

RER/03/G41/A/1G/31: Reducing Trans-boundary Degradation of the Kura-Aras River Basin

# **Kura-Aras River Basin Transboundary Diagnostic Analysis**

**January 2007**

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## **EXECUTIVE SUMMARY**

The Kura-Aras river basin is an internationally significant river system, which is seriously degraded and continues to be threatened. The basin covers almost all of Armenia and Azerbaijan, and a sizeable part of the populated and urbanized parts of Georgia. These countries together with Iran and Turkey rely heavily on the Kura-Aras river system as a principal source of water for all sectors and users: industry, agriculture, energy and residential uses.

Integrated, inter-country efforts are urgently required to evaluate the degree of ongoing degradation of these river ecosystems and to take action to halt and reverse damaging trends where necessary. Awareness of this fact has promoted the development of a UNDP-GEF project titled “Reducing Trans-boundary Degradation of the Kura-Aras River Basin” among four of the riparian nations (Armenia, Azerbaijan, Georgia and Iran). A cornerstone of this project is the Kura Aras River Basin Transboundary Diagnostic Analysis (TDA). This document is the result of the collaborative effort of leading specialists of the Armenia, Azerbaijan, Georgia and Iran, assisted by many international experts. It represents the first-ever attempt to produce an in-depth and comprehensive Transboundary Diagnostic Analysis of the Kura-Aras River Basin.

Information gathered by the TDA Technical Task Team (TTT) from the four riparian countries and thematic reports produced within the framework of the Project are unique, both in terms of their wealth and depth of analysis. This material has covered a broad range of economic, environmental, institutional and other activities, as well as their environmental consequences.

The TDA ‘fact-finding’ process employed the GEF ‘Best Practice’ approach and the experiences of other GEF projects to date. This document is an objective, non-negotiated analysis using best available verified scientific information and examines the state of the environment and the root causes for its degradation. It will provide the factual basis for the formulation of a Kura-Aras River Basin Strategic Action Programme (SAP).

The TDA for the Kura-Aras River Basin identified four priority transboundary environmental problems, namely: variation and reduction of hydrological flow; deterioration of water quality; ecosystem degradation; and flooding and bank erosion. Underlying regional causes of these transboundary problems include poor law enforcement and compliance, inadequate development planning, undeveloped civil society and public awareness and inadequate pricing policies.

Each transboundary problem and the key governance issues that underpin the problems are described below.

### **Variation and Reduction in Hydrological Flow**

Variation in hydrological flow has been caused by numerous human interventions including direct water abstraction from surface and groundwater bodies, increased evaporation due to impoundments, urbanization and deforestation. This has significant transboundary consequences and it has been calculated that 40 % of the natural runoff of the Kura and 27 % of the Aras runoff is lost to the Caspian Sea. Severe water deficit has not occurred in the

basin to date and consequently shortages of water have not presented any serious threats to the population. However, population growth and rapid economic development in the basin countries will impose increased pressure on surface and groundwater resources. Climate change could also have a catastrophic impact in the medium and long term with potential scenarios indicating flow reductions of 50% as a consequence of increased average temperature and decreased precipitation. Variation and reduction of flow has already impacted fish species such as sturgeon in the Kura-Aras river basin and affected terrestrial ecosystems such as tugai forests. The construction of new reservoirs is likely to further alter flows. Non-rational use of water is a widely spread practice throughout the basin. Agriculture (and in particular irrigation activities) is the major consumer of water in the basin and water loss (through wastage, leakages and failures), particularly from domestic and municipal water use, is an acute problem for the South Caucasus countries. Currently, the underlying causes can mainly be attributed to low capital investments in operation and maintenance (due to a lack of finance and historical economic difficulties), a lack of investment in developing new irrigation schemes and water supply systems, and a lack of a knowledge base of the hydrology and usage of the basin upon which to construct an integrated water resource management and river basin management policy and regulatory framework. This is compounded by the low awareness of the population which currently has little regard for water efficiency and is often careless with its use. Furthermore the lack of an integrated approach in water resources management is a major problem in all the basin countries where ground and surface water are dealt with separately, and land and forest management often fails to take into account management issues relating to water resources. This creates many of the problems outlined above. If present trends of water use are maintained, the impacts on the flow regime will continue to increase. In order to ensure the equitable use of water, coordinated actions between the basin countries are needed in order to avoid negative consequences in downstream countries occurring due to increased water consumption upstream.

