramsar Site and includes Lake Arpi and Amasia IBAs. It is a reservoir which was established in 1951 by damming of Lake Arpi. The bottom and shorelines are swampy and the landscape is flat. Despite a damming-caused dramatic change in hydrological regime and loss of riparian vegetation essential for nesting, it still remains a crucial site for breeding of threatened birds. The main threats are water fluctuations, freezing, climate change, poaching and overfishing; for this reason, most of local birds occur here only during migrations but do not nest.	Javakheti-Armenian Plateau with steppe and meadow-steppe vegetation; High-mountain landscapes with plant micro-communities, mosses and lichens; Delta and floodplain landscapes with wetlands, swamp forest and grasslands and salt marshes; Armenian highland volcanic plateau landscapes with steppes and meadows-steppes in combination with wetlands; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; Caucasian alpine landscapes with grasslands and Rhododendron thickets; Lakes: Bugdasheni, Paravani, Madatapa, Sagamo, Khanchali, Arpi.
15	Khrami - Debeda - Marts	106,872	Georgia-Armenia	Georgia Amphibia: Pelobates syriacus Aves: Haliaeetus albicilla,Tadorna ferruginea,Ciconia nigra, Oxyura leucocephala, Grus grus, Pelecanus crispus, Pelecanus onocrotalus Crustacea: Pontastacus pylzowi Mammalia: Lutra lutra Pisces: Salmo trutta, Sabanejewia aurata Plantae: Quercus pedunculiflora Armenia Insecta: Aeoloides figuratus Mammalia: Lutra lutra Amphibia: Ommatotriton ophryticus	Totally: 15 species - National Red List: 13 species - IUCN and National Red Lists: 2 species Georgia: 13 species - National Red List: 11 species - IUCN and National Red Lists: 2 species Armenia: 3 species - National Red List: 3 species	Georgia: The Khrami River is a 201 km-long river in eastern Georgia and partly in western Azerbaijan, a right tributary to the Kura River. Its tributaries are: the Debeda and Mashavera. The Tsalka Reservoir and three hydroelectric power plants have been built on the Krami River. The KBA holds the transboundary Jandara Lake, an important IBA from Georgia. The KBA landscape comprise with southeast Caucasian low-mountain Landscapes with juniper woodlands, dry shrublands and draw-shrub vegetation. Armenia: In Armenia, this site covers the middle part of the Debed River which is fast flowing and intensively used for irrigation and HPP. This site also includes the Marts River and small lakes in montane forests. Water is used for irrigation. The main threats are poaching, mining, hydroenergy, water pollution and eutrophication from land use and deforestation.	South East Caucasian (transitional to semi-humid) low-mountain landscapes with hornbeam-oak, oak forests and secondary dry scrublands; South East Caucasian sub-Mediterranean (transitional to moderate-thermophitic semi-humid) foothill landscapes with hornbeam-oak forest and woodlands and Botriochloa steppes; South East Caucasian middle-mountain landscapes with beech forests alternating with hormbeam-oak, partly with pine forests and secondary grasslands; East Georgian hilly and foothill landscapes with Botriochloa and Stipa steppes, dry shrubland (shibljak), dwarf-shrub (phrygana) vegetation and semi-desert; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; Delta and floodplain landscapes with wetlands, swamp forest and grasslands and salt marshes; Caucasian upper-mountain landscapes with birch and pine forests; South East Caucasian low-mountain landscapes with juniper woodlands, dry shrublands (shibljak) and dwarf-shrub vegetation (phrygana); Rivers: Khrami, Mtkvari; Lake Jandari.

16	Iori - Mingechauri	328,763	Georgia - Azerbaijan	Georgia Amphibia: Pelobates syriacus Aves: Haliaeetus albicilla, Anser erythropus, Tadorna ferruginea, Ciconia nigra, Grus grus, Panurus biarmicus, Pelecanus crispus Mammalia: Lutra lutra Pisces: Sabanejewia aurata Plantae: Quercus pedunculiflora, Populus euphratica Azerbaijan Aves: Anser erythropus, Aythya nyroca, Cygnus olor, Oxyura leucocephala, Pelecanus crispus, Pelecanus onocrotalus Crustacea: Pontastacus pylzowi Insecta: Hemidicera fritillum, Rhaesus serricollis Mammalia: Lutra lutra Pisces: Ballerus sapa, Salmo trutta caspius, Luciobarbus capito, Luciobarbus brachycephalus Plantae: Najas minor, Ludwigia palustris, Urticularia vulgaris	Totally: 26 species - National Red List: 18 species - IUCN and National Red Lists: 5 species - Species of additional conservation concern: 3 species Georgia: 12 species - National Red List: 10 species - IUCN and National Red Lists: 2 species Azerbaijan: 17 species - National Red List: 9 species - IUCN and National Red Lists: 5 species - Species of additional conservation concern: 3 species	Georgia/Azerbaijan: The Iori River originates in the Greater Caucasus Mountains in eastern Georgia and flows to Azerbaijan into the Mingechevir Reservoir. Its length is 320 km. The landscape of KBA comprise with hilly and foothill landscapes with Botriochloa and Stipa steppes, dry shrubland, dwarf-shrub vegetation and semi-desert. Lori Cascade unites three seasonal regulation power plants Sioni HPP (9.14 MW), Satskhenisi HPP and Martkophi HPP (3.86 MW). The KBA is one of IBA area. Territory covers low mountainous areas on the right and left side of Mingechevir water basin, Bozdag, Palantokan, Axar-Baxar mountain ranges and Acinour and Sarija lowlands. The KBA is already significantly impacted by Mingechevir Reservoir, which was built in the early 1950s. Since, the annual water flow off at the mouth of Kura River decreased by 38% because of Mingechevir Reservoir. There is simply not enough water in the river since that time. This, over decades, caused serious negative impacts. In addition, Mingechevir and other large reservoirs have influence of the temperature regime of the rivers, because their release is cold deep-water. The construction of the Mingechevir dam marked a serious indirect human intervention in the development of Kura River Delta. This caused intensive delta erosion from the early 1960s on a loss of land at a rate of 15-20 m/a in the eastern part of the delta. Deterioration of water quality, land degradation, habitat fragmentation, over hunting and persecution, water pollution, floods, variation and reduction in hydrological flow are among other threats to KBA.	South east Caucasian low-mountain Landscapes with juniper woodlands, dry shrublands (Shibyak) and draw-shrub vegetation (Phrygana); East Georgian hilly and foothill landscapes with Botriochloa and Stipa steppes, dry shrubland (shiblijak), dwarf-shrub (phrygana) vegetation and semi-desert; Caucasian upper-mountain landscapes with birch and pine forests; Delta and floodplain landscapes with wetlands, swamp forest and grasslands and salt marshes; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; Caucasian alpine landscapes with grasslands and Rhododendron thickets; East Caucasian North subtropical lowland and foothill landscapes with Artemisia, halophytic deserts and semi-deserts; East Caucasus low-mountain Landscapes with semidesert and desert; South East Caucasian (transitional to semi-humid) low-mountain landscapes with hornbeam-oak, oak forests and secondary dry scrublands; South-East Caucasian sub-Mediterranean (transitional to moderate-thermophitic semi-humid) foothill landscapes with hornbeam-oak forest and woodlands and Botriochloa steppes; South East Caucasian middle-mountain landscapes with beech forests alternating with hormbeam-oak, partly with pine forests and secondary grasslands; Rivers Mtkvari, Iori; Reservoirs: Mingechevir, Sioni, Dali.
