



From 1992 to 2012 and beyond:
Sustainable Mountain Development
Central Asia



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The present report aims to provide an easily understandable illustrated overview of trends and challenges in the sustainable mountain development of Central Asia since 1992, highlight selected achievements and lessons learned by various stakeholders and identify opportunities. It builds on information from the original experience and interviews with key actors, official and scientific sources and numerous news.

The Swiss Development Cooperation (SDC) has provided support for the process of identifying trends, developments, lessons and opportunities in the Central Asia mountains and other global mountain regions.

The views expressed in this document are those of the authors and do not necessarily reflect views of the partner organizations and governments.

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Executive Summary

For the countries of Central Asia, the transition from a socialist planned economy of the Soviet Union to a market economy, and from totalitarianism to democracy and independence has coincided with the global sustainable development movement, and as the new countries have increasingly engaged with the wider world, the ideas of sustainable development have helped shape progress in the region. The mountains have always played a pivotal role in this vast area comprising five countries – the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan, Turkmenistan and the Republic of Uzbekistan – providing an astonishing array of essential ecosystem goods and services that serve not only the mountain inhabitants but also those in the lowlands and people around the globe. These goods and services include forest products and land for food production; watershed protection; habitat for flora and fauna of local and global significance; the regulation of natural hazards and climate; natural areas for leisure and recreational activities; a sense of place, source of inspiration and cultural heritage; and perhaps most important of all, the storage and release of water.

The transition period also coincided with rapid technological development and globalization and a growing awareness of global environmental changes related to climate, biodiversity and land degradation. New requirements for security arose out of international and regional conflicts over governance, ethnic differences and resources. Socio-economic forces added to the mix as new demographic and labor market realities emerged, and changes in the ownership and control of land and other vital natural resources took effect. And all of this played out in the context of the environmental degradation and the limited capacity to respond that were the legacies of the former Soviet Union.

China's rise on the global stage and its dominance in international trade is changing the patterns of business and trade in Central Asia. Imports and foreign investment and infrastructure development projects increasingly come not from the West or from Russia, but from China, and political relations are changing in the region in concert with economic ties and trade.

The expansion of the road system has increased the accessibility to remote mountain areas. This new accessibility has brought both additional pressures from visitors and from business development, and new income opportunities in terms of tourism and hospitality and the trade of native products.

The Central Asian region is experiencing a significant upward trend in the availability and affordability of communication technology such as mobile telephones and Internet access. Mobile networks now cover most of the mountain territory where people live. This creates major opportunities for e-learning, e-commerce, tourism promotion and data exchange.

Tourism is not currently a large part of the GDP of any Central Asian country, but given the remoteness of mountain communities and the limitations of mountain agricultural production, a broad spectrum of mountaineering opportunities, and ecological, cultural, ethnographic and medical types of tourism offer a promising source of alternative livelihoods.

In addition to oil and gas extraction in Kazakhstan, Turkmenistan and Uzbekistan, the development of the metal mining and processing has been significant over the past decade in Central Asia's mountain countries of Kyrgyzstan and Tajikistan where the opportunities for crop production are limited due by the terrain. But abandoned mines, hazardous industrial waste sites and mine tailings in the mountains remain an obstacle to sustainable development and environmental security of the broader Central Asian region.

As the independence era has unfolded and new political realities have set in, interstate tensions and diverging priorities over the use of water resources have started to dominate the political, economic and environmental agenda in region. The last decade in particular has been characterized by an increase in disputes over water usage, particularly in countries dependent on irrigated agriculture.

The tangible and detrimental impact of conflict on both mountain populations and the surrounding environment highlights the urgent need for collective efforts in progressing towards sustainable development and security for highland communities. By minimizing the root causes of discontent and insecurity, such as poverty, the unequal distribution of land and water, unaffordable food and energy, lack of job opportunities and basic education, the risk of conflict can be lessened and the chances of sustainable development of mountain environments and the well-being of mountain communities can be increased.

The rules on the ownership rights for land, gardens, livestock, pastures and forests have generally been relaxed across the region, and the market structures for agricultural and other mountain-related products and services have evolved into a free and competitive market system. Although official private ownership is still not common, systems such as long-term individual leasing are now widespread.

A positive environmental development in the independence era is the expansion of protected areas – a doubling in the size of the total area protected, and the use of buffer zones and corridors.