### **Deterioration of Water Quality**

Deterioration of water quality in the Kura-Aras river basin has significant transboundary consequences in the downstream countries. This can be confirmed by the presence of chemical compounds of anthropogenic origin in the transboundary sections of the basin as well as in bottom sediments of the Kura Delta in the Caspian Sea. Water pollution in the Kura basin comes from a number of land based sources including industrial and mining sites, agricultural lands, households in rural areas and municipalities. Wastewater treatment facilities are absent in many municipalities and enterprises, and are available only in some locations in the Aras basin in Iran. Most of the wastewater treatment facilities were built 20-30 years ago and are currently non-operational. The application of fertilizers and pesticides has been significantly reduced in the basin over the last two decades. Furthermore, the usage of persistent chlorine-organic pesticides, such as DDT, hexachlorocyclohexane (HCH) and aldrin, etc has been prohibited in the region. However, recent studies indicate that there is strong evidence that the illegal application of banned chlorinated pesticides in the region is occurring. The unregulated use of fertilizers results in diffuse pollution of both surface and ground water resources. Nutrient loading also comes from direct point source discharges of animal slurry from cattle and pig farms. These incidents have greatest impact in early spring during the snow melt, when waters wash out nitrates and phosphates from previous autumn applications. There is little information that can directly attribute water quality to specific environmental impacts in the Kura-Aras river basin. However, it is likely to be a contributing factor and certainly increases the pressure on already stressed ecosystems. Industrial development and the construction of industrial wastewater treatment facilities are not

coordinated. The only exception is enterprises which have local wastewater treatment facilities. However, it should be noted that most of them are currently not operating. Of particular danger are wastewaters from the mining industry and tailing lagoons and dumps.

### **Ecosystem Degradation**

Transboundary ecosystem degradation including increased trends of biodiversity loss, deforestation, and land degradation are observed throughout the basin. The decline of species has intensified over the last few decades, due to a large extent by habitat fragmentation and degradation. There has been a remarkable decline in several bird species, small mammals and several plant species. Forest degradation in the Kura-Aras basin has intensified during the last two decades. Boundaries of the mountain forests remained more or less stable until the beginning of the 1990s, but since then, the situation has changed as a result of extensive logging, both illegal and authorized by government institutions. Desertification and land degradation is a critical problem in the Kura-Aras basin. The main forms of degradation are salinization (especially in desert and semi-desert areas) and soil erosion (washing out of fertile soil). The most important reason for land degradation appears to be deforestation and overgrazing. Increased demand on timber for commercial purposes is one of the major drivers of ecosystem degradation. This includes timber logging for use in the construction business nationally and for export, and has consequently resulted in a reduction in deciduous forest areas. The energy crisis that has taken place during the last decade in the South Caucasus countries has also put great pressure on forests in the basin. The acute energy deficit in these countries, accompanied with poverty problems has resulted in excessive logging as the population has been forced to use wood for heating and cooking. The causes are related to weak legislation and regulations, institutional complexities, poor law enforcement and low public awareness on the importance of biodiversity and ecosystem act together with financial constraints to create unfavorable conditions for protecting ecosystem integrity and biodiversity. The absence of integrated water resources management also contributes to this process.

### **Flooding and Bank Erosion**

Flooding and bank erosion in the Kura-Aras river basin has significant transboundary consequences. Anthropogenic interventions in the natural flow regime including river training and changes in land cover (intensive deforestation) combined with the degradation of natural floodplains as a consequence of urban development and agriculture, increases the risk of floods and mudflows in downstream countries. Deterioration in the flood protection infrastructure throughout the basin has worsened the situation. It is likely that climate change will further increase the risk. Flooding and mudflow events in the Kura-Aras basin have adverse economic and social implications for the basin countries. Despite extensive investments in flood control schemes in the past, significant damage and occasional loss of human life still occurs. High floods have been reduced by the construction of a number of dams and reservoirs on the Kura and Aras rivers. However, Lack of flood protection reservoirs is listed as one of the main underlying causes of floods in the basin. There are insufficient financial resources for the construction and maintenance of flood control and defense schemes. This is compounded by the lack of a proper monitoring and flow forecasting system that would allow effective early warning. The lack of integrated flood management is another other issue that needs to be addressed in the basin and approaches restricted to flood control using only hard engineering solutions have to be revised, especially when the financial and environmental costs of such solutions are considered.

## **Governance**

After the collapse of former Soviet Union environmental legislation has undergone significant changes in Armenia, Azerbaijan, and Georgia. Although the legal frameworks are relatively new, innovative and dynamic, a major concern is the coherence and consistency among the many legal documents. This has led to some confusion with regard to the institutional arrangements. Consequently, water management in the Kura-Aras basin is fragmented and there are duplications in the various water resources management bodies at the national level within each country. This is compounded by regular and sudden structural changes in the Environmental Ministries in Armenia, Azerbaijan and Georgia after the collapse of former Soviet Union which has destabilized these institutions. Analysis of various donor funded projects shows a lack of integrated environmental management. As a result, duplications of efforts frequently occur. In addition to this, there is a lack of institutional structures in the different economic sectors for planning, coordinating and supporting environmental activities. In the Kura-Aras basin countries one of the technical tools to promote more effective allocation of water resources and collection of corresponding fees are water use permitting systems. A number of regulations exist in Armenia, Azerbaijan, Iran and Georgia that define water use permitting procedures. Despite a comprehensive legal and regulatory framework, gaps still exist, which prevent the full and efficient implementation and enforcement of the water use permitting and associated payment system. The analysis of payments associated with water use permitting shows that the current water resources fees system does not provide incentives in most of the Kura-Aras basin countries for the permit holders to meter water use, conserve water, or to reduce pollution. The current system of water resources fees also does not provide any incentives for the agencies charged with the implementation and enforcement of the system. The Kura-Aras basin countries recognize the importance of transboundary cooperation and are trying to address priority transboundary issues with neighbouring countries.

## **Stakeholder involvement**

Stakeholder involvement and participation was a cornerstone of the Kura-Aras TDA. Consequently detailed Qualitative and Quantitative Stakeholder Analysis was conducted in the riparian countries. The Qualitative Stakeholder Analysis was conducted in order to directly attain the opinions of the residents throughout the river basin about water quality and quantity issues, to ascertain their perceptions of water management challenges, and to identify the region wide concerns for the TDA/SAP process. In order for the public stakeholders to be active participants in environmental governance, it was important that their common and transboundary priority concerns were included in a larger scale Quantitative Stakeholder Analysis within the TDA/SAP process.

The most notable finding of the stakeholder analysis was the high level of concern among all stakeholders regarding the deterioration of water quality. Among all stakeholders surveyed, this was the highest priority concern by a significant margin. The second highest priority set of concerns were the variation and reduction of hydrological flow. The third highest priority set of concerns were ecosystem degradation in the river basin and decline in bioresources. The lowest priority concern was increased flooding and bank erosion.

The Kura-Aras Stakeholder Advisory Group (SHAG) finally provided detailed feedback and recommendations on further project development based on the findings of the TDA (refer to Appendix 1 for details).

# 1. INTRODUCTION

The Kura-Aras river basin is an internationally significant river system, which is seriously degraded and continues to be threatened. The basin covers almost all of Armenia and Azerbaijan, and a sizeable part of the populated and urbanized parts of Georgia. These countries together with Iran and Turkey rely heavily on the Kura-Aras river system as a principal source of water for all sectors and users: industry, agriculture, energy and residential uses. Notably, many of the region's poorest communities live within the Kura-Aras river basin and depend upon its waters.

The Kura and Aras rivers are important to regional cooperation as they cross and form many of the borders between the riparian states. Both rivers are seriously degraded in places. Water quality is impaired by the dumping of untreated municipal, industrial, medical and agricultural wastes, and by high sedimentation loads resulting from upstream deforestation and land degradation. Water quantity is constrained by use of water for domestic, agricultural and hydropower purposes, which impacts upon the river ecosystem in places. Finally, the rivers run into and impact the Caspian Sea, affecting the ecosystem and biodiversity of the region, particularly that of Iran and Azerbaijan.

As past experience has shown, single sector oriented management of water resources does not solve the problems of transboundary water resources and only integrated planning of water resources at the basin level can address the environmental and social-economic development needs in the basin. Consequently, integrated, inter-country efforts are urgently required to evaluate the degree of ongoing degradation of these river ecosystems and to take action to halt and reverse damaging trends where necessary.

Awareness of this fact has promoted the development of a UNDP-GEF project titled "Reducing Trans-boundary Degradation of the Kura-Aras River Basin" among four of the riparian nations (Armenia, Azerbaijan, Georgia and Iran). This PDF-B funded project aims to ensure that the quality and quantity of the water throughout the Kura-Aras river system meets the short and long-term needs of the ecosystem and the communities relying upon the ecosystem. The project is expected to achieve its objectives by: fostering regional cooperation; increasing capacity to address water quality and quantity problems; demonstrating water quality/quantity improvements; initiating required policy and legal reforms; identifying and preparing priority investments and; developing sustainable management and financial arrangements.

A cornerstone of this project is the Kura Aras River Basin Transboundary Diagnostic Analysis (TDA). This document is an objective, non-negotiated analysis using best available verified scientific information and examines the state of the environment and the root causes for its degradation. It will provide the factual basis for the formulation of a Kura-Aras River Basin Strategic Action Programme (SAP), which will embody specific actions (policy, legal, institutional reforms or investments) that can be adopted nationally, usually within a harmonized multinational context, to address the major priority transboundary problems identified in the TDA, and over the longer term enable the sustainable development and environmental protection of the Kura-Aras river basin.

## **2. METHODOLOGY**

### **2.1 Background**

Historically, advice on TDA and SAP approaches given by GEF has been rather limited. However, the experiences of senior IA portfolio managers, IW Chief Technical Advisors (CTAs) and practitioners from a number of IW projects, together with GEF IW Focal Area Programme Study, provided an opportunity to develop more formal guidelines to assist with the preparation of TDAs and to ensure inter-regional comparability.

Consequently a GEF guidance document was developed to provide a road map for best practice in formulating a TDA and a SAP as part of a GEF IW project. It was prepared on the basis of discussions between specialists from UNDP, UNEP and the GEF Secretariat, together with practitioners who had completed the process in freshwater and marine systems. The final document reflected the experience obtained in conducting TDA/SAPs between 1996 and 2003 but was not intended as a prescriptive formula, merely a guide that should be adapted to the cultural socio-economic and political realities of each region.

The GEF IW TDA/SAP “best practice” approach underpins the methodology used in the development of the Kura-Aras River Basin TDA. Consequently the methodology for the TDA consists of the following steps:

- **Identification and initial prioritisation** of transboundary problems
- Gathering and interpreting information on **environmental impacts** and **socio-economic consequences** of each problem
- **Causal chain analysis** (including root causes)
- Completion of an **analysis of institutions, laws, policies and projected investments**

It focuses on transboundary problems without ignoring national concerns and priorities and identifies information gaps, policy distortions and institutional deficiencies. The analysis is cross-sectoral and examines national economic development plans, civil society (including private sector) awareness and participation, the regulatory and institutional framework and sectoral economic policies and practices.

### **2.2 Kura-Aras TDA Methodology**

#### **2.2.1 Identification of the priority transboundary issues**

The first step in the TDA process was to agree on the transboundary problems. The initial stakeholder consultation had highlighted the main problems, but it is important for the TDA Technical Task Team (TTT) to revisit them, agree on whether or not the list is complete, examine their transboundary relevance, determine preliminary priorities and examine the scope of each.

The TTT, made up of 16 experts<sup>1</sup> from the Riparian countries brainstormed the list of 23 common GEF transboundary problems shown in Box 1 below in order to determine their relevance and transboundary nature in the context of the Kura-Aras River Basin.

<b>Box 1: Common transboundary problems</b>	
<b>Major Concern I. Freshwater Flow Modifications</b>	
1	Excessive withdrawals of surface and/or groundwater for human uses
2	Changes in freshwater availability
3	Changes in flow regimes from structures
<b>Major Concern II: Pollution</b>	
4	Pollution of existing drinking water supplies
5	Microbiological pollution
6	Nutrient overenrichment
7	Hydrocarbon pollution
8	Heavy metal pollution
9	Radionuclide pollution
10	Suspended solids/accelerated sedimentation
11	Excessive salinity
12	Thermal pollution
<b>Major Concern III: Habitat and community modification</b>	
13	Loss of ecosystems or ecotones
14	Modification of ecosystems or ecotones
15	Invasive Species
<b>Major Concern IV: Exploitation of fisheries &amp; other living resources</b>	
16	Over-exploitation
17	Excessive bycatch and discards
18	Destructive fishing practices
19	Decreased viability of stocks through contamination and disease
20	Impact on biological and genetic diversity
<b>Major Concern V: Fluctuating Climate</b>	
21	Freshwater flow fluctuations such as drought and floods
22	Fluctuating ocean circulation patterns
23	Sea level change (including saltwater intrusion)

This priority transboundary problems were identified by assigning a score to each problem of between 0 (no importance), 1 (low importance), 2 (moderate importance) and 3 (high importance) to determine the relevance of the problem from the perspective of the *present day* and *15-20 years in the future*. When examining future change the TTT were asked to consider the effects of climate change. The scoring activity was based on the following suite of criteria:

- Transboundary nature of a problem.
- Scale of impacts of a problem on economic terms, the environment and human health.
- Relationship with other environmental problems.

<sup>1</sup> A full list of the TTT experts is shown in Appendix 3.

- Expected multiple benefits that might be achieved by addressing a problem.
- Lack of perceived progress in addressing/solving a problem at the national level.
- Recognised multi-country water conflicts.
- Reversibility/irreversibility of the problem

This initial meeting of the TTT also served as a project planning exercise. The expertise for the subsequent stages of the process can be discussed, as well as the availability of information. Agreement on a preliminary contents page for the TDA is a useful way of ensuring that the entire process has been thoroughly discussed.

### **2.2.2 National TDA Reviews and Thematic Reports**

National TDA Reviews and Thematic Reports were drafted by selected consultants from the TTT and project team. The list of the Thematic Reports is shown below:

- Socio-economic situation in the Kura-Aras River Basin
- Legal and institutional framework for the water sector in Armenia, Azerbaijan, Iran and Georgia
- Change of climate and evaluation of environmental vulnerability in the Kura-Aras Basin
- Biodiversity and ecosystems in the Kura-Aras River Basin
- Water quality
- Assessment of land based sources of pollution
- Non rational use of water
- Irrigation and drainage
- Flooding
- Aquifer systems in the Kura-Aras river basin
- Impacts on Caspian Sea
- Causal Loop Diagrams of the Transboundary Problems

Each review and report used a similar structure and the consultants were asked to produce reports that: described the particular problem; identified any gaps in knowledge; identified the environmental impacts and socio-economic consequences; detailed the immediate and underlying causes of the impacts and consequences; and listed proposed options for addressing the identified problem. Consequently, the Thematic Reports constituted the main sources of information for the TDA. All the Thematic Reports are presented in the Annexes associated with this TDA document, together with other key supporting information (e.g. UNDP/SIDA Reports<sup>2</sup>).

### **2.2.3 Development of causal chains for the priority transboundary problems**

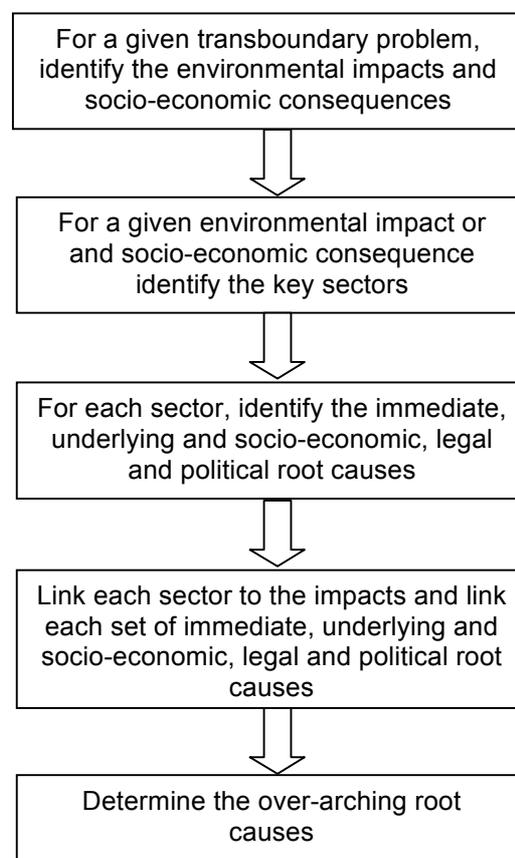
Causal Chain analysis (CCA) is one of the most useful aspects of the TDA for the development of future corrective actions. The causal chain should relate the transboundary problems with their impacts, immediate physical causes and their social and economic underlying root causes.

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<sup>2</sup> UNDP/SIDA refers to the reports prepared under UNDP/SIDA component of this project. SIDA is the Swedish International Development Cooperation Agency

The CCA methodology developed for this TDA was based on the approach used by the Global International Waters Assessment (GIWA) and the Dnipro River Basin TDA. However, previous approaches only linked the causes to the transboundary problem, and failed to focus on why a particular cause results in a given impact. The Kura-Aras methodology aims to bridge this gap by linking the sectors and causes of a given transboundary problems with the impacts of the problem. The advantage of this approach, together with the Causal Loop Diagram methodology, is that it aids in the identification of well-targeted interventions that can address both institutional and technical solutions to problems. This is in contrast to existing approaches in which the interventions in the SAP do not address the findings outlined in the TDA. A simple step by step guide to the process is shown in Figure 2.1.

**Figure 2.1:** Stepwise sectoral analysis approach to developing a causal chain



#### **2.2.4 Development of causal loop diagrams for the priority transboundary problems**

Causal Loop Diagrams (CLDs) conceptualise transboundary problems in a different way to CCA. Here complex problems are presented in a dynamic way that shows not only simple cause-effect relationships but a complex system of feedbacks where impacts act as causes. It gives the opportunity to observe the behaviour of the whole system and how sub-systems interact. Impacts of interventions introduced at one point into the system can be followed throughout the chain. The need for an integrated approach to develop solutions for transboundary problems is also very clearly demonstrated in CLDs which help better focus on more appropriate interventions.

After the priority transboundary problems have been identified, a team of experts developed a dynamic model for each problem getting by initially listing all exogenous and endogenous components that have contributed to the transboundary problem. The next step was to identify causality between the different system components: linking effects and causes and identifying feedback relations. Arrows with plus or minus signs are used for demonstrating these causalities and the character of the changes that one system component triggers in other. Analyses of all the impacts of each transboundary problem were carried out, helping to identify the most critical variables in each system. Along with CCAs, CLDs were used to identify potential areas of interventions.

### **2.2.5 Stakeholder analysis**

The Kura Aras Stakeholder Analysis involved both qualitative and quantitative surveys of stakeholders in the region. These complimentary analyses provide insights into the concerns, priorities and perceptions of stakeholder groups throughout the region. They also identify where tensions or potential tensions could emerge as a result of different expectations and priorities for water use within the basin.

The qualitative study was conducted in Armenia, Azerbaijan, and Georgia in summer 2005. The interview process involved traveling throughout the region with local experts familiar with the riparian communities and local language abilities. Stakeholder interviews were conducted with individuals in these communities. Initial questions were posed regarding water management concerns in the communities, with follow-up questions posed by the stakeholder analyst. Approximately 150 people were consulted in this process and included a wide array of local stakeholders including farmers, housewives, municipal and state government officials, shopkeepers, public healthcare providers, school teachers, local ministry officials, municipal water management officials and others.

Following the Qualitative Stakeholder Analysis the Quantitative Stakeholder Analysis was conducted. This survey based analysis was conducted in all four South Caucasus countries among 36 different stakeholder groups. Surveys were translated into local languages and were administered by local and national level stakeholder consultants throughout the river basin. A total of 512 surveys were collected and statistically analyzed for trends among and between groups. Areas of notably high and low priority concern or high levels of variation within groups were detailed and analyzed for the potential causality and significance of these trends. Issues which showed potential for conflict between groups were highlighted. The full methodological approach can be found in the Annex 12.

### 3. DESCRIPTION OF THE BASIN

This section provides an overview of the Kura-Aras River Basin, covering the geographical characteristics of the basin, its ecological status, a summary of the socio-economic situation and an introduction to the institutional arrangements within the basin.

#### 3.1 Geographical Characteristics

##### 3.1.1 General characteristics

The basin of the rivers Kura and Aras covers the territory of Armenia, Azerbaijan, Georgia, Iran, and Turkey. The total area of the Kura-Aras basin is approximately 188,400 km<sup>2</sup>, occupying the greater part of the South Caucasus<sup>3</sup>. Table 3.1 shows the distribution amongst the five countries.

**Table 3.1:** Distribution of the riparian countries in the Kura-Aras River Basin

Country	Total Country Area (1000 km <sup>2</sup> )	Area in the Basin (1000 km <sup>2</sup> )	% of the country area	% of the basin area
Armenia	29.8	29.8	100.0	15.8
Azerbaijan	86.6	55.1	63.6	29.2
Georgia	69.7	36.4	52.2	19.3
Turkey	771	28.9	3.7	15.3
Iran	1648	38.2	2.3	20.3
<b>Total</b>	<b>2605.1</b>	<b>188.4</b>	<b>7.2</b>	<b>100.0</b>

The basin spreads over the major part of eastern Georgia; over 60% of Azerbaijan, excluding the northeast of the country and the Lenkoran region; the entire area of Armenia; the northwestern part of Iran and territories of northeast Turkey. A map of the Kura-Aras Basin is shown in Figure 3.1.

The Kura is the main water artery of the Caucasus. Its total length is 1,364 km. It originates at a height of 2,700 m in the Anatolian highland of Northeast Turkey in the Kizil-Giadik mountain range, winding its way 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 main tributary of the Kura is the Aras.

The altitude of the Kura watershed ranges from 4,500 m to the Caspian Sea (-27 m). The flow in the spring flood periods makes up 58-64% of the total annual discharge with 19-22% of the total discharge during the summer-autumn period and 17-20% in winter (JRM Final report 2004).

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<sup>3</sup> South Caucasus refers to Georgia, Armenia and Azerbaijan