17	Alazani	284,763	Georgia-Azerbaijan	Georgia Amphibia: Pelobates syriacus Aves: Haliaeetus albicilla, Tadorna ferruginea, Ciconia nigra, Grus grus, Panurus biarmicus, Pelecanus crispus Crustacea: Pontastacus pylzowi Mammalia: Lutra lutra Pisces: Oxynoemacheilus alasanicus, Salmo trutta, Sabanejewia aurata Plantae: Pterocarya pterocarpa, Zelkova carpinifolia, Quercus hartwissiana, Gymnospermium smirnovii Azerbaijan Crustacea: Pontastacus pylzowi Insecta: Ancyclocheria solomonii Mammalia: Lutra lutra Mollusca: Unio crassus Pisces: Ballerus sapa, Salmo trutta caspius, Luciobarbus capito, Luciobarbus brachycephalus	Totally: 22 species - IUCN Red List: 1 species - National Red List: 17 species - IUCN and National Red Lists: 3 species - Species of additional conservation concern: 1 species Georgia: 16 species - National Red List: 14 species - IUCN and National Red Lists: 1 species - Species of additional conservation concern: 1 species Azerbaijan: 8 species - IUCN Red List: 1 species - National Red List: 5 species - IUCN and National Red Lists: 2 species	Georgia/Azerbaijan: The Alazani River is one of the main tributary of the Kura River in east Georgia. In the 1990s, Chinese investors built many small hydroelectric power plants, which use the Alazani's strong current. There are 34 ponds present on Alazani River Basin spread over the agricultural land. The KBA landscape comprise with beech forests alternating with hornbeam-oak, partly with pine forests and secondary grasslands. Lagodekhi nature reserve belongs to the site. Territory covers low mountainous areas on the left side of Mingechevir water basin, Acinour and Sarija lowlands. Natural landscape zones of the territory is characterized by wormwood – saltmarsh semi-deserts, semi-desert, coast plant complexes, arid forests and etc. Plant cover comprises plant complexes of arid forests and river basins and wormwood-salt marshes, salt-wormwooded plant groups. The KBA is already impacted by Mingechevir dam. Deterioration of water quality, land degradation, water pollution, floods, variation and reduction in hydrological flow are among other threats to KBA.	South East Caucasian (transitional to semi-humid) low-mountain landscapes with hornbeam-oak, oak forests and secondary dry scrublands; East Georgian hilly and foothill landscapes with Botriochloa and Stipa steppes, dry shrubland (shiblijak), dwarf-shrub (phrygana) vegetation and semi-desert; East Trans Caucasian (Kakhetian) plain landscapes with oak and oak-Dzelcova forest; East-Georgian (Kakhetian) low-mountain landscapes with hornbeam-oak partly alternating with chestnut forests; South-East Caucasian sub-Mediterranean (transitional to moderate-thermophitic semi-humid) foothill landscapes with hornbeam-oak forest and woodlands and Botriochloa steppes; Delta and floodplain landscapes with wetlands, swamp forest and grasslands and salt marshes; South East Caucasian middle-mountain landscapes with beech forests alternating with hormbeam-oak, partly with pine forests and secondary grasslands; South east Caucasian low-mountain Landscapes with juniper woodlands, dry shrublands (Shibyak) and draw-shrub vegetation (Phrygana). River Alazani.
18	East Greater Caucasus	314,950	Georgia - Azerbaijan	Georgia Crustacea: Pontastacus pylzowi Insecta: Onychogomphus assimilis Mammalia: Lutra lutra Pisces: Oxynoemacheilus alasanicus, Salmo trutta, Sabanejewia aurata Plantae: Pterocarya pterocarpa, Quercus hartwissiana, Zelkova carpinifolia Azerbaijan Insecta: Rhaesus serricollis Mollusca: Unio crassus Pisces: Salmo trutta Reptilia: Natrix megalocephala	Totally: 12 species - IUCN Red List: 2 species - National Red List: 9 species - IUCN and National Red Lists: 1 species Georgia: 9 species - National Red List: 8 species - IUCN and National Red Lists: 1 species Azerbaijan: 4 species - IUCN Red List: 2 species - National Red List: 2 species	Georgia/Azerbaijan: The KBA holds several IBA areas. The KBA consists with main tributaries of Alazani, which are the most important areas for fish species of this site. Azerbaijan: East Greater Caucasus KBA is one of the most important freshwater KBAs in the southern Caucasus holding important populations of globally threatened species. Lagodekhi-Zakatala-West Dagestan priority conservation area and Lagodekhi-Zakatala-Alazani-Ganykh corridor are within this KBA. The district borders with the watershed line of the Major Caucasus Ridge. Mountain parts are characterized by a moderate warm climate with an almost even distribution of precipitation, and the high mountain areas – by the climate of mountainous tundra. Botanists refer to the territory as the Iberian area of the Caucasus flora province. Contemporary flora has more than a thousand species. The main threat for this KBA is blocking of spawning migrations in Mountain Rivers. Deterioration of water quality, land degradation, habitat fragmentation, over hunting and persecution, variation and reduction in hydrological flow are among other threats to KBA.	Glacio-Nival; Caucasian upper-mountain landscapes with birch and pine forests; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; Caucasian alpine landscapes with grasslands and Rhododendron thickets; East Trans Caucasian (Kakhetian) plain landscapes with oak and oak-Dzelcova forest; East-Georgian (Kakhetian) low-mountain landscapes with hornbeam-oak partly alternating with chestnut forests; South East Caucasian (transitional to semi-humid) low-mountain landscapes with hornbeam-oak, oak forests and secondary dry scrublands; South East Caucasian middle-mountain landscapes with beech forests alternating with hormbeam-oak, partly with pine forests and secondary grasslands; Reservoir Chala; Glaciers

#	KBA Name	KBA (ha)	Country(ies)	Species Richness	Species Summary Analysis by Categories	KBA Overview	KBA Landscape Subtypes and Water Bodies
19	Sheki	36,149	Azerbaijan	Azerbaijan Crustacea: Pontastacus pylzowi Insecta: Rhaesus serricollis Reptilia: Natrix megalocephala	Totally: 3 species - IUCN Red List: 1 species - National Red List: 2 species	The relief of KBA is formed by a combination of mountain ridges and deep river valleys. The climate is conditioned by the geographical location of the territory, which is protected from the north by the Major Caucasus Ridge, the area's height amplitude and the highly indented relief. The favourable climatic conditions (mild winter, mild summer, warm spring and autumn, plenty of precipitation during the vegetation period, absence of prolonged droughts and strong frost) contribute to the forming of luxuriant vegetation, particularly forests. The main protected objects are the natural complexes of the middle area of the macro-slopes of the Greater Caucasus. On the territory of KBA there are about 300 vascular plants with more than 90 species of shrubs and trees. The KBA is already impacted by Ayricay dam constructed in Sheki district for irrigation purposes. Deterioration of water quality, land degradation, habitat fragmentation, over hunting and persecution, floods, variation and reduction in hydrological flow are among other threats to KBA.	South East Caucasian middle-mountain landscapes with beech forests alternating with hornbeam-oak, partly with pine forests and secondary grasslands; East-Georgian (Kakhetian) low-mountain landscapes with hornbeam-oak partly alternating with chestnut forests; High-mountain landscapes with plant micro-communities, mosses and lichens; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; Caucasian alpine landscapes with grasslands and Rhododendron thickets; East Trans Caucasian (Kakhetian) plain landscapes with oak and oak-Dzelcova forest.
20	Karachay	30,506	Azerbaijan	Mammalia: Lutra lutra Pisces: Salmo trutta f Rutilus atropatenae	Totally: 3 species - IUCN Red List: 1 species - National Red List: 2 species	The KBA occupies the mountainous part of the northern slope of the south-eastern Caucasus, the relief of which is from 200 to 4500 m above sea level. There are lots of ravines, canyons, and valleys on the territory. The followings types of climate are characteristic for this district: moderate with an almost even distribution of precipitation (low- mountain relief); cold with a dry winter (middle-, partially high-mountain relief), the climate of high mountain. The annual precipitation constitutes 400mm for low-mountain relief and 1200 mm for high-mountain relief. The mountainous-timber brown typical and carbonate-mountainous-timber brown soil are developed in the low- and middle-mountain areas. More than 40% of the physical-geographic districts of the region are covered by forests. In some river forests the representatives of Girkan-Kolkhidian dendroflora - Caucasian persimmon, salsola, Zelkova carpinfolia, walnut, ironwood, Quercus castaneivolia and others, are found. Here fragments of natural groves with Platanus orientalis are preserved. In the area from 1,000 to 2,000m, the dominating formation is beech forests mixed with hornbeam, maple, ash-trees and others. The KBA is already impacted by Ayricay dam constructed in Sheki district for irrigation purposes. Deterioration of water quality, land degradation, habitat fragmentation, over hunting and persecution, water pollution, floods, variation and reduction in hydrological flow are among other threats to KBA.	South east Caucasian low-mountain Landscapes with juniper woodlands, dry shrublands (Shibyak) and draw-shrub vegetation (Phrygana); East Trans Caucasian (Kakhetian) plain landscapes with oak and oak-Dzelcova forest; South-East Caucasian sub-Mediterranean (transitional to moderate-thermophitic semi-humid) foothill landscapes with hornbeam-oak forest and woodlands and Botriochloa steppes.
21	Kura - Ara(k)s	427,712	Azerbaijan	Aves: Anser erythropus, Aythya nyroca, Branta ruficollis, Cygnus bewickii, Cygnus olor, Marmaronetta angustirostris, Oxyura leucocephala, Platalea leucorodia, Pelecanus crispus, Pelecanus onocrotalus Insecta: Ancyclocheria solomonii, Rhaesus serricollis, Megacephala (Grammognatha) euphratica Mammalia: Lutra lutra Pisces: Acipenser nudiventris, Acipencer guldenstaedti, Acipencer persicus, Acipenser stellatus, Salmo trutta caspius, Leocaspius delinatus, Luciobarbus capito, Luciobarbus brachycephalus, Ballerus sapa, Pelecus cultratus, Huso huso Plantae: Najas minor, Ludwigia palustris, Urticularia vulgaris, Sagittaria trifolia, Punica granatum, Nymphaea alba, Nelumbo caspica, Iris pseudacorus	Totally: 33 species - IUCN Red List: 3 species - National Red List: 17 species - IUCN and National Red Lists: 9 species - Species of additional conservation concern: 4 species	This KBA covers the South-East Shirvan lowland, located in the mouth of the Kura River, the right bank of Aras river, the eastern border of Salyan-Baku motorway, south-eastern part of Shirvan Plain and the Caspian Sea coast of the Kura River. The territory of the site is at the bottom of the Caspian Sea and at present it is an accumulative plain, which is 20-25 m below sea level with a slight increase in the relief westwards. In terms of climate the site lies in an area of moderate warm semi-desert and arid steppe. The main protected objects are the natural semi-desert complexes of the south-eastern Shirvan, with the world's biggest population of gazelle (Gazella sulgutturosa) and the water-wading ecosystem, which is a place of nesting, a migration route and wintering area for many valuable bird species. Deforestation in the upper part of the river catchment areas has led to poor soil protection with damaging mud slides as a result. Deterioration of water quality, land degradation, habitat fragmentation, over hunting and persecution, water pollution, floods, variation and reduction in hydrological flow are among other threats to KBA.	East Caucasian North subtropical lowland and foothill landscapes with Artemisia, halophytic deserts and semi-deserts; Delta and floodplain landscapes with wetlands, swamp forest and grasslands and salt marshes; Rivers: Mtkvari, Araks; Lakes: Shorgol, Hajikabul, Aggol, Duzdag, Sarisu.

22	Gyzylaghaj	51,346	Azerbaijan	Aves: Anser erythropus, Aythya nyroca, Branta ruficollis, Cygnus bewickii, Cygnus olor, Marmaronetta angustirostris, Oxyura leucocephala, Platalea leucorodia, Pelecanus crispus, Pelecanus onocrotalus	Totally: 10 species - National Red List: 5 species - IUCN and National Red Lists: 5 species	The major area consist of the Gyzyl-Agach state reserve (88,360 hectares), which was established in 1929 for the protection and reproduction of wintering and migratory waterfowl, wader and steppe birds. In 1975, the reserve was classified as being of international significance, mainly as a habitat for waterfowl and coastal birds. The territory of the reserve is an important place for the rest and wintering of migratory birds in the Caspian region, where many bird species from northern Europe stay. A typical feature of the Gyzyl-Agach reserve is the extreme dynamic connected between the variation in the level of the Caspian Sea, the wandering of the Kura and Araks River beds, and anthropogenic activity. At present the territory of the reserve is coastal lowlands, which is below sea level and with a different set of natural and artificial water reservoirs. At present the relief of the reserve is characterized by the alternation of low (up to 1 m) ridges and open hollows and old silty riverbeds. In some places there are separated former riverbeds – akhmazes; for the northern part lshores plain lowlands with salines are typical. The rise in the level of the Caspian has resulted in the formation of vast shallow gulfs with rich feeding grounds, due to which the number of wintering waterfowl has increased. In some years 5-7 million birds have wintered here. Deterioration of water quality, land degradation, habitat fragmentation, over hunting and persecution, water pollution, floods, variation and reduction in hydrological flow are among other threats to KBA.	Hyrcanic plain landscapes with grassland-shrublands and Hyrcanian forest; East Caucasian North subtropical lowland and foothill landscapes with Artemisia, halophytic deserts and semi-deserts; Delta and floodplain landscapes with wetlands, swamp forest and grasslands and salt marshes.
23	Kura	154,058	Azerbaijan	Aves: Anser erythropus, Cygnus olor,Ciconia nigra Insecta: Hemidicera fritillum, Rhaesus sericollis Mammalia: Lutra lutra Pisces: Rutilus sojuchbulagi, Luciobarbus capito Plantae: Najas minor, Ludwigia palustris, Urticularia vulgaris	Totally: 11species - IUCN Red List: 1 species - National Red List: 5 species - IUCN and National Red Lists: 2 species - Species of additional conservation concern: 3 species	The KBA covers low mountainous areas on the left side of Mingecaur and Shamkir water basins, the Bozdag, and Palantokan mountain ranges. The territory of the area is part of the quaternary accumulative lowland, sloping slightly to the River Kura. The Eldar pine-tree State Reserve is also at the territory of the area and was established to preserve the genetic heritage, biological diversity of ecological systems, unique forests of Eldar pine trees. The KBA is impacted significantly with Mingechevir, Shamkir and Varvara dams. The intensive processes of "flowering" of water and oxygen absorption enhancement take place in three largest waterreservoirs of Mingechevir, Shamkir, and Varvara. The water of the river is not able to restore its natural stability due to enormous pollution with sewage and waste in the lower part of course downstream of Mingechevir dam. The hydrotechnical constructions and dams, hydroelectric power stations, thermal power stations constitute a menace to the Kura.	South-East Caucasian sub-Mediterranean (transitional to moderate-thermophitic semi-humid) foothill landscapes with hornbeam-oak forest and woodlands and Botriochloa steppes; East Georgian hilly and foothill landscapes with Botriochloa and Stipa steppes, dry shrubland (shiblijak), dwarf-shrub (phrygana) vegetation and semi-desert; South east Caucasian low-mountain Landscapes with juniper woodlands, dry shrublands (Shibyak) and draw-shrub vegetation (Phrygana); East Caucasian North subtropical lowland and foothill landscapes with Artemisia, halophytic deserts and semi-deserts; East Caucasus low-mountain Landscapes with semidesert and desert; Delta and floodplain landscapes with wetlands, swamp forest and grasslands and salt marshes; Rivers: Mtkvari,Khrami; Lake Jandari; Reservoir Shamkhori.
24	Ara(k)s - Hrazdan	89,001	Armenia	Amphibia: Pelobates syriacus Aves: Acrocephalus agricola, Anas clypeata, Anser albifrons, Anser anser, Anser erythropus, Aythya nyroca, Branta ruficollis, Charadrius alexandrinus, Chettusia leucura, Chlidonias hybrida, Cygnus bewickii, Cygnus cygnus, Cygnus olor, Glareola nordmanni, Glareola pratincola, Haematopus ostralegus, Himantopus himantopus, Larus armenicus, Locustella luscinioides, Marmaronetta angustirostris, Oxyura leucocephala, Pandion haliaetus, Pelecanus crispus, Pelecanus onocrotalus, Phalacrocorax carbo, Phalacrocorax pygmaeus, Platalea leucordia, Plegadis falcinellus, Podiceps grisegena, Recurvirostra avosetta, Sterna albifrons, Sterna nilotica, Tadorna ferruginea, Tadorna tadorna Insecta: Aeoloides figuratus, Cteniopus persimilis, Erythromma lindeni, Gomphus ubadschii, Hemianax ephippiger, Lestes macrostigma, Libellula pontica, Proserpinus proserpina, Sympecma paedisca Mammalia: Lutra lutra Mollusca: Shadinia akramovskii Pisces: Cyprinus carpio, Leuciscus aspius, Luciobarbus capito, Rutilus rutilus schelkovnikovi Plantae: Acorus calamus, Falcaria falcarioides, Glycyrrhiza echinata, Najas minor, Oenanthe silaifolia, Puccinellia grossheimiana, Tamarix octandra, Trigonella capitata, Carpesium abrotanoides	Totally: 59 species - IUCN Red List: 2 species - National Red List: 52 species - IUCN and National Red Lists: 5 species	The site is the stronghold for freshwater species, especially birds, in Armenia due to the plenty of non-freezing and food-rich fish farms, lakes, rivers, canals and associated small wetlands. This site is located in the Ararat Valley along the middle part of the Arax River basin and its junction with the lower Hrazdan River. Armash fish farms play the key role for waterfowl in the country. This site includes Armash fish farms and Metsamor Important Bird Areas (IBA). The main threats are urban, agricultural and infrastructure development, aridization from climate change, reedbed burning, overgrazing and water overuse for irrigation.	Armenian-Iranian low-mountain landscapes with semi-deserts, dwarf-shrub vegetation and partly with shrublands; South Caucasian (transitional to moderate-thermophitic) middle-mountain landscapes with steppes, dry shrublands and dwarf-shrub vegetation, partly with mountain semi-deserts; Delta and floodplain landscapes with wetlands, swamp forest and grasslands and salt marshes; Ararat mountain flat terrain landscapes with stony type deserts, semi-deserts and dry dwarf-shrub vegetation; South Caucasian middle-mountain landscapes with meadows, meadows-steppes and steppes, partly with beech and hornbeam-beech forests, dry shrublands and dwarf-shrub vegetation; Armenian highland volcanic plateau landscapes with steppes and meadows-steppes in combination with wetlands; Rivers: Araks, Hrazdan; Reservoir: Azat.

#	KBA Name	KBA (ha)	Country(ies)	Species Richness	Species Summary Analysis by Categories	KBA Overview	KBA Landscape Subtypes and Water Bodies
25	Akhurian	18,908	Armenia	Aves: Anas clypeata, Chlidonias hybrida, Phalacrocorax carbo, Platalea leucordia, Tadorna ferruginea, Tadorna tadorna Mammalia: Lutra lutra Pisces: Cyprinus carpio, Leuciscus aspius, Luciobarbus capito Insecta: Platycnmis pennipes, Sympecma paedisca	Totally: 12 species - IUCN Red List: 2 species - National Red List: 10 species	This site encompasses the Akhurian Reservoir and the adjacents parts of the Akhurian River. The reservoir was constructed and is used for the irrigation of 300 km2 of arid lands in Shirak and Armavir provinces, as well as in Turkey. The reservoir freezes in winter. The main threats are water overuse and land degradation.	Armenian Plateau with steppe and meadow-steppe vegetation; Delta and floodplain landscapes with wetlands, swamp forest and grass-lands and salt marshes; Ararat mountain flat terrain landscapes with stony type deserts, semi-deserts and dry dwarf-shrub vegetation; Armenian highland volcanic plateau landscapes with steppes and meadows-steppes in combination with wetlands; Reservoir: Akhurian.
26	Dzoraget - Tashir	20,811	Armenia	Aves: Aythya nyroca, Grus grus, Platalea leucor-dia, Podiceps grisegena, Tadorna ferruginea Insecta: Duvalius stepanavanensis, Leucorrhinia pectoralis Mammalia: Lutra lutra, Neomys schelkovnikovi Mollusca: Gyraulus albus Plantae: Carex bohemica, Chamaenerion dodonaei, Nymphaea alba, Potentilla erecta, Ra-nunculus lingua, Sagittaria sagittifolia, Sagittaria trifolia, Salvinia natans, Utricularia intermedia	Totally: 19 species - National Red List: 19 species	This site covers the middle part of the Dzoraget River, springs and small lakes on the Lori Plateau. Swampy and slow-flow-ing waters in lakes and streams, but Dzoraget is powerful. The river has been used for irrigation and HPP (Dzoraget HPP). Part of Tashir IBA and an important stopover site for migrating birds. The site needs urgent establishment of a protected area. The main threats are hydroenergy, pollution and overgrazing.	South East Caucasian middle-mountain landscapes with beech forests alternating with hormbeam-oak, partly with pine forests and secondary grasslands; Armenian Plateau with steppe and mead-ow-steppe vegetation; Armenian highland volcanic plateau landscapes with steppes and meadows-steppes in combination with wetlands; Caucasian upper-mountain landscapes with birch and pine forests; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets.
27	Agstev	11,619	Armenia	Insecta: Aeoloides figuratus, Aeshna cyanea, Duvalius yatsenkokhmelevskii, Onychogomphus assimilis, Sympecma paedisca Mammalia: Neomys schelkovnikovi Plantae: Coccyganthe flos-cuculi, Potentilla erecta	Totally: 8 species - National Red List: 7 species - IUCN and National Red Lists: 1 species	This site is located along the Agstev River which is rapid and narrow in its headwaters, but widening in downstream section. In This area is rich in forest streams, small wetlands and lakes, including the Lake Parz. Part of Dilijan National Park and Ijevan Managed Reserve / Sanctuary, includes Pambak and Haghartsin IBAs. The main threat is recreational development.	South East Caucasian sub-Mediterranean (transitional to moder-ate-thermophitic semi-humid) foothill landscapes with hornbeam-oak forest and woodlands and Botriochloa steppes; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; South East Caucasian (transitional to semi-hu-mid) low-mountain landscapes with hornbeam-oak, oak forests and secondary dry scrublands; Armenian transitional to mountain meadow and high mountain steppe and meadow-steppe; South East Caucasian middle-mountain landscapes with beech forests alternating with horm-beam-oak, partly with pine forests and secondary grasslands.
28	Chilli	3,198	Armenia	Aves: Tadorna ferruginea Plantae: Callitriche hermaphroditica	Totally: 2 species - National Red List: 2 species	This is a small highland glacial lake. The threats are overgraz-ing and climate change.	Armenian Plateau with steppe and meadow-steppe vegetation; Arme-nian transitional to mountain meadow and high mountain steppe and meadow-steppe.
29	Sevan	164,475	Armenia	Aves: Anas clypeata, Anser albifrons, Anser anser, Anser erythropus, Aythya nyroca, Branta ruficollis, Chlidonias hybrida, Cygnus bewickii, Cygnus cygnus, Cygnus olor, Glareola nordman-ni, Glareola pratincola, Haematopus ostralegus, Larus armenicus, Melanitta fusca, Motacilla citreola, Oxyura leucocephala, Pandion haliae-tus, Pelecanus crispus, Pelecanus onocrotalus, Phalacrocorax carbo, Phalacrocorax pygmeus, Platalea leucordia, Plegadis falcinellus, Podiceps grisegena, Recurvirostra avosetta, Sterna nilotic-a, Tadorna ferruginea, Tadorna tadorna Insecta: Dyschirius sevanensis Mammalia: Lutra lutra, Neomys schelkovnikovi Mollusca: Bithynia troscheli, Gyraulus albus, Gyraulus laevis, Planorbis carinatus Pisces: Barbus goctschaicus, Capoeta sevangi, Salmo ischchan aestivalis, Salmo ischchan gegarkuni Plantae: Falcaria falcarioides, Groenlandia densa, Menyanthes trifoliata, Puccinellia gross-heimiana	Totally: 44 species - National Red List: 40 species - IUCN and National Red Lists: 4 species	This site covers Lake Sevan, lower parts of its inflowing tributaries and the headwater of the only outflowing tributary Hrazdan. Lake Sevan is the largest freshwater lake in the Caucasus. The site is completely covered by Lake Sevan National Park, Ramsar Site and Lake Sevan IBA. Artificial drainage of the lake in the mid-1950s for irrigation and ener-getic needs had caused irreversible changes in biodiversity status and ecosystem functioning. The drainage of water level, gold mining, uncontrolled fishing and recreational pres-sure led to a dramatic decline in breeding grounds, diversity and abundance of species, first of all birds and endemic fish. Implementation of governmental projects (fishery and drainage control, cleaning) made the water level to increase in recent years, which gives hope for a slow recovery of local biodiversity and ecosystem. Because of the disappearance of riparian vegetation from lake drainage, most birds occur here only during migrations and/or wintering, but do not nest. The main threats are uncontrolled recreation, eutrophication, changes in hydrological regime, pollution and gold mining.	South Caucasian (transitional to moderate-thermophitic) mid-dle-mountain landscapes with steppes, dry shrublands and dwarf-shrub vegetation, partly with mountain semi-deserts South Caucasian middle-mountain landscapes with meadows, mead-ows-steppes and steppes, partly with beech and hornbeam-beech forests, dry shrublands and dwarf-shrub vegetation; Armenian transitional to mountain meadow and high mountain steppe and mead-ow-steppe; Lake: Sevan.

30	Arpa	15,748	Armenia	Aves: Tadorna ferruginea Insecta: Coenagrion scitulum, Onychogomphus assimilis, Prosperpinus proserpina, Sympecma paedisca Mammalia: Lutra lutra, Neomys schelkovnikovi Pisces: Cyprinus carpio, Leuciscus aspius, Luciobarbus capito Plantae: Colchicum ninae, Menyanthes trifoliata, Tamarix octandra, Thelypteris palustris Amphibia: Pelobates syriacus	Totally: 15 species - IUCN Red List: 2 species - National Red List: 12 species - IUCN and National Red Lists: 1 species	This site is stretched along the Arpa River, but also contains some highland lakes and riparian wetlands. The landscape is comprised of steep rocky slopes and canyons with xerophilic vegetation. It is a part of Noravank IBA. The river is intensively used for irrigation, HPP and replenishment of Lake Sevan water level through the Arpa-Sevan tunnel. Due to these factors, Arpa is very vulnerable to ecosystem degradation and biodiversity loss. Apart from the threats mentioned above, its water is polluted by municipal and mining waste.	Armenian transitional to mountain meadow and high mountain steppe and meadow-steppe; South Caucasian middle-mountain landscapes with meadows, meadows-steppes and steppes, partly with beech and hornbeam-beech forests, dry shrublands and dwarf-shrub vegetation; Caucasian alpine landscapes with grasslands and Rhododendron thickets; Armenian-Iranian low-mountain landscapes with semi-deserts, dwarf-shrub vegetation and partly with shrublands; Delta and floodplain landscapes with wetlands, swamp forest and grasslands and salt marshes; Armenian highland volcanic plateau landscapes with steppes and meadows-steppes in combination with wetlands; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets.
31	Lake Jan	115	Armenia	Mollusca: Musculium strictum	Totally: 1 species - National Red List: 1 species	This is a small glacial lake on the Syunik Highland. The main threats are overgrazing and climate change.	Armenian transitional to mountain meadow and high mountain steppe and meadow-steppe; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets.
32	Vorotan	13,873	Armenia	Amphibia: Pelobates syriacus Aves: Anas clypeata, Tadorna ferruginea Insecta: Proserpinus proserpina Mammalia: Lutra lutra; Neomys schelkovnikovi Pisces: Leuciscus aspius Plantae: Lomatogonium carinthiacum, Rorippa spaskajae	Totally: 9 species - National Red List: 9 species	This site covers the headwater and middle part of the Vorotan River, Spandarian and Shamb Reservoirs. The headwater and the reservoir are situated on the plateau, but downstream Vorotan becomes a powerful mountainous river running through a deep canyon. The plateau is in the Gorayk IBA. The reservoirs and the river are intensively used for energy supply (Vorotan Cascade) and irrigation (Vorotan Canal). This is the only occurrence site of the Armenian endemic Rorippa spaskajae. The main threats are recreation (Jermuk) and mining (Amulsar) in headwaters and hydropower production throughout the river.	South East Caucasian (transitional to semi-humid) low-mountain landscapes with hornbeam-oak, oak forests and secondary dry scrublands; Armenian transitional to mountain meadow and high mountain steppe and meadow-steppe; South East Caucasian middle-mountain landscapes with beech forests alternating with hormbeam-oak, partly with pine forests and secondary grasslands; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; South Caucasian middle-mountain landscapes with meadows, meadows-steppes and steppes, partly with beech and hornbeam-beech forests, dry shrublands and dwarf-shrub vegetation; Reservoirs: Shamb, Spandarian, Tolors.
33	Voghji	5,227	Armenia	Insecta: Onychogomphus assimilis, Proserpinus proserpina, Sympetrum depressiusculum Mammalia: Lutra lutra, Neomys schelkovnikovi	Totally: 5 species - National Red List: 4 species - IUCN and National Red Lists: 1 species	This site covers the Voghji River with its riparian vegetation. The main threats are hydropower production, mining, climate change, poaching and pollution.	South East Caucasian (transitional to semi-humid) low-mountain landscapes with hornbeam-oak, oak forests and secondary dry scrublands; South East Caucasian middle-mountain landscapes with beech forests alternating with hormbeam-oak, partly with pine forests and secondary grasslands; South Caucasian middle-mountain landscapes with meadows, meadows-steppes and steppes, partly with beech and hornbeam-beech forests, dry shrublands and dwarf-shrub vegetation; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets.
34	Tsav	18,690	Armenia	Insecta: Lestes macrostigma Mammalia: Lutra lutra, Neomys schelkovnikovi Plantae: Platanus orientalis	Totally: 4 species - National Red List: 4 species	This site covers the Tsav riverside in Shikahogh State Reserve and Plane Grove Managed Reserve / Sanctuary. Partly covers the Meghri IBA. Mountain rivers and streams in mountain forests. The main threats are water pollution and overuse.	Armenian transitional to mountain meadow and high mountain steppe and meadow-steppe; South East Caucasian middle-mountain landscapes with beech forests alternating with hormbeam-oak, partly with pine forests and secondary grasslands; Caucasian alpine landscapes with grasslands and Rhododendron thickets; South East Caucasian (transitional to semi-humid) low-mountain landscapes with hornbeam-oak, oak forests and secondary dry scrublands; South Caucasian middle-mountain landscapes with meadows, meadows-steppes and steppes, partly with beech and hornbeam-beech forests, dry shrublands and dwarf-shrub vegetation; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets.
35	Ara(k)s - Meghri	41,268	Armenia	Aves: Tadorna ferruginea Insecta: Aeoloides figuratus, Coenagrion scitulum, Crocothemis servilia, Drasterius atricapillus, Onychogomphus assimilis, Orthetrum sabina, Proserpinus proserpina Mammalia: Lutra lutra, Neomys schelkovnikovi Mollusca: Gyraulus regularis, Odhneripisidium annandalei Pisces: Leuciscus aspius, Cyprinus carpio, Luciobarbus capito Plantae: Anthochlamys polygaloides, Colchicum ninae, Erianthus ravennae, Glycyrrhiza echinata	Totally: 19 species - IUCN Red List: 2 species - National Red List: 16 species - IUCN and National Red Lists: 1 species	This site covers the middle and lower parts of the Meghri River, semi-desert ponds and streams with stagnant water, and the Arax River basin along the Armenian-Iranian state border. In the eastern part, this site overlaps with the Meghri and Zangezur IBAs. The Meghri watershed is narrow in headwaters, then widening towards the Araks. Water of this river is used for irrigation. Contrary to other parts, here the Arax flows along the narrow and steep canyon. The main threats are water overuse for irrigation, mining, pollution and aridization from climate change.	Armenian transitional to mountain meadow and high mountain steppe and meadow-steppe; South East Caucasian middle-mountain landscapes with beech forests alternating with hormbeam-oak, partly with pine forests and secondary grasslands; Caucasian alpine landscapes with grasslands and Rhododendron thickets; Armenian-Iranian low-mountain landscapes with semi-deserts, dwarf-shrub vegetation and partly with shrublands; Delta and floodplain landscapes with wetlands, swamp forest and grasslands and salt marshes; Caucasian alpine landscapes with grasslands and Rhododendron thickets; Caucasian sub-alpine landscapes with combination of meadows, tall-herb communities, elfin woods and thickets; Glacio-Nival; River: Araks.

Annex 3. Protection status of the freshwater Key Biodiversity Areas

CONGRUENCE BETWEEN FRESHWATER KYE BIODIVERSITY AREAS AND ACTUAL PROTECTED AREAS

#	Freshwater KBA Name	Area of Freshwater KBA (ha)	Country of KBA	Area of Protected Freshwater KBA (ha	Percentage of Protected Freshwater KBAs	Protected Area Name	Country of Protected Area	Protected Area National Category	Protected Area IUCN Category
1	Ritsa	9,077	Georgia	8,189	90.2%	Ritsa	Georgia	Strict Nature Reserve	I
2	Kolkheti 1	505,063	Georgia	396	0.1%				
				288		Sataplia	Georgia	Strict Nature Reserve	I
				34		Sataplia	Georgia	Managed Reserve / Sanctuary	IV
				2		Khomuli Cave	Georgia	Natural Monument	III
				47		Prometheus Cave	Georgia	Natural Monument	III
				12		Nazodelao Cave	Georgia	Natural Monument	III
				13		Gochkadili Canyon	Georgia	Natural Monument	III
3	Enguri	11,992	Georgia	0	0.0%				
4	Khobi	31,091	Georgia	7,421	23.9%	Kolkheti	Georgia	National Park	II
5	Rioni	82,862	Georgia	9,251	11.2%				
				710		Ajameti	Georgia	Managed Reserve / Sanctuary	IV
				8,242		Kolkheti	Georgia	National Park	II
				299		Kacoburi	Georgia	Managed Reserve / Sanctuary	IV
6	Paliastomi	23,832	Georgia	13,673	57.4%	Kolkheti	Georgia	National Park	II
7	Kolkheti 2	84,980	Georgia	771	0.9%				
				439		Kobuleti	Georgia	Managed Reserve / Sanctuary	IV
				333		Kobuleti	Georgia	Strict Nature Reserve	I
8	Chorokhi - Ajaristskali	9,032	Georgia	54	0.6%	Machakhela	Georgia	National Park	II
9	Adjara	265,435	Georgia	37,749	14.2%				
				15,699		Mtirala	Georgia	National Park	II
				2,628		Kintrishi	Georgia	Protected Landscape	V
				10,791		Kintrishi	Georgia	Strict Nature Reserve	I
				8,595		Machakhela	Georgia	National Park	II
				36		Goderdzi Petrified Forest	Georgia	Natural Monument	III
10	Borjomi	90,577	Georgia	45,625	50.4%				
				14,466		Borjomi	Georgia	Strict Nature Reserve	I
				30,532		Borjomi - Kharagauli	Georgia	National Park	II
				627		Nedzvi	Georgia	Managed Reserve / Sanctuary	IV
11	Kura-Ksani	100,698	Georgia	74	0.1%				
				56		Tbilisi	Georgia	National Park	II
				18		Bodorna Rock Columns	Georgia	Natural Monument	III
12	Tabatskuri - Tsalka	20,056	Georgia	8,563	42.7%	Ktsia - Tabatskuri	Georgia	Managed Reserve / Sanctuary	IV
13	Kartsakhi	11,139	Georgia	4,061	36.5%				
				309		Sulda	Georgia	Managed Reserve / Sanctuary	IV

#	Freshwater KBA Name	Area of Freshwater KBA (ha)	Country(ies) of KBA	Area of Protected Freshwater KBA (ha)	Percentage of Protected Freshwater KBAs	Protected Area Name	Country of Protected Area	Protected Area National Category	Protected Area IUCN Category
				157		Kartsakhi	Georgia	Managed Reserve / Sanctuary	IV
				3,594		Javakheti	Georgia	National Park	II
14	Javakheti - Arpi	153,051	Georgia -Armenia	26,187	17.1%				
				727		Khanchali	Georgia	Managed Reserve / Sanctuary	IV
				119		Bughdasheni	Georgia	Managed Reserve / Sanctuary	IV
				1,398		Madatapa	Georgia	Managed Reserve / Sanctuary	IV
				2,846		Javakheti	Georgia	National Park	II
				20,829		Arpi Lake	Armenia	National Park	II
				134		Javakheti	Georgia	National Park	II
				134		Arpi Lake	Armenia	National Park	II
15	Khrami - Debeda - Marts	106,872	Georgia - Armenia	3,474	3.3%	Gardabani	Georgia	Managed Reserve / Sanctuary	IV
16	Iori - Mingechauri	328,763	Georgia - Azerbaijan	73,028	22.2%				
				423		Turyanchay	Azerbaijan	Strict Nature Reserve	I
				4,991		Ilisu (Gakh)	Azerbaijan	Managed Reserve / Sanctuary	IV
				5,238		Korchay	Azerbaijan	Managed Reserve / Sanctuary	IV
				2,460		Ilisu Branch	Azerbaijan	Strict Nature Reserve	I
				1,884		Eldar Pine	Azerbaijan	Strict Nature Reserve	I
				36,096		Samukh hunting	Azerbaijan	Managed Reserve / Sanctuary	IV
				4,423		Chachuna	Georgia	Managed Reserve / Sanctuary	IV
				2,048		Korugi	Georgia	Managed Reserve / Sanctuary	IV
				1,594		Iori	Georgia	Managed Reserve / Sanctuary	IV
				7,145		Vashlovani	Georgia	National Park	II
				5,999		Vashlovani	Georgia	Strict Nature Reserve	I
				693		Tbilisi	Georgia	National Park	II
				17		Eldar Pine	Azerbaijan	Strict Nature Reserve	I
				17		Chachuna	Georgia	Managed Reserve / Sanctuary	IV
17	Alazani	284,763	Georgia-Azerbaijan	6,788	2.4%				
				4,259		Ilisu Branch	Azerbaijan	Strict Nature Reserve	I
				29		Zagatala	Azerbaijan	Strict Nature Reserve	I
				1,779		Vashlovani	Georgia	National Park	II
				517		Lagodekhi	Georgia	Managed Reserve / Sanctuary	IV
				204		Alaznis chala Natural Monument	Georgia	Natural Monument	III

#	Freshwater KBA Name	Area of Freshwater KBA (ha)	Country of KBA	Area of Protected Freshwater KBA (ha)	Percentage of Protected Freshwater KBAs	Protected Area Name	Country of Protected Area	Protected Area National Category	Protected Area IUCN Category
18	East Greater Caucasus	314,950	Georgia-Azerbaijan	86,163	27.4%				
				49		Ilisu	Azerbaijan	Strict Nature Reserve	I
				6,931		Zagatala	Azerbaijan	Managed Reserve / Sanctuary	IV
				47,660		Zagatala	Azerbaijan	Strict Nature Reserve	I
				862		Babaneuri	Georgia	Strict Nature Reserve	I
				131		Batsara	Georgia	Strict Nature Reserve	I
				6,725		Ilto	Georgia	Managed Reserve / Sanctuary	IV
				4,109		Lagodekhi	Georgia	Managed Reserve / Sanctuary	IV
				19,696		Lagodekhi	Georgia	Strict Nature Reserve	I
19	Sheki	36,149	Azerbaijan	5,883	16.3%	Shakhdagh	Azerbaijan	National Park	II
20	Karachay	30,506	Azerbaijan	415	1.4%	Turyanchay	Azerbaijan	Strict Nature Reserve	I
21	Kura-Ara(k)s	427,712	Azerbaijan	28,628	6.7%				
				11,716		Barda	Azerbaijan	Managed Reserve / Sanctuary	IV
				1,500		Shirvan	Azerbaijan	Strict Nature Reserve	I
				15,411		Ag-Gel	Azerbaijan	National Park	II
22	Gyzylaghaj	51,346	Azerbaijan	14,679	28.6%	Gyzylaghaj (Gizil-Agaj)	Azerbaijan	Strict Nature Reserve	I
23	Kura	154,058	Azerbaijan	24,601	16.0%				
				12,488		Shamkir	Azerbaijan	Managed Reserve / Sanctuary	IV
				12,113		Garayazy	Azerbaijan	Strict Nature Reserve	I
24	Ara(k)s - Hrazdan	89,001	Armenia	354	0.4%				
				50		Khor Virap	Armenia	Managed Reserve / Sanctuary	IV
				13		Goravan Sands	Armenia	Managed Reserve / Sanctuary	IV
				213		Ararat Vordan Karmir	Armenia	Managed Reserve / Sanctuary	IV
				77		Khosrov Forest	Armenia	Strict Nature Reserve	II
25	Akhurian	18,908	Armenia	0	0.0%				
26	Dzoraget-Tashir	20,811	Armenia	0	0.0%				
27	Agstev	11,619	Armenia	3,312	28.5%				
				270		Margahovit	Armenia	Managed Reserve / Sanctuary	IV
				154		Gandzakar-Upper Aghdan	Armenia	Managed Reserve / Sanctuary	IV
				2,888		Dilijan	Armenia	National Park	II
28	Chilli	3,198	Armenia	0	0.0%				
29	Sevan	164,475	Armenia	141,060	85.8%				
				185		Juniper Open Woodland	Armenia	Managed Reserve / Sanctuary	IV
				140,875		Sevan	Armenia	National Park	II
30	Arpa	15,748	Armenia	1,662	10.6%				
				117		Herher Open Woodland	Armenia	Managed Reserve / Sanctuary	IV
				143		Jermuk Forest	Armenia	Managed Reserve / Sanctuary	IV
				1,402		Gnishik	Armenia	Protected Landscape	IV
31	Lake Jan	115	Armenia	0	0.0%				

#	Freshwater KBA Name	Area of Freshwater KBA (ha)	Country of KBA	Area of Protected Freshwater KBA (ha	Percentage of Protected Freshwater KBAs	Protected Area Name	Country of Protected Area	Protected Area National Category	Protected Area IUCN Category
32	Vorotan	13,873	Armenia	406	2.9%				
				17		Gubadly	Azerbaijan	Managed Reserve / Sanctuary	IV
				390		Goris	Armenia	Managed Reserve / Sanctuary	IV
33	Voghji	5,227	Armenia	0	0.0%				
34	Tsav	18,690	Armenia	10,101	54.0%				
				63		Plane Grove	Armenia	Managed Reserve / Sanctuary	IV
				26		Khustup	Armenia	Managed Reserve / Sanctuary	IV
				9,946		Shikahogh	Armenia	Strict Nature Reserve	I
				66		Arevik	Armenia	National Park	II
35	Ara(k)s-Meghri	41,268	Armenia	19,187	46.5%				
				21		Zangezur	Azerbaijan	National Park	II
				2,678		Boghaqar	Armenia	Managed Reserve / Sanctuary	IV
				16,208		Arevik	Armenia	National Park	II
				11		Arazboyu	Azerbaijan	Managed Reserve / Sanctuary	IV
				135		Zangezur	Azerbaijan	National Park	II
				135		Arevik	Armenia	National Park	II

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WWF was founded
in 1961

Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony and nature.