Part 1: Setting the stage

The Preamble to Agenda 21, the comprehensive programme for global action on sustainable development adopted by the 1992 Earth Summit in Rio de Janeiro, begins with a simple statement: “Humanity stands at a defining moment in history.” The same might have been said in a different context the previous year when the Soviet Union collapsed. For the people of Central Asia, the transition to independence has coincided with the global sustainable development movement, and as the new countries of Central Asia have increasingly engaged with the wider world, the ideas of sustainable development have helped shape progress in the region. Diverse mountain ranges described by the early Persians as the “Roof of the World” and by the Chinese as the “Heavenly Mountains” have always played a pivotal role in this vast area comprising five countries – the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan, Turkmenistan and the Republic of Uzbekistan. Agenda 21 recognizes the mountain environment as nothing less than “vitally necessary for the survival of mankind.”

This report concentrates on sustainable mountain development in Central Asia over the past 20 years, considers the influence of the transition to independence, identifies some of the challenges and opportunities and presents selected case studies of mountain projects designed to meet the challenges and take advantage of the opportunities.

1.1 Mountain ecosystem goods and services

The mountains of Central Asia provide an astonishing array of essential ecosystem goods and services that serve not only the mountain inhabitants but also those in the lowlands and people around the globe. These goods and services, which fall into three broad categories – provisioning, regulating and cultural – include forest products and land for food production; watershed protection; habitat for flora and fauna of local and global significance; the regulation of natural hazards and climate; natural areas for leisure and recreational activities; and perhaps most important of all, the storage and release of water. In the Regional Sustainable Development Strategy of Central Asia (2007), the governments officially acknowledge the role of mountains as “water towers” and storehouses of biodiversity.

By virtue of their role in the hydrologic cycle, mountains have been called the “water towers” for the lowlands. Almost 90 per cent of the population of Central Asia relies on water that falls in the mountains where it is stored in glaciers and snow before making its way downstream to population centres. Densely populated valleys and oases of the vast drylands of Central Asia depend on mountain water transported by numerous rivers and streams, especially the Syr Darya River, which arises in the Tien Shan Mountains, and the Amu Darya, which arises in the Pamirs. Each flows more than 2 000 kilometres to empty into the Aral Sea. Other major regional rivers originating in the mountains are the Ili, Chu, Talas and Saryjaz.

Overall, Tajikistan holds 40 per cent, and Kyrgyzstan 30 per cent, of the water resources serving the five Central Asia countries. These water resources also serve China and Russia. Uzbekistan, the most populated country in the region, is also the biggest water consumer, in large part because of an economy based on irrigated agriculture. With 90 per cent of their water resources coming from mountains located outside of country borders, Uzbekistan and Turkmenistan, and especially their downstream communities, are highly vulnerable to water shortages. Global warming is slowly decimating mountain glaciers, affecting snow reserves and at the same time increasing water requirements of basic agricultural crops. A projected reduction in the Amu Darya river runoff – the expected effect of climate change in the Pamir mountains and glaciers over the next 20 to 40 years – can only make matters worse.

Mountain regions are crucial to the maintenance of the natural and agricultural global biodiversity that underpins all ecosystem services. The vertical distribution of natural species by elevation results in a wide range of species and ecosystems spread over a relatively small surface area. Endemic species find homes in isolated islands of mountain habitat with characteristics conducive to unique life forms and varieties. More than half of the world's 150 wild tulip species are found in Central Asia; many of them grow only in the

mountains. Similarly, the number of crops that either originated or further diversified in Central Asia mountains is impressive. The region is famous for harbouring genetic resources of the wild species of several domesticated plants and animals such as wheat, apples, almonds, walnuts, pistachios, as well as horses, goats and yaks.

The Central Asia mountains host at least 20 distinct ecosystems and 4 500–5 500 species of vascular plants, almost one quarter of which are unique (endemic) to the region. At lower altitudes and in the foothills, dryland ecosystems prevail. At higher altitudes, grasslands, shrubs and forests are widespread. Meadows and tundra-like ecosystems are found at the top of high mountain plateaus. Globally endangered species resident in the mountains include the snow leopard (with more than half of global population) and the Marco Polo sheep. The numbers of these species have declined, however, as a result of poaching, hunting and the depletion of the food base. The high biodiversity richness and endemism of flora and fauna of the mountains of Central Asia is exemplified by the fact that the number of vascular plant species found in the Pamir-Alai or the Tien Shan mountains is four times higher than that of the nearby lowland Karakum Desert, which has twice the area.

Mountain forests and shrublands in Central Asia cover almost five million hectares, including 2.5 million hectares of coniferous forests, and more than 350 000 hectares of globally significant fruit-and-nut forests comprising walnuts, almonds, pears, apples, cherries and pistachios.

Mountain forests provide invaluable watershed protection and erosion control, and contribute to the regulation of water resources by decreasing or smoothing runoff – with a corresponding decrease in erosion – and by retaining groundwater. They also provide mountain people with a rich source of the fuel wood essential to the heating of living spaces, the cooking of food and the purification of drinking water, and with timber and other forest products such as wild fruits, nuts and medical plants for subsistence or trade. A relic species of Tien Shan spruce forms a unique and spectacular forest belt in the Tien Shan Mountains. Juniper woodlands of the Gissar and Pamir-Alai Mountains could be 1 000 years old.

In addition to reducing erosion, mountain forests also protect communities and transport infrastructure from natural hazards by preventing, or reducing the impact of, such events as landslides, flash floods and avalanches. And while mountains are vulnerable to the effects of climate change, they also play an important role in modulating the climate across wide areas, and are important reservoirs for the storage of carbon.

For residents of the largest Central Asian cities – Tashkent, Almaty, Bishkek, Dushanbe and Ashgabat – mountains provide fresh air and the breezes that disperse urban air pollution. Mountains and their refreshing lakes and white streams are among the most popular weekend destinations for urban residents. In addition to picnics, hiking or skiing in unspoiled beautiful highlands, the key mountain attractions include geothermal sources and spas, "kumis" horse milk therapy and sampling diverse mountain honey, local herbal teas and traditional products.

Mountains provide a profound sense of place, a source of inspiration and a rich cultural heritage. The degree of cultural diversity varies among the mountain regions of the world. In a manner reminiscent of Switzerland, people in isolated mountain areas of Central Asia, especially in the Pamirs, differ significantly from those in the main valleys, and communities tend to develop distinctive cultural identities and languages. In the Soviet period, however, mountain minorities were integrated with the "mainland" and partly lost their specificity. Before the era of industrialization and urbanization, spirituality was also common in mountain communities of Central Asia, where people regarded the mountains as living forces and sources of power or symbols of the sacred.

The rich and diverse cultures of Central Asia and the strong sense of place in the mountains attract visitors from around the world, and the tourism offers an additional income source for mountain communities.

The challenges to the continuing capacity of mountain environments to deliver their ecosystem goods and services come from natural hazards and disasters, from climate change and its effects on mountain ecosystems and from the competing uses of the resources. The management of risks entails the balancing of interests –

highland and lowland; agricultural and industrial; local, national and regional; and economic, educational and cultural.

The main drivers of change in the extent and quality of Central Asian mountain ecosystems and their services since the 1950s have been population growth (and associated increasing consumption of natural resources and energy); agricultural developments; land use change; industrialization (and associated ecosystem fragmentation, over-exploitation and pollution); and, increasingly, climate change effects. During the last two decades, a continuation or augmentation of these drivers in combination with political, economic and social changes has made development unsustainable in some areas. At the same time, new opportunities and initiatives for sound nature resource management and nature conservation have developed and counter-balanced some of the negative trends. Details of these are mentioned in Section 1.3 below.

1.2 Key characteristics of the Central Asian mountains

The landscape of Central Asia is characterized by dramatic peaks, high mountain plateaus, deep valleys, massive glaciers, steppes and vast desert plains. Two of Asia's major mountain ranges – the Pamirs in Tajikistan and the Tien Shan in Kyrgyzstan – make those countries the most mountainous in the region, with an average elevation of about 3 000 metres above sea level, peaks exceeding 7 000 metres and more than 90 per cent of their national territories considered as mountainous. In addition to being more mountainous, Kyrgyzstan and Tajikistan are less developed and less economically advanced than the other three Central Asian countries. At the same time, these countries often compare or label their mountain territories as the Alps of Central Asia.

Mountain ecosystems also cover parts of Eastern Kazakhstan (Kazakh uplands, Djungar Alatau, Tarbagatai and Altai), south-east Uzbekistan (Western Tien Shan, Gissar, and Kugitang) and Turkmenistan (Kopet-Dag), and extend into Afghanistan (Hindu Kush) and China (Eastern Tien Shan and Pamir). Mountains comprise 20 per cent of the area of Uzbekistan, 10 per cent of Kazakhstan and five per cent of Turkmenistan, but the natural resource programmes in these countries nevertheless tend to highlight the role of mountains in specific geographic areas, and to focus on mountain biodiversity treasures. Overall, mountains cover 800 000 square kilometres or 20 per cent of the total area of Central Asia.

The Tien Shan Mountains, one of the most extensive mountain systems of Central Asia, cover all of Kyrgyzstan and extend into Kazakhstan and the Chinese province of Xinjiang. The highest peak of the Tien Shan is Jengish Chokusu, or Victory Peak, which stands at 7 439 metres. In south-eastern Kazakhstan, the picturesque Djungar Alatau Mountains, together with the Tien Shan, form a 400 kilometre-long natural border with China.

The 300 kilometre-long and 170 kilometre-wide Fergana valley separates the Tien Shan from the Pamir Mountains. The Ferghana Valley is the most densely populated and ethnically diverse region of Central Asia, with the average population density of 350 persons per square kilometre, and in some districts exceeding 1 000 persons per square kilometre.

The Pamir Mountains join the Tien Shan in Kyrgyzstan in the north and the Hindu Kush Mountains in Afghanistan and Pakistan in the south, and contain some of world's highest peaks including the Conger, which rises to 7 719 metres in China, and Somoni Peak, at 7 495 metres in central Tajikistan. The Eastern Pamir are dominated by high plateaus (above 3 000 metres) and host nomadic populations of Kyrgyz origin, while the Western Pamir are carved by rapid mountain rivers, with deep valleys and spectacular gorges and traditional settlements nestled on alluvial fans. Eighteen distinct ethnic groups are known to occupy this culturally diverse region, and the 220 000 people living there depend largely on subsistence farming and international aid.

Glaciers cover four per cent of Kyrgyzstan and six per cent of Tajikistan. They are also present in Kazakhstan and Uzbekistan. In total they cover an area of 12 000–14 000 square kilometres within Central Asia and around 20 000 square kilometres if the glaciers within China's territory are added. Frozen water reserves contained in the glaciers are about 1 000 cubic kilometres – the equivalent of 10 years of water flowing down the rivers Amu Darya and Syr Darya. Melt water from snow, glaciers and permafrost supplies about 80 per cent of the total

river runoff in Central Asia. Glaciers are crucial to the agricultural economy of the region. They produce water in the hottest and driest period of the year in summer and compensate for low precipitation.

The Tien Shan and the Pamirs feature contrasting climates from harsh (below zero annual surface temperatures) and dry (150–300 millimetres average annual precipitation, mainly in summer) in the inner and eastern corners to more humid (1 000–1 500 millimetres average annual precipitation, mainly in winter and spring) and temperate in the western parts. Many high mountains consist of barren ground, glaciers and other types of environments inhospitable to humans, but home to wild animals such as the Marco Polo sheep and the snow leopard, both of which are globally endangered species. Mountains with more favorable climatic conditions possess fine grasslands and forests.

The Kopet-Dag, also known as the Turkmen-Khorasan Mountain Range, is an extensive range that runs along the border of Turkmenistan and Iran, a region characterized by foothills, dry and sandy slopes, mountain plateaus and steep ravines. The highest Kopet-Dag peak in Turkmenistan stands southwest of the capital Ashgabat at 2 940 meters. The country's highest elevation is 3 137 metres in the Kugitang range. Turkmen mountains are famous for their deep and spectacular caves.

Arable lands occupy less than 0.5 per cent of the total area in the Pamir Mountains, and pastures another 12 per cent. In the Tien Shan Mountains of Kyrgyzstan, the proportion of pastures and arable lands is higher. Only half of Kyrgyzstan's land area and less than one third of Tajikistan's land area is suitable for agriculture, mainly for grazing. Croplands and gardens occupy less than seven and five per cent of their land areas, respectively. Other lands are considered not suitable for agriculture due to harsh climate, poor soils, predominance of rocks and glaciers. Nevertheless, a majority of the mountain communities of Central Asia practice agriculture – principally cultivating cereals and vegetables, gardening, collecting forest products and extensively grazing livestock on a wide range of pastures. Tourism, mining and trade form important economic sectors which have