

# CHAPTER 6:

## Central Asia and the Caucasus

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The Central Asia and the Caucasus subregion is divided by the Caspian Sea into two distinct areas which differ in geography, culture and ecology. The Caucasus, comprising Armenia, Azerbaijan and Georgia, is located to the west of the Caspian Sea and is both culturally and ethnically strongly associated with Europe. These countries are facing declining fish catches and biodiversity, and increasing environmental pressures relating to transportation of oil and natural gas and exploration and exploitation activity. Effective pollution control, access to investment and environmentally sustainable, sustained and equitable growth required for employment creation and poverty reduction are critical challenges to sustainable development in the Caucasus.

Central Asia is the main focus of this chapter. To the east of the Caspian Sea, Central Asia, made up of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, covers about four million km<sup>2</sup>; an area roughly the size of Western Europe. The Central Asian countries share common cultural roots, histories, and natural environments. They also share problems related to transition from centrally-planned economic systems. The Aral Sea and its associated river systems link Central Asian countries and sustain a large proportion of their populations. At the same time, the Aral Sea has become internationally acknowledged as a symbol of the effects of extensive use of natural resources exceeding the environmental carrying capacity. As of 2003, this sea was still shrinking as a result of environmentally unsustainable water use regimes, but may be rebounding as a result of extensive waterworks. Kazakhstan's Lake Balkash also appears to be suffering a similar fate. Industry, including mining, and associated land-use change and energy resource exploitation, are acknowledged as the other significant pressures on the natural environment in this subregion. Natural disasters exacerbated by human activities have become increasingly common, and environmental degradation linked to oil exploitation has been spreading. Growing environmental remediation costs, poverty reduction needs, deteriorating infrastructure and urban environments, all underline the necessity for action to promote more environmentally sustainable growth patterns. Climate change, which threatens to reduce water supplies from glacier-fed river systems, makes such a shift all the more imperative.

Growing stakeholder participation and subregional cooperation has ensured significant promise. These countries are signatories of the Aarhus Convention, a unique step forward in the Asian and Pacific region. The implementation of the principles promoted by this convention could provide an opportunity for improving governance processes in areas even beyond environmental protection.

## 6.1 The economy

Central Asia and the Caucasus is home to some of the fastest-growing economies in Asia and the Pacific, with three Central Asian countries (Kazakhstan, Tajikistan and Turkmenistan), Azerbaijan and Armenia within the top ten positions in terms of the average annual GDP growth rate from 1999 to 2003.<sup>1</sup> Heavily dependent on their natural resource base to support their economic activity, these countries have benefited from soaring commodity prices (including oil and gas), strong exports and growing trade with the reviving economy of the Russian Federation. Energy-exporting economies of Azerbaijan, Kazakhstan and Turkmenistan have benefited from a recovery in foreign direct investment flows in this sector.<sup>2</sup> The subregion is on its way to overcoming the economic crisis that followed the collapse of the Union of Soviet Socialist Republics. Market reform, active privatization and growth of entrepreneurial activity

have been cited as the most important factors in boosting economic optimism in Central Asia.<sup>3</sup>

Despite its recent rapid growth, the combined GDP of the five Central Asian countries was only US\$39 billion in 2002, with a total export value equal to just one-quarter of Australia's exports. Per capita income, although on the rise in all countries, was highest in the oil-rich, relatively reform-oriented Kazakhstan and lowest in mountainous Kyrgyzstan and Tajikistan (Table 6.1). The latter countries, despite their relatively high GDP growth rates, were also struggling to lower their high external debts.

Industrial production supports about one third of Central Asia's GDP. With the exception of Kazakhstan, all of these economies remain highly agriculture-based. The most important sectors are hydrocarbons (Kazakhstan), metallurgy, food processing and hydroelectricity production (Kyrgyzstan), aluminum, hydroelectricity and

Table 6.1 Economic indicators: Central Asia and the Caucasus

	Armenia	Azerbaijan	Georgia	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
GDP growth rate, % per annum (1999-2003)	10.6	10.1	5.8	10.6	4.4	9.4	18.9	2.9
GNI per capita, US\$ (2003)	903	803	750	1 695	353	250	2 724	336
Consumer Price Index change, % per annum (1999-2003)	2.01	2.09	4.77	8.41	7.5	-	-	-
Unemployment rate, % (2003)	10.1	1.4	11.5	8.8	9	2.5	-	0.2
Merchandise Trade, billion US\$ (2003)								
Exports	0.67	2.59	0.48	12.93	0.58	0.77	-	-
Imports	1.24	2.63	1.14	8.41	0.72	0.86	-	-
Total debt/GNI (2003)	-	0.23	-	0.87	1.09	0.66	-	0.43
ODA received, million US\$ (2003)	247.41	296.71	219.81	268.36	197.65	144.08	27.17	194.36
Foreign direct investment, net inflows, million US\$ (2003)	121	2 293	338	2 188	46	32	100	70
Structure of GDP, % of GDP (2003)								
Agriculture	24	14	20	8	39	23	29	35
Industry	39	55	25	38	23	20	51	22
Services	37	31	54	54	38	56	20	43

Sources: See Annex V.

cotton (Tajikistan), grain and cotton (Uzbekistan) and hydrocarbons, grain and cotton (Turkmenistan). The environmental pressures exerted by these economic activities are manifested in high levels of waste and pollution, land degradation and biodiversity loss. Telecommunications, retailing and construction sectors have, in recent years, been among the most dynamic across Central Asia. Currently established economic policy priorities in Central Asia include structural reform to reduce the high dependence on natural resources exploitation.

Official unemployment rates continue to be high in Kazakhstan and Kyrgyzstan. However, while Kazakhstan's recent economic growth has reduced unemployment rates to some two thirds of the level in 2000, Kyrgyzstan's unemployment rates have shown a marginal increase since then.<sup>4</sup> Reflecting rising poverty rates, household consumption has contracted sharply from 1990 levels in Kyrgyzstan, Tajikistan and Uzbekistan.

The fortunes of these economies and societies revolve around water and energy; in turn, the futures of these resources are critically interlinked. The Syr Darya and the Amu Darya river systems are the source of considerable hydropower potential, of which only 10 per cent has so far been exploited. Kyrgyzstan and Tajikistan possess 90 per cent of the economically viable hydropower potential, a vital resource for these small economies. At the same time, these river systems are the lifelines of the agricultural systems on which depend sizeable proportions of the downstream populations of Uzbekistan, Kazakhstan and Turkmenistan. Over 80 per cent of water in Kazakhstan is used for agriculture, and over 90 per cent, in other Central Asian countries. The damming required to exploit the hydropower potential has reduced the volume of water available for agriculture downstream, a situation that has been positively addressed by bilateral cooperation, but has, at times, been the source of tension.

While water and energy resources are relatively limited in Central Asia, water use and energy efficiency are significantly below the world average.<sup>5</sup> The status of Central Asian countries as economies in transition has limited the effectiveness of a response to this situation. However, these governments

are gradually privatizing their water, energy and agriculture sectors. This has achieved mixed results, including greater energy efficiency in Kazakhstan. The withdrawal of government budgetary support from the privatizing agricultural sector has left it unable to finance the rehabilitation and maintenance of irrigation and drainage systems. As a consequence, non-productive water loss has increased.

## 6.2 Social development

Central Asia is sparsely and unevenly populated. The more inhospitable desert and mountain areas have a population density of less than one person per km<sup>2</sup>, while the populations of the natural oases located in the river deltas and valleys number 100 or more people per km<sup>2</sup>. The Central Asian urban population share varies from 25 per cent in Tajikistan to 56 per cent in Kazakhstan (Table 6.2). With the possible exception of Turkmenistan, the urban housing and other infrastructure of Central Asian countries have not been able to adequately meet the needs of urban residents. Despite the overall low population density, high concentrations of populations in fertile areas, and Central Asia's overall limited environmental carrying capacity, mean that population growth is a potentially serious environmental pressure. Both Kyrgyzstan and Uzbekistan are implementing birth control measures such as improving access to family planning services and prophylactics.

With the collapse of the former Soviet Union, there has been a dramatic increase in poverty and a reduction in social services and social protection, which is reflected in the available high official poverty rates (Table 6.2), and similarly high unofficial estimates. Recent economic growth has reduced poverty rates in Kazakhstan and Turkmenistan, but has not yet impacted on poverty rates in Kyrgyzstan, Tajikistan and Uzbekistan. Growing social pressures in Kyrgyzstan have been cited as a factor in its recent political upheaval. Kyrgyzstan has initiated government programmes to combat poverty.

The Central Asian countries score in the middle range out of the 177 countries ranked based on the human development index. Their life

expectancies and GDP per capita are markedly below those of the highest scoring countries. However, all of the Central Asian countries have very high literacy rates of over 97 per cent. Health care expenditure per capita is low and only 50-80 per cent of the population has access to drinking water. Tajikistan has fallen 21 places in HDI ranking based on its declining life-expectancy, poverty rates and extremely high levels of undernourishment (Table 6.2). Though most of the countries in Central Asia

have benefited from economic recovery, income inequality is much higher than before the disintegration of the Union of Soviet Socialist Republics. Under-five mortality rates have also increased in all Central Asian countries.<sup>6</sup>

Impassable mountain ranges combined with national borders that do not necessarily reflect historical ethnic distributions have created a number of ethnic enclaves. In places such as the Ferghana Valley, shared by Uzbekistan, Tajikistan and

Table 6.2 Social indicators: Central Asia and the Caucasus

	Armenia	Azerbaijan	Georgia	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
Total population, thousands (2005 estimate)	3 016	8 411	4 474	14 825	5 264	6 507	4 833	26 593
Population growth, % (2004-2005)	-0.4	0.7	-0.9	-0.2	1.2	1.3	1.4	1.4
Urban population, % of total (2003)	64.4	50.0	51.9	55.8	33.9	24.7	45.3	36.6
Slum population, % of urban (2001)	2.0	7.2	8.5	29.7	51.8	56.0	2.0	50.7
Human Development Index (2002)	0.75	0.75	0.74	0.77	0.70	0.67	0.75	0.71
Primary school enrollment rate, % (2001)	84.5	79.8	90.7	89.5	90	-	-	-
Population below US\$1 (1993 PPP) per day consumption, % (2001-2003)	13 <sup>a</sup>	4 <sup>a</sup>	3 <sup>a</sup>	2 <sup>c</sup>	2 <sup>b</sup>	7 <sup>c</sup>	10 <sup>a</sup>	14 <sup>a</sup>
Life expectancy at birth, years (2002)	72.3	72.1	73.5	66.2	68.4	68.6	66.9	69.5
Under-five mortality rate, per 1,000 live births (2003)	33	91	45	73	68	95	102	69
Population with dietary energy supply below minimum requirement, % (2000-2002)	34	15	27	13	6	61	9	26
Access to an improved water source, % of population (2002)	92	77	76	86	76	58	71	89
Gender-related Development Index, (2001)	0.752	-	-	0.761	-	0.668	0.748	0.705
Digital Access Index (2002)	0.30	0.24	0.37	0.41	0.32	0.21	0.37	0.31

Sources: See Annex V.

Notes:

<sup>a</sup> 2001

<sup>b</sup> 2002

<sup>c</sup> 2003

## Box 6.1 Sustainable development challenges in the Caucasus

The Caucasus (Armenia, Azerbaijan and Georgia), is bordered to the north by the Russian Federation, to the south by Turkey, to the west by the Black Sea and, to the east by the Caspian Sea. It has a varied climate including temperate and sub-tropical zones which allow for a high a degree of biological diversity. Having served as an important part of the silk route, these countries enjoy a culture and history enriched by influences from far beyond their borders. With the break-up of the former Soviet Union, the Caucasus experienced disruption of economic links between the countries, political instability and a dramatic decline in industrial and agricultural production. In addition, the Nagorno-Karabach conflict between Armenia and Azerbaijan created nearly one million refugees and internally displaced people, and is still a source of political tension.<sup>7</sup>

Agriculture is traditionally the most important economic activity for the Caucasus, employing the majority of the adult population. Among the most important traditional crops are wheat, barley, oat, rye grain, legumes and a wide variety of fruit. The major industrial sectors include energy (oil, gas and hydroelectricity), chemicals, machinery, metallurgy, cement, fertilizer, light manufacturing and food processing industries. Since the late 1990s, the economies of the Caucasus have achieved a degree of stability and modest growth which has accelerated in recent years. Azerbaijan is considered to be one of the most prosperous and industrialized countries among the newly independent states of Eurasia. With the construction of new natural gas and oil pipelines, Azerbaijan is expected to become a significant energy exporter over the next decade. Azerbaijan's oil production (total liquids) averaged 327,700 barrels per day in 2003. Georgia's oil reserves are much smaller and Armenia has no proven reserves.

In spite of dire socio-economic conditions and widespread poverty, the countries of the Caucasus have maintained high levels of literacy, access to healthcare and education. However, unemployment is on the rise, and close to half of the population has emigrated to the Russian Federation and other countries in search of jobs. In Georgia, some 50-60 per cent of the population lives below the poverty line. Unemployment in urban areas is about 26 per cent, and in Tbilisi, Georgia ranges between 30 to 40 per cent depending on the season. In Armenia, poverty rates have reached 55 per cent, although the number of those living under extreme poverty has decreased over the past several years. The refugees of Azerbaijan are the most vulnerable to poverty, but are being strongly supported by the Government of Azerbaijan's focus on maintaining and investing in social services, in particular education.

The Caspian Sea hydrocarbon resource and commercial fisheries values are considerable. The Caspian Sea is especially known for the increasingly rare sturgeon, which has served as a valuable economic resource for over a century. Other valuable species include salmon and trout. Forests cover more than four million hectares or some 25 per cent<sup>8</sup> of the land area of these three countries, with more than 60 per cent in Georgia. There are 6,300-6,350 plant species of which 1,600 or 25 per cent are endemic. Total fauna consists of 152 species of mammals, of which 32 are endemic. Deteriorating social conditions are partially responsible for over-exploitation of natural resources. Over the past twenty years, the sturgeon catch has declined by 90 per cent and Azerbaijan's fish catch fell from 39.7 to 6.9 thousand metric tons between 1991 and 1996. The decline in fish catch was even more acute in Georgia, where the volume of fish catch decreased by a factor of 50 between 1990 and 1992. Many species, both flora and fauna have become endangered or threatened due to human activities. The Nagorno-Karabakh conflict has resulted in an estimated 13.5 ha of forest and other damage to two nature reserves in Azerbaijan. The damage to Azerbaijan's environment during 1989-1991 was valued at about US\$5 million, increasing in subsequent years.<sup>9</sup>

Meeting energy security needs, both within these countries and in others, has become a major source of environmental pressure as oil is known to contaminate freshwater systems, groundwater and land during its exploitation and transportation. Energy projects are expected to grow in scope and, thereby in potential impact. Two recent initiatives include the Islamic Republic of Iran-Armenia gas pipeline initiated in May 2004, and the July 2005 agreement between Armenia and Georgia on energy cooperation which may provide for electrical grid connection and reciprocal seasonal energy sharing. Degradation and pollution of land resources consequently feature among the major environmental issues facing the Caucasus. Industrial activity (outside of the energy sector) while slowing, has left a legacy of waste, including hazardous waste that will add to this problem. Heavy-metal water pollution, such as reported in Armenia's largest water reservoir in July 2005 is not an isolated occurrence. Other anthropogenic pressures (intensive land cultivation, overuse of agricultural chemicals, intensive irrigation, illegal timber exploitation, over-grazing and open-pit mining), as well as natural pressures, such as wind and water erosion, landslides, mudflows and flooding, further contribute to land degradation.

Among the most pressing development-related issues facing the Caucasus are: a) the development of effective subregional cooperation mechanisms to protect and manage resources; b) the strengthening of regulatory and incentive-based anti-pollution measures; c) the provision of adequate access to international investment, international expertise, and cleaner technologies; and d) environmentally sustainable, sustained and equitable growth needed to reduce unemployment, poverty and environmental pressures. Political conflict and tension in several parts of the Caucasus remain a significant deterrent to action on several of these fronts.

Sources: UNEP (2002). *Caucasus Environmental Outlook 2002* (Tbilisi, UNEP GRID-Tbilisi); Energy Information Administration, United States of America, Caucasus Region Country Analysis Briefs webpage, accessed at <[www.eia.doe.gov/emeu/cabs/caucasus.html](http://www.eia.doe.gov/emeu/cabs/caucasus.html)> on 20 September 2004.

Kyrgyzstan, country borders cut across traditional transport routes and therefore require residents using traditional transport routes to pass through neighbouring territories. The resultant tensions act as a barrier to social and economic development in affected areas.

### 6.3 Environment and sustainable development conditions and trends

Despite the relatively low levels and diversity of economic activity, the environmental pressure experienced by all countries is high and is further exacerbated by poverty, resource limitations, closely shared and interlinked resources, and in particular, fragility of land resources.

Water resources continue to be one of the key concerns of this subregion. Diminishing water quality, specifically groundwater, has further reduced the availability of water of adequate quality, while water infrastructure has been deteriorating. Pollution and waste continue to threaten human health as the legacy of industrial waste persists. Exploitation of oil is a source of industrial pollution and a further cause of land degradation. The pressures on the land resources of this arid area have been linked to an alarming increase in frequency of natural disasters in almost every Central Asian country. The pressure on ecosystems is not just exerted by economic activity; poverty and rising energy prices are also playing their part in increased exploitation of natural resources.

Table 6.3 Environmental indicators: Central Asia and the Caucasus

		Armenia	Azerbaijan	Georgia	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
Protected areas, % of land area	2004	10	6	4	3	4	18	4	5
Forest area, % of land area	1990	11	11.5	43.7	3.7	4	2.7	8	4.6
	2000	12.4	13.1	43.7	4.5	5.2	2.8	8	4.8
Land use, % (2002) <sup>c</sup>	Arable and permanent crops	20	24	-	8	7	8	4	12
	Permanent pasture	30	32	-	69	49	23	65	54
Renewable water resources, m <sup>3</sup> /capita/year	2003-2007	3 450	3 584	12 481	7 116	3 952	2 537	5 004	1 904
Water withdrawal, m <sup>3</sup> /capita/year	1998-2002	960	2 079	697	2 263	1 989	1 931	5 142	2 270
Threatened species, numbers (2004)	Animals	34	38	43	52	15	22	40	30
	Plants	1	0	0	1	1	2	0	1
Access to improved sanitation, % of population	1990	-	-	-	72	-	-	-	58
	2002	84	55	83	72	60	53	62	57
Energy intensity, energy supply (kg of oil equivalent) per US\$1,000 (PPP) GDP	2002	209	464	228	551	323	549	702	1 277

Sources: See Annex V.

After gaining independence, the countries of Central Asia pursued new policies aimed at creating a legal basis for environmental regulation and sound socio-economic frameworks for achieving sustainable development. Countries that adopted over-arching environmental strategies were Turkmenistan, with its *National Environmental Action Plan* (NEAP) which includes incentives for investment in environmental protection up until 2010; Kazakhstan with its wide-ranging *Law on Environmental Protection* approved in 1997 and its *National Environmental Action Plan* in 1998; and Uzbekistan, which used its NEAP as the basis of its *Environmental Programme of Action* for 1999-2005. Kazakhstan has also explicitly described the planned use of environmental resources in its long-term development strategy.

Institutional arrangements recently established for environmental protection include Uzbekistan's State Committee for Nature Protection, which is a specially authorized regulatory body exercising state control and inter-sectoral management over nature protection, utilization and conservation of natural resources. Uzbekistan has also established the Ministry of Health Care, the Ministry of Agriculture and Water Management, the State Forest Committee, the Hydrometeorology Administration and the State Committee on Geology. In addition, Uzbekistan's local management of environmental protection and the utilization and protection of natural resources is overseen by local environmental committees.

The Central Asian countries have strengthened legislative provisions for sectoral environmental protection: Tajikistan has adopted a number of environment-related laws, the most important of which are the *Law on Nature Protection*, the *Law on Preservation and Use of Fauna*, the *Law on Subsurface Resources*, the *Law on Air Protection*, the *Water Code* and the *Forest Code*.

The development of an agreed set of environmental indicators has been a major achievement of the Central Asian countries. All countries are engaged in coordinated data collection, with the strong support of the Scientific Information Centre of the International Fund for the Aral Sea (IFAS) and the Interstate Sustainable Development Commission (ISDC). At the Regional

Workshop on the System of Decision-Making Support, held in Ashkabad, Turkmenistan, in 2002 and a follow-up workshop in Bangkok, Thailand, in 2003, countries adopted, with the support of the UNEP Regional Resource Center for Asia and Pacific, a set of more than 50 indicators of sustainable development in the Central Asian countries.<sup>10</sup> OECD has also begun a similar programme of work with these countries, focusing on the development and use of such indicators for measuring environmental performance.

Expanding stakeholder participation is very much a feature of the subregion. Central Asian and Caucasus countries, with the exception of Uzbekistan, are the only ESCAP region countries to have ratified the *Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters* which entered into force on 30 October 2001. The convention was ratified by 36 signatories as of July 2005, and links environmental and human rights. It broadly provides for access to environmental information (including public disclosure), public participation and access to justice. Civil society and scientific activity has continued to expand, with several active NGOs.

### 6.3.1 Water resources

Freshwater resources are unevenly distributed throughout Central Asia. Most of the river flow in the Aral Sea basin is formed in the territory of Tajikistan and Kyrgyzstan; 43.4 per cent and 25.1 per cent, respectively.<sup>11</sup> These two countries have the mountainous characteristics favourable for the formation of water resources and possess nearly 90 per cent of the economically viable hydropower potential. Kazakhstan, Turkmenistan and Uzbekistan are richer in arable land and are major users of surface water for irrigation purposes.

The total volume of river flow in Central Asia is 196 km<sup>3</sup> per year, and flows principally into the Aral Sea, the Caspian Sea and Lake Balkhash. The largest volume of water flows through the subregion's major rivers, the Amu Darya (79.3 km<sup>3</sup>/year) and the Syr Darya (37.2 km<sup>3</sup>/year).<sup>12</sup> River flow in the streams and rivers of Central Asia is declining, due in

part to hydroelectric dams and irrigation. Shrinking mountain glaciers will deprive the Central Asian rivers of melt water in the long run. The conservation of glaciers as a source of river run-off has been identified by Kyrgyzstan and Tajikistan as a crucial issue requiring joint action.<sup>13</sup>

The heavy dependence of these countries on water for agricultural production,<sup>14</sup> and energy generation has resulted in drastic reduction in water flows into the Aral Sea for the past 50 years (Box 6.2). Representing about 90 per cent of total water use in 1999, irrigation accounts for a high, but slowly declining proportion of annual surface water use (Table 6.4). From 1995 to 1999, total surface water consumption declined by 22 to 34 per cent in Turkmenistan, Kyrgyzstan and Kazakhstan. Tajikistan's off-farm water use increased marginally during that period, while Uzbekistan's 16 per cent increase in water use was virtually all for irrigation purposes. The poor maintenance of the extensive irrigation systems inherited from the Soviet Era and their use of unlined canals resulted in the loss of 30 per cent of the water diverted for irrigation from the Syr Darya and Amu Darya rivers. These systems also caused soil salinization, which affected Turkmenistan more than any other Central Asian country, although there are indications that the situation is improving. Industry accounted for about 2 per cent of water consumption, while domestic consumption accounted for 2 to 5 per cent. During the growing season, water was used extensively for irrigation and water shortages reached up to 50 per cent of demand.<sup>15</sup>

The assessment of water quality based on national reports by the United Nations' Special Programme for the Economies of Central Asia (SPECA), concluded that declining water use for irrigation and industry had reduced mineralization in rivers in recent years. In the meantime, however, contamination of groundwater had become widespread. In Kazakhstan, where more people are relying on self-dug wells, the situation has left a growing number of people vulnerable. Statistics for 1995-2001 indicated that, "on average, 8 to 15 per cent of water samples fail to satisfy bacteriological requirements and 20 to 40 per cent fall short of

physical and chemical standards."<sup>16</sup> While table 6.3 shows that access to improved drinking water is relatively good in most Central Asian countries, data provided by the Scientific Information Centre of the Interstate Sustainable Development Commission (SIC ISDC) indicate that access may be lower by 10 per cent or more of the population of each country. Similarly, in Kazakhstan and Kyrgyzstan, SIC ISDC data on access to sanitation indicates much lower levels of access for these countries.<sup>17</sup>

The SPECA report confirmed that Central Asian water management regimes need to be modernized to equally represent the interests of all sectors, and to focus their priorities on drinking water, water supply conservation and greater stakeholder involvement. Importantly, the report pointed out that many irrigation systems have outlived their standard depreciation period. In a transitioning political and economic system, the responsibility for the restoration and modernization of these systems is unclear, which has become a critical barrier to improving the water resources management.

Turkmenistan has been identified by SPECA as having a unique approach to water resources management. Its water management structure is

Table 6.4 Surface water withdrawals in the Aral Sea Basin

	km <sup>3</sup> (1995)		km <sup>3</sup> (1999)	
	Total	Irrigation	Total	Irrigation
Kazakhstan	11.3	10.1	8.2	8
Kyrgyzstan	5	4.7	3.4	3.1
Tajikistan	12.1	10.4	12.5	10.1
Turkmenistan	23.2	22.5	18.1	16.8
Uzbekistan	54.2	49.0	62.8	56.7
<b>Total</b>	<b>105.8</b>	<b>96.7</b>	<b>105</b>	<b>94.7</b>
Amu Darya	64.4	60.7	66.1	59.6
Syr Darya	41.4	36.0	38.9	35.1

Source: Scientific Information Centre, Interstate Commission for Water Coordination (2000), partially reproduced in United Nations (2004). *Strengthening Cooperation for Rational and Efficient Use of Water and Energy Resources in Central Asia*. United Nations Economic Commission for Europe and United Nations Economic Commission for Asia and the Pacific Special Programme for the Economies of Central Asia Project Working Group on Energy and Water Resources (New York, United Nations).

dominated by a single body, with the state retaining control over all centralized and municipal management of water resources in all sectors, although opportunities exist for setting up private water supply and sewerage treatment services. While water (along with electricity and gas) is free, consumers pay for consumption in excess of quotas established by the state, as a penalty for wasteful use. Available data distinguishes Turkmenistan as having reduced its irrigation water consumption by some 25 per cent between 1995

and 1999, while maintaining the same irrigation area and reducing the area affected by salinization by some seven per cent over the same period.<sup>18</sup>

### 6.3.2 Land degradation

Land degradation and desertification are serious ecological and economic issues for all of the Central Asian countries. In each country, natural, climatic and anthropogenic factors have contributed to the problem. The total land area currently suitable for

#### Box 6.2 The Aral Sea crisis, a new outlook - and a new crisis for Lake Balkash?

Special attention has been given by the international community to improving public access to environmental information, environmental monitoring, and advocacy, in support of improved water management practices. Despite these collective efforts, the Aral Sea crisis continues to be a powerful reminder of the link between environmental degradation and socio-economic problems.

In 1960, the water withdrawal from the Aral Sea basin was estimated at 60.61 km<sup>3</sup> annually. At this rate of withdrawal, the Aral Sea ecosystems remained largely undisturbed. By the year 2000, the population of the basin had almost tripled, and the irrigated area, and water withdrawal from the rivers feeding the Aral Sea, almost doubled.<sup>19</sup> Once the fourth-largest inland sea in the world, the Aral Sea has been fragmented into three separate bodies of water: the small Northern Aral Sea and the Western and Eastern Aral Seas. As of 2003, it had been reduced to less than a third of the original area, at 17.158 km<sup>2</sup>, and the water level lowered by as much as 23 metres. The concentration of salts in the Western Aral Sea was more than 60 g/litre or six times the normal level in 2003. The local climate has also changed. There has been significant loss of wetlands and biodiversity, lowered groundwater levels, soil and water salinization, erosion, and pollution.

The decision to focus on developing the agricultural sector came at the expense of the Aral Sea fishing communities, as well as others depending on the rich resources of this sea. Fishery resource depletion resulted in increased unemployment among the local population and, by consequence, emigration, as well as reduced nutritional status. The exposed Aral Sea bed has turned into a salt desert, from which up to 70 million metric tons of salty dust has been annually transported by wind to the adjacent Priaral territory, covering agricultural lands with salts and other harmful substances toxic to plants. As a result of drinking-water pollution in the area, a number of diseases, such as anemia and tuberculosis are affecting the local population and causing an increase in child mortality.

Despite the establishment of the International Fund for saving the Aral Sea (IFAS) in 1993, and awareness of the critical state of the Aral Sea, the area of the sea continued to decrease between 1996 and 2003, almost halving during that period. In the seven-year period from 1989 to 1996, the volume of the sea decreased by 72 km<sup>3</sup>; in the following seven year period it shrank by twice that amount. It is unclear whether increases of river flow to the Aral Sea reported in 2005 were the result of accelerated glacier melt or the result of improved water resources management. However, a recent in-depth review of the current and future water and energy demand concludes that "the growth in the extensive use of water resources in the Amu Darya and Syr Darya river basins will further increase the risk that the Aral Sea will disappear completely ... This would accelerate desertification and salt transport, disrupt the environmental equilibrium and significantly lower the living standards and reduce the economic opportunities for the population of large parts of the region."<sup>20</sup>

An ambitious plan announced by Kazakhstan in September 2005 is expected to raise the level of the Aral Sea through building of dykes and rehabilitation of irrigation and other waterworks on the Syr Darya at a cost of US\$85 million. Funded by the World Bank, the project has the potential to reduce enough salinity levels to partially restore the Aral Sea fishing industry, and in its early stages, seems to have improved inflows to the Aral Sea, with sea level increases of several metres in only a few months.<sup>21</sup>

UNDP Kazakhstan reports that Lake Balkash, one of the three major water bodies in Central Asia, may be suffering the same fate as the Aral Sea. Fed by the river Ili originating in China, the volume of this lake has been reported to have shrunk by over 2000 km<sup>2</sup>. While it is unclear whether the changing volumes are a result of natural fluctuations, the impact of China's growing water demand has been cited as a cause for concern.<sup>22</sup>

agriculture in Central Asia covers more than 250 million hectares of which 10 million hectares are irrigated; 220 million hectares are hayfields and pastures; and 20 million hectares are not in use.

Some 77 per cent of arable land has been subject to degradation of vegetation cover, 9.1 per cent to salinization as a result of irrigation practices, 3.6 per cent to soil salinization, 5.9 per cent to water erosion, 2.4 per cent to desertification caused by anthropogenic factors and 1.5 per cent to topsoil loss from wind erosion, known as deflation. After the collapse of the former Soviet Union, arable land productivity decreased by 20-30 per cent throughout Central Asia. The minimum annual loss caused by salinization was estimated at US\$2 billion, or approximately 5 per cent of Central Asia's GDP. In the Turkmen and Uzbek Aral Sea area, approximately 90-95 per cent of the irrigated land displayed various degrees of salinity.

The Aralkum desert is an expanding area of alkaline soil formed by the receding Aral Sea. Unsuitable for any form of agriculture, it covers an area of some 25,000 km<sup>2</sup>. The area has become a source of severe salt-dust storms, transporting salt and dust as far as 500 km in distance. From the southeastern coast alone, 15-75 million metric tons of pesticide laden sand and salt are annually moved by the wind. Desertification has high social, economic and environmental costs; Kazakhstan alone has lost an estimated US\$6.2 billion annually to desertification. The countries of Central Asia are employing a wide range of strategies to combat this problem. Kazakhstan has been working on forest fire prevention and penalization for illegal logging, while Kyrgyzstan has increased its reforestation efforts and Uzbekistan is in the process of improving its monitoring capacity.

Oil exploration and extraction has caused other environmental problems. Oil has been extracted since the mid-twentieth century from the Atyrau, Tengiz and Mangystau oil-fields of Kazakhstan, where the ground has been saturated with oil up to 10 metres in depth. About 800 hectares have been polluted with crude oil, and about 200,000 metric tons of oil have been stored in oil-field facilities. The situation has been further

aggravated by ineffective oil extraction equipment, poor infrastructure, and a lack of systems for preventing loss and damage control. The result has been the formation of desertification zones around the oil fields and pipelines. Stratum water from oil production which has been contaminated with high levels of thorium and other sources of radiation, has been discharged without treatment.

The Caspian Sea transgression has been cited as another major cause of land degradation. This little-understood phenomenon is characterized by oscillation of Caspian Sea water levels over long periods, and linked to changes in precipitation across the Caspian Sea Basin. The transgression has caused Caspian Sea levels to rise by more than 2.5 metres since 1978, submerging the coastal zone at a rate of 1-2 km per year. The transgression has also led to drastic changes in the geological and hydro-meteorological conditions of the coastal zone. Large waves of 2 to 3 metres in height have also penetrated far into the coastal zone under specific wind and tide conditions, with similar impacts.

Kyrgyzstan has been taking measures to improve land use and to encourage crop rotation. Uzbekistan is enacting legislation for better land management and soil fertility protection. Turkmenistan has reportedly reduced the salinized area by some 28 per cent between 1990 and 2000, and Kazakhstan by some 11 per cent. The area affected by salinization in Tajikistan increased by 36 per cent during the same period.<sup>23</sup>

### 6.3.3 Habitat loss and biodiversity

Reflecting changes in temperature and precipitation with longitude, Central Asia's ecosystems range from semi-arid zones in the north to temperate continental deserts in the south. The deserts are considered to be the most vulnerable ecosystems and their biodiversity has already been largely depleted. The mountainous forests, alpine meadows, floodplains and tugai ecosystems are considered to be ecologically more productive and remain comparatively healthy. Mountains cover 40 per cent of the territory, where the high-altitude climates consist of desert and alpine desert. Central Asia is home to more than a half of the species found in Eurasia. These include

7,000 species of higher plants, 900 vertebrate species and 200,000 invertebrate species.

Intensive and long-term unsustainable use of natural resources has resulted in significant ecological damage. In some areas of Central Asia, especially the Aral Sea basin, the damage has been irreversible. In Central Asia, the most important ecosystem services are derived from healthy forests and vegetation, which are particularly crucial in preventing soil salinization, landslides, and desertification.

In Tajikistan and Kyrgyzstan only 20 to 25 per cent of natural forest area has remained untouched. Industrialization, expanding agricultural lands, and intensive felling for fuel, livestock grazing, and reduction of investment in forest protection have taken their toll. Considering the fact that mountain xerophyte<sup>24</sup> forests and floodplain forests are among Central Asia's most productive and species-rich ecosystems, loss of these ecosystems would be the most serious threat to bird and mammal species. The area of the tugai forests in the Amu Darya river flood plains has been reduced from 1,500 km<sup>2</sup> in 1928, to 220 km<sup>2</sup> in 1995. While national and other data shows stable or expanding forest area throughout the subregion, this could possibly be due to reforestation activity.

Central Asia is experiencing severe species loss as a result of human modification of natural habitat, coupled with extremely high levels of poaching and inadequate monitoring of game species. Substantial numbers of predators, such as wolves and jackals, are damaging the populations of certain species. The saiga population is of particular concern. This extremely rare and valuable gazelle is a living relic from the Pleistocene. In the 1950s, the Kazakh saiga population showed promising signs of recovery. Today, poaching and hunting has reduced the population by up to 50 per cent. Many other animals are falling prey to human predation. Snakes and spiders are hunted for their venom, used as medicine. Almost half of the 35 species of birds of prey that have been found in Kazakhstan are considered rare or endangered as a result of intensive hunting. Recently, commercial demand for falcons has increased sharply.

Aquatic ecosystems have also been threatened by human activity. Major threats include agricultural, industrial and municipal effluent, transport activities, and human predation. Over-exploitation of commercially valuable species and pollution has resulted in the loss of important microorganisms, algae, fish and amphibian species. This has disrupted the ecology and natural chemical composition of the aquatic ecosystems resulting in loss of bio-productivity. The situation translates to economic loss from declining fishery resources. In the Caspian Sea, invasive species such as the Ctenophora (*Mnemiopsis leidyi*) are causing significant changes to plankton that forms the base of the food chain. The uncontrolled fishing of sturgeon has caused the fish catch to decline by over 90 per cent in the last 20 years. The population of herrings, the most common fish species in the Caspian Sea, has fallen 20-fold. Lack of control and monitoring, over-hunting of wintering and migratory birds such as the waterfowl and Caspian seals, and overfishing of the Caspian lobsters has significantly damaged the population of these important species.

Biodiversity loss in the Aral Sea has been even more dramatic than in the Caspian. Many of the Aral Sea's endemic fish species have gone extinct as a result of increased mineralization of the seawater. The once flourishing deltas and wetlands, which provided natural habitat for numerous migratory waterfowl have become separated due to low water levels, and are now completely unsuitable as habitat. The fragmentation of wetland areas which began in 1960, has made it impossible for aquatic species to continue their migratory patterns. Currently they survive in small isolated patches of wetlands, although their chances for survival appear slim. Over 50 alien species have been found in the Aral Sea, with the majority introduced deliberately, or accidentally in association with deliberately-introduced species.

Tajikistan and Turkmenistan both report that 100 per cent of their forest area is protected.<sup>25</sup> However while Tajikistan's forests continue to be exploited, Turkmenistan's policy of supplying gas free of charge has been credited with eliminating the demand for fuelwood, and creating favourable conditions for

natural forest regeneration.<sup>26</sup> All Central Asian countries with the exception of Tajikistan, have placed only limited areas of their land under protection for biodiversity conservation purposes (Table 6.3). The effectiveness of these protection measures has been reportedly reduced by high poverty levels and linked to this, the exploitation for biodiversity, timber and non-wood forest products, some of which are illegal.

### 6.3.4 Pollution and waste management

Industry is the largest source of pollution, and the most highly-polluting industries are construction, mining, and petroleum refining. In 1999, the volume of industrial waste in Central Asia was 168 million metric tons; more than half of this waste was in Kazakhstan alone, and one third in Kyrgyzstan (Table 6.5). The rate of accumulation of this waste has slowed down, with declining industrial production across Central Asia.

The mining industry has been the largest generator of industrial and toxic waste throughout the subregion, with more than 130 mining waste sites in Central Asia. Depending on the type of production, mining waste contains radionucleotides, salts of heavy metals (cadmium, lead, zinc), and other toxic substances (cyanides, acids, silicates, nitrates and sulphates). In addition, chemical substances used by the mining industry such as flotation agents could be a significant source of air and water pollution, leaching into subsoil, surface and groundwater. The large slag heaps of discarded rock have become an increasingly important source of dust. In the Fergana, Chirchik, Akhangaran and Pskem valleys of Uzbekistan, updrafts circulate dust, odorous vapours, and ashes from these mining sites and other industrial sources causing serious air pollution that covers vast portions of the valleys.

Central Asia also faces an accumulation of significant volumes of radioactive waste. This has been the result of uranium mining and processing as far back as the late 1940s. Rehabilitation of surface mines through reburial of soil into the mines, has become a successful practice in recent years.

In 1999, the volume of municipal waste in Central Asia was more than 13 million metric tons.

Growth in the volume of domestic waste coupled with an increase in its chemical content has increased the danger to public health and the environment.

The processing, storage and burial of industrial, household, and radioactive waste does not provide adequate protection to Central Asia's resource base and has further aggravated the already precarious ecological situation. Many tailing dumps containing hazardous waste are located in inter-mountain hollows, debris cones, and river flood plains. These sites are prone to mudslides, mudflows, and erosion, creating potential for severe environmental pollution. The high population densities of fertile river-valleys also pose a potential threat. Upstream settlements dispose of their waste in unauthorized storage facilities, which have not been monitored and have no safety standards, placing downstream populations at risk of contamination.

The use of pesticides has decreased considerably. However, unregulated imports of small quantities of pesticides could pose more of a threat than the former high levels of controlled use. Lack of standards and an understanding of how to properly apply, store and dispose of unused pesticides, has led to increasing sicknesses and weakened immune systems among the rural population.

Some of these waste management challenges are being addressed. Kazakhstan has begun to analyze the effects of pollution on human health, develop sanitation standards and health services in remote settlements, and to implement control and management of solid, hazardous and radioactive waste. Kyrgyzstan has improved hydro-meteorological and environmental monitoring of sources of pollution and the degree of contamination by country, region and major cities. The 1997 Conception of Environmental Safety was issued, developed and approved by the Security Council of Kyrgyzstan in 1997. Kyrgyzstan plans to reduce toxic waste and monitor the impact of pollution on health. Uzbekistan is working on improving collection, transport and recycling of household and industrial waste along with better monitoring of toxic chemicals.

Table 6.5 Industrial waste produced in Central Asia, by country, 1999

	Waste quantity (thousand metric tons)	Type of storage	Major pollutants
<b>Kazakhstan (South Kazakhstan region)</b>			
Shymkent, city	7	Slime collector	Petroleum products
Shymkent, city	1 352	Worked-out pit	Rubber waste
Shymkent, city	2 985	Oil meal dumps	Vegetative raw oil meal
Shymkent, city	52 633	Site, Slag dump	Arsenato-calcium wastes, Ash
Shymkent, city	3 851	Dump, Slime collector, burial	Phosphorite, quartzite, elektrothermophosphate slag, slurry, Kottrel milk, arsenic waste
Kentau, city	137 630	Dump, Tailing dump	Metallurgical clinker, heavy metal salts
<b>Kyrgyzstan</b>			
Khaidarkan (town-type settlement, TTS) Batken region	20 477	Tailing dumps, Slime collectors	Mercury, antimony
Kadamjai, city Batken region	4 851	Tailing dumps, Slime collectors	Antimony
Kumtor natural boundary, Issyk-Kul region	14 658	Tailing dump	Cyanides
TTS Kazarman, Naryn region	4 578	Tailing dump	Cyanides
TTS Ak-Tyuz, Orlovka Chu region	3 314	Tailing dumps	Heavy metal salts, Torium row of elements, cyanides
Kara-Balta, city Chu region	36 422	Tailing dump	Uranium row of elements, cyanides
<b>Tajikistan</b>			
Aininsk district Sogodsk region	11 719	Tailing dump	Antimony, mercury
Adrasman, city Sogodsk region	217	Tailing dump	Lead, zinc, gold
Pedjikent, city Sogodsk region	560 114	Tailing dump	Cyanides
Chkalovsk, city Sogodsk region	147	Tailing dump	Uranium row of elements, Vanadium
Tursunzade, city	152	Open site storing	Fluorite, gas cleaning slime, floatation tailings
<b>Uzbekistan</b>			
Tashkent region	856 584	Slime collectors	Sulphides, oil products, Copper, lead, cadmium, molybdenum, prussic acid, cyanides
<b>Turkmenistan</b>			
Turkmenistan	14 194	Polygons/testing areas, open site storing, burial	Toxic waste products. Oil products, ore slurry, sand, used oils

Source: Regional Environmental Action Plan for Central Asia (2001).

### 6.3.5 Energy resources

Energy intensities, or energy used per unit of GDP, reflect both efficiency of energy use across the economy, as well as the economic dependence on energy-intensive activity, such as heavy industry. The energy intensities of the Central Asian economies are several times higher than that of many other countries. Recent reductions in energy intensity may be attributed to declines in economic activity and living standards, but are also likely to reflect shifts in economic structure and the contribution of the energy sector to total GDP, particularly in Kazakhstan.

Reflecting declines in industrial production, broken trade links, and limited access to foreign

markets, total consumption of primary energy declined by 27 per cent and production by 21 per cent between 1992 and 1999<sup>27</sup> (Table 6.6). This trend has recently been reversed; in Kyrgyzstan, despite a shortage in fossil fuels, increased energy consumption has been facilitated by the substitution of hydroelectric energy for electricity generated from coal, oil and gas.

Both Kyrgyzstan and Tajikistan are high consumers of hydropower, reflecting their geographic location, while Kazakhstan, the most heavily industrialized of the Central Asian countries, is largely reliant on coal. Energy consumption in Turkmenistan and Uzbekistan is to a large extent based on oil and natural gas. Kyrgyzstan's and Tajikistan's increasing exploitation of hydropower has necessitated changes in annual discharge schedules for the Toktogul reservoir. Where, prior to 1993, water flow control was synchronized with the needs of irrigation farming in Kazakhstan and Uzbekistan, this has been changed to allow for the accumulation of water in summer and increased discharge in winter to meet Kyrgyzstan's domestic demand for hydroelectricity.<sup>28</sup>

There has been a significant reduction in electricity trade between the countries of Central Asia, beginning in 1990. Electricity imports have declined in all countries, with the exception of Uzbekistan. Exports have also decreased in all countries.<sup>29</sup> Tajikistan and Kyrgyzstan, as net importers of energy remain the least self-sufficient of the Central Asian countries. The region's economically viable potential for energy savings through conservation measures has been estimated at approximately 40-45 million tonnes of coal equivalent, representing almost 30 per cent of total primary energy use. Kazakhstan's potential energy savings alone represent some 67 per cent of this amount. Kazakhstan's high dependence on coal as an energy source, represents a significant opportunity for reducing emissions of SO<sub>2</sub>. Kyrgyzstan has set a goal for reducing energy losses by 20 per cent, so as to better meet its energy needs.<sup>30</sup>

Biomass in the form of fuelwood is an important source of energy for domestic use in Tajikistan and Kyrgyzstan. Dependence on this

Table 6.6 Primary energy consumption: Central Asia

	1992	1999
<b>Total primary energy production (million tonnes of coal equivalent)</b>		
Kazakhstan	102.9	54.7
Kyrgyzstan	4.3	3.3
Tajikistan	6.5	5.2
Turkmenistan	24.5	15.5
Uzbekistan	61.3	67.4
<b>Electricity (billion kWh)</b>		
Kazakhstan	96.9	50.3
Kyrgyzstan	9.8	7.51
Tajikistan	18	17.3
Turkmenistan	8.1	9
Uzbekistan	49	46.0
<b>Gas (billion m<sup>3</sup>)</b>		
Kazakhstan	17.3	4.5
Kyrgyzstan	1.9	0.6
Tajikistan	1.8	2.27
Turkmenistan	10.8	7.0
Uzbekistan	41.3	46
<b>Oil and petroleum products (million metric tons)</b>		
Kazakhstan	17.37	6
Kyrgyzstan	1.73	0.2
Tajikistan	1.17	0.5
Turkmenistan	6.84	5.2
Uzbekistan	9.22	7.9
<b>Coal (million metric tons)</b>		
Kazakhstan	86	50
Kyrgyzstan	4	0.4
Tajikistan	1	0.02
Turkmenistan	0.7	0
Uzbekista	6	3

Source: United Nations, 2004, based on national and World Bank data.

source of energy has increased with increases in poverty levels and rising energy prices. Central Asia's relatively small economies signify that the contribution to climate change processes is limited. While Kazakhstan emits the highest volumes of CO<sub>2</sub> in the subregion, these account for only slightly more than one-tenth the emissions of Japan. However, Kazakhstan's per capita emissions are among the highest in the region. Kyrgyzstan and Uzbekistan are taking steps to limit greenhouse gas emissions.

### 6.3.6 Impacts of disasters

Central Asia is vulnerable to a variety of natural disasters, and the historical records confirm a rapid increase in frequency of such disasters during the 1990s, with an increasing contribution from anthropogenic activity (Table 6.7 and box 6.3). Many parts of the territory feature karst topography and as a consequence are subject to ravine erosion and slumps. It has become increasingly clear that human degradation of the natural environment exacerbates the destruction wrought by these events.

The four most common natural disasters in Central Asia are mudflows, landslides and avalanches; dust storms; earthquakes; and severe weather events. Mudflows, landslides, and avalanches are generally caused by rain and glacier melt water. Disastrous mudflows occur almost annually around May to June in West and South

Uzbekistan, West Tajikistan and Kyrgyzstan. About 84 per cent of Tajik territory is subject to mudflows, of which 32 per cent experience very destructive mudflows. Serious mudflows also occur in Turkmenistan.

Landslides occur in the mountainous areas of Kyrgyzstan, Uzbekistan, Tajikistan and Kazakhstan, but rarely in Turkmenistan. During the last 40 years, 4,240 locations have been registered as dangerous landslide zones in Uzbekistan. More than 50 per cent of recorded landslides occurred during the 1990s. This was more than four times the rates for the 1970s and 1980s. In Tajikistan, the geological and climatic conditions are highly conducive to landslides and avalanches. Since records have been kept, almost 50,000 landslides have been registered; of these, 1,200 presented an immediate danger to human settlements and industry. The share of landslides caused by human activity in Central Asia increased from 10 per cent in 1960 to 60-70 per cent in 2000.

Dust-storms related to erosion processes are typical in Central Asia's plains, and occur in Tajikistan, Uzbekistan and Turkmenistan during the spring-summer period. During the five to six month hot season, moisture evaporates from the soil surface. Consequently the upper soil layer turns into a dusty mass, which is blown away by the wind. These dust-storms cause great environmental and economic damage by smothering vegetation and

Table 6.7 Natural and anthropogenic disasters: Central Asia

	1992	1995	1996	1997	1998	1999
Total number of disasters	11	95	183	147	118	126
Natural disasters	9	84	146	105	84	88
Landslides	4	15	32	17	21	25
Mudflows, freshets, water logging	2	12	53	67	53	39
Avalanching	2	51	39	6	3	11
Earthquakes	1	6	22	15	7	13
Anthropogenic disasters	2	11	37	42	34	38
Casualties	60	26	40	44	8	6
Losses caused by natural disasters in Million Soms (Thousands of US\$, 2002 exchange rate)	7.5 (345)	216.2 (10 370)	3.3 (158)	357.0 (17 126)	1 129.0 (54 160)	757.8 (36 353)
Total cases causing environmental damage and pollution	-	12	4	9	12	37

Source: SIC ISCD, unpublished report for ESCAP (2004).

crops. Dust is also blown across the borders from the Islamic Republic of Iran, Iraq, Afghanistan, Mongolia and China into Central Asia.<sup>31</sup>

Severe weather events include heavy snowstorms and rainfall. Precipitation rates in excess of 30 mm a day have been recorded, intensifying soil erosion processes considerably. Heavy showers are a principal cause of mudflows and landslides, freshets and floods.

The collapse of dams is coming into focus as a potential man-made disaster in Central Asia. The construction of the dam systems began in the 1960s and 1970s. In recent years, regular maintenance of these aging structure has been hampered by technical and economic limitations. Earthquakes are common throughout Central Asia; every year up to 10 earth tremors measuring three to five on the Richter scale, and more than a thousand small earthquakes take place.<sup>32</sup> These earthquakes endanger weakening dam and reservoir systems and pose a serious danger throughout Central Asia.

To address the wide range of natural disasters endemic to the subregion, all countries have established disaster-related ministries or agencies. In addition, legislation to minimize the impacts of natural disasters has been enacted and norms and

standards for construction and road transport have been adopted to reduce the incidence of man-made disasters. Establishment of a well-organized control system that analyzes threats from environmental disasters and encourages inter-state cooperation is required.

#### 6.4 Subregional cooperation

Following the 1992 United Nations Conference on Environment and Development, the countries of Central Asia proceeded to identify environmental problems, resulting in subregional cooperation that prioritizes a transition to sustainable development. Taking into consideration the international significance of the shrinking Aral Sea and its associated social and economic crises, the Central Asian States established the *Agreement on Joint Actions for the Solution of Problems of the Aral Sea and the Aral Sea Region* in 1993. This was the first agreement that had as its fundamental goal the promotion of sustainable development in Central Asia. The International Fund for saving the Aral Sea (IFAS) was subsequently established in that same year. Subsidiaries to this intergovernmental body are the Interstate Sustainable Development Commission (ISDC) the Interstate Commission for

##### Box 6.3 Man-made environmental disasters, Central Asia

**Air pollution and radiation poisoning, Kazakhstan.** The mortality rate among the population surrounding the Tengiz oil-and-gas field in Kazakhstan is more than six times higher than average, due to sulphur and nitrogen dioxide air pollution. In the early 1990s, about six million metric tons of particulate matter was emitted into the air. In Karaganda and Pavlodar Oblasts there were 10.5 and 7.7 metric tons of hazardous emissions per capita, respectively. Vast areas of Kazakhstan have been used for nuclear, military and space technology activities. From 1949 to 1991, 470 nuclear test bombs were detonated at the Semipalatinsk nuclear test site. Half a million people were exposed to radiation. In addition, two million hectares of agricultural land were contaminated by radiation.

**Chemical spills, Kyrgyzstan.** In 1998, a truck crashed into the Barskoon River contaminating it with 1,762 kg of sodium cyanide. Large quantities of chemicals reached the Issyk-Kul Lake, killing a large number of fish across a 10,000 m<sup>2</sup> area.

**Irrigation-related landslides, Tajikistan.** Irrigation-related landslides occur on the hill slopes of Gissar, Yavan, and Obikiik valley. Landslides have been the cause of heavy damage and deaths in Zakhmatabad, Kamchinsky and Sharorinsky, because of poor construction and management of the irrigation systems.

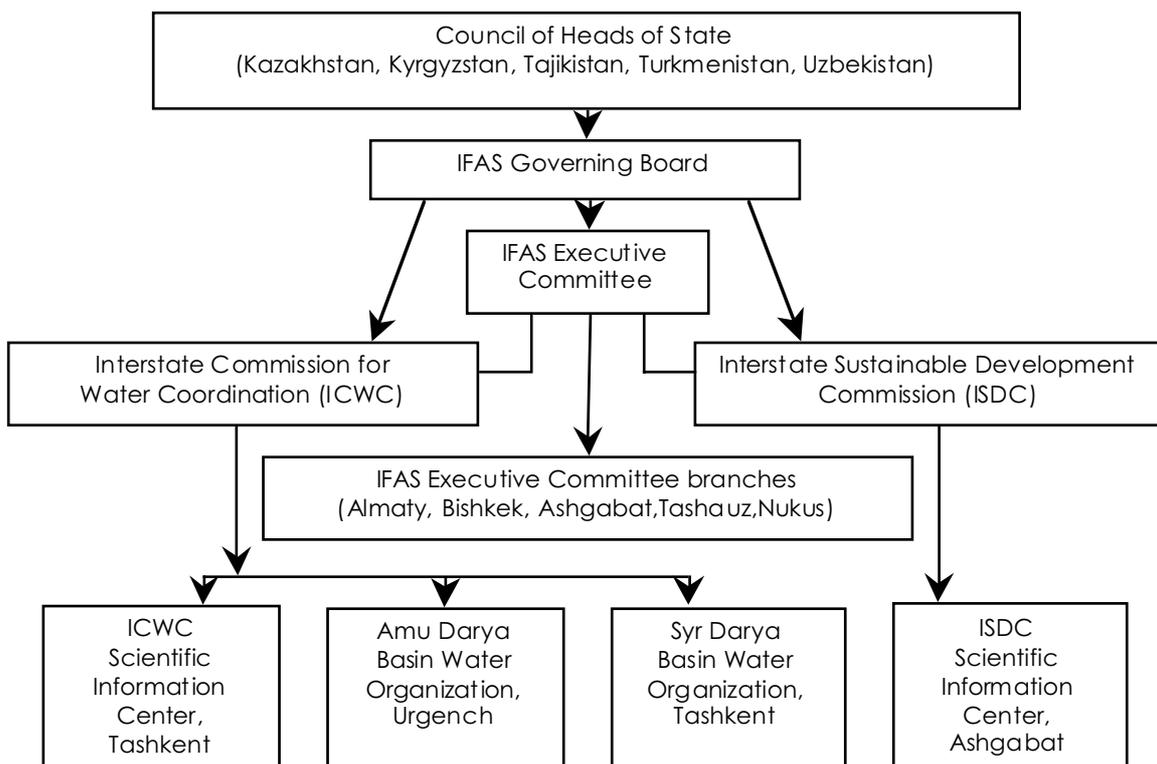
**Pollution from oil exploitation, Turkmenistan.** Oil and gas hydrocarbons are the main natural resources of Turkmenistan. Hydrocarbon development and oil production increased significantly from 1980 to 1990. Correspondingly, the level of pollution rose. With the introduction of highly efficient and cleaner technologies, pollution levels have dropped noticeably. Annual emissions by oil-and-gas enterprises during the period 1995 to 1999 totalled 416,000-1,356,000 metric tons (equivalent to 70-87 per cent of total emissions). Oil and gas fields extract 10-12 million metric tons of stratum water along with hydrocarbons. Despite regulations requiring appropriate disposal, this water is often disposed of in a manner that leads to soil salinization.

Water Coordination (ICWC) and the Scientific Information Centers which serve each commission (Figure 6.1). Inter-state cooperation on environmental and water resources monitoring has been particularly effective. The main areas of IFAS' work are fundraising for the Aral Sea Basin Programme, awareness creation and information dissemination. The Aral Sea Basin Programme's principal objectives are (1) the stabilization of the environmental situation; (2) rehabilitation of damage to the ecology; (3) improvement of water and land resources management; and (4) establishment of programme planning and implementation of management structures at all levels.

The Special Programme for the Economies of Central Asia (SPECA) framework facilitates inter-governmental cooperation and capacity-building. Initiated by ESCAP and ECE in 1998, this programme has focused on the priority areas of transport infrastructure and border-crossing facilitation, rational and efficient use of energy and water resources and an international economic conference on Tajikistan.

The SPECA Project Working Group on Transport led by Kazakhstan developed the Action Programme for Transit Transport Cooperation for SPECA Countries in 2003, and is monitoring its implementation. The Project Working Group on Energy has, through a United Nations Development Account Project implemented by ESCAP and ECE, undertaken a comprehensive assessment of Central Asia's water and energy resources, and formulated a Cooperation Strategy to Promote the Rational and Efficient Use of Water and Energy Resources in Central Asia. The strategy has been formally adopted by four SPECA member countries. As a follow-up to the adoption of the strategy, ESCAP and ECE have supported the establishment of a Kazakhstan-Uzbekistan Commission on the Chu and Talas Rivers. Other prospective areas of cooperation include the safety of the many aging dams in Central Asia. The Project Working Group on Tajikistan organized the International Economic Conference on Tajikistan in the context of Central Asia, in Dushanbe in April 2003. This conference approved a number of policy documents, including

Figure 6.1 Organizational structure of the International Fund for saving the Aral Sea



the Strategy of Subregional Economic Cooperation in Central Asia, aimed at strengthening cooperation in macroeconomic management, international trade, and foreign direct investment, among the countries.

The International Conference on Strengthening Subregional Economic Cooperation in Central Asia and the Future Role of the United Nations Special Programme for the Economies of Central Asia (SPECA) was held in Astana from 25 to 27 May 2005. The event endorsed the membership of Afghanistan, action to revitalize SPECA, and the SPECA Work Plan for 2005-2007. The future work plan includes activities in the areas of transport, trade, water, energy, and information and communication technology. Government representatives stressed the continuing need for technical assistance and donor support to help Central Asian countries in implementing the agreed-upon strategies.

The *Agreement on the Cooperation in the Field of Environmental Protection and Rational Resource Use* was signed in March 1998 by four Central Asian States. Following the confirmed intent of Central Asian States to start developing a Regional Environmental Action Plan (REAP) for Central Asia, UNEP supported its development, and IFAS was assigned to coordinate its preparation. This preparation process was endorsed at various stages of the REAP preparation by the Interstate Sustainable Development Commission of IFAS. The REAP was officially launched in September 2001, with each country taking responsibility for one priority area identified in the plan, namely, air pollution, water pollution, waste management, land degradation and mountainous ecosystems degradation. However, REAP's implementation has been slowed by the lack of formal adoption and clear implementation mechanism, as well as evolving mandates of the IFAS.<sup>33</sup> A Central Asian convention is being drafted to overcome these hurdles.

## 6.5 Conclusion

Central Asia and the Caucasus is perhaps the subregion in Asia and the Pacific in which the direct pressures exerted by economic activity are impacting most heavily on the human population and their future economic and social sustainability.

Economic structures are beginning to shift, but are still heavily dependent on the exploitation of the natural resource base. While this resource base is extremely rich, the subregion is increasingly ecologically fragile, and the environmental carrying capacity increasingly limited. Paradoxically, the economic activities intended to improve the lives of people are indirectly linked to poverty increases in communities in the Aral Sea and Caspian Sea basins, as a result of environmental degradation.

The increasingly frequent natural disasters of anthropogenic origin and spreading environmental damage linked to oil exploitation, still significant poverty reduction needs, growing environmental remediation and clean-up costs, deteriorating environmental infrastructure and urban environments, all underline the need for action to promote more environmentally sustainable growth patterns. Climate change, which threatens to reduce water supplies makes such a shift all the more urgent.

It is perhaps the strong cultural traditions rooted in the land, coupled with the lack of options, and institutional weaknesses that will keep the subregion from taking more concrete steps in the direction of environmentally sustainable economic growth. Strong political vision, peaceful resolution of conflict and government action are needed in building effective and targeted stakeholder cooperation, creation of more environmentally-beneficial economic opportunities for the youth, and improved governance. Unless oil revenues are invested in building new foundations for long-term prosperity, in particular in re-building lost human and social capital, rising oil prices may prove to be more of a curse than a blessing.

Government initiatives to reform existing institutions, and governance processes to develop mechanisms for stakeholder participation, in particular under the Aarhus Convention, are critical steps.

## End notes

- 1 International Monetary Fund World Economic Outlook Database, September 2004 <<http://www.imf.org/external/pubs/ft/weo/2004/02/data/index.htm>>.
- 2 ESCAP (2005). *Economic and Social Survey of Asia and the Pacific 2005* (New York, United Nations).
- 3 United Nations (2004). *Strengthening Cooperation for Rational and Efficient Use of Water and Energy Resources in Central Asia*. United Nations Economic Commission for Europe and United Nations Economic Commission for Asia and the Pacific Special Programme for the Economies of Central Asia Project Working Group on Energy and Water Resources (New York, United Nations).
- 4 See ADB (2005). *Asian Development Outlook 2005* (Manila, ADB).
- 5 United Nations (2004), op. cit.
- 6 UNDP (2003). *Human Development Report 2003* (New York, UNDP).
- 7 The population of this region of Azerbaijan is predominantly ethnic Armenian and currently under Armenian military control. The population of Nargano-Karabakh declared itself independent from Azerbaijan in 1991, but is not recognized as such in diplomatic circles. A cease fire agreement was concluded between Azerbaijan and Armenian forces was in May 1994.
- 8 FAO FAOSTAT online database data, accessed in May 2005 from <<http://faostat.fao.org>>. National data given in the UNEP (2002). *Caucasus Environmental Outlook (CEO)* (Tbilisi, UNEP GRID -Tbilisi), indicates the following forest coverages for Armenia, Azerbaijan and Georgia: 45, 1214 and 2773 thousand hectares respectively.
- 9 Ministry of Foreign Affairs, Government of Azerbaijan (2006), e-mail communication.
- 10 Scientific Information Center of the Interstate Sustainable Development Commission (SIC ISDC) (2004a). *Indicators of Sustainable Development of Central Asia* (Ashgabat, SIC ISDC).
- 11 Scientific Information Centre of the Interstate Coordination Water Commission (SIC ICWC) (2000), as cited in United Nations (2004), op. cit.
- 12 SIC ICWC (2000), as cited in United Nations (2004). River run-off in the Amu Darya Basin – Average annual run-off over three water availability cycles, 1934-1992; Syr Darya Basin – Average annual run-off over two water availability cycles, 1951-1974.
- 13 United Nations (2004), op. cit.
- 14 Irrigation accounts for some 90 per cent of consumptive water use.
- 15 Scientific Information Center of the Interstate Sustainable Development Commission (SIC ISDC) (2004b). Unpublished report for ESCAP, used as the basis for the preparation of this chapter.
- 16 United Nations (2004), op. cit.
- 17 Based on data from SIC ISDC, developed with the financial support of UNEP and provided in May 2006.
- 18 Based on data from SIC ISDC and SIC ICWC.
- 19 Based on data from SIC ICWC.
- 20 United Nations (2004), op. cit.
- 21 Pala, Christopher (2006). “World Bank restores Aral Sea,” *Washington Times*, 1 April 2006, accessed on 22 April 2006 from <[http://www.washingtontimes.com/world/20060331-101327-7460r\\_page2.htm](http://www.washingtontimes.com/world/20060331-101327-7460r_page2.htm)>.
- 22 BBC News service (2005). “Kazakh ‘national treasure’ under threat” BBC News Report, Wednesday 28 September, 2005.
- 23 Based on data from SIC ISDC, developed with the financial support of UNEP and provided in May 2006. Other land resource information from the Regional Environmental Action Plan for Central Asia (2001).
- 24 Xerophytes are a category of plants that have adapted to arid climates.
- 25 SIC ISDC (2004a) specifies that protection is from “industrial production.”
- 26 SIC ISDC (2004a), op. cit.
- 27 United Nations (2004), op. cit.
- 28 United Nations (2004), op. cit.
- 29 In Kazakhstan, imports declined from 10.5 GWh in 1988 to 1.3 GWh in 2000. In Kyrgyzstan imports dropped from 3.3 GWh in 1990 to 0.3 GWh in 2000 and exports declined from 7.2 GWh to 3.1 GWh. In Tajikistan imports declined from 3.9 GWh in 1990 to 1.7 GWh in 2000 and exports fell from 2.6 GWh to 0.4 GWh. In Turkmenistan imports diminished from 1.1 GWh to 0.03 GWh and in 2000 exports totaled 920 MWh. In Uzbekistan imports increased from 1.4 GWh in 1994 to 2.2 GWh in 2000 and exports declined from 13.2 GWh in 1990 to 1.0 GWh in 2000.
- 30 United Nations (2004), op. cit.
- 31 SIC ISDC (2004a), op. cit.
- 32 UNEP (2000). *Environment in Central Asia* webpages, accessed in 2004 from <[www.grida.no/arak](http://www.grida.no/arak)>.
- 33 UNEP (2004). “Strengthening Political and Institutional Support to the Implementation of the Regional Environmental Action Plan (REAP) in Central Asia Assessment Report.” Consultant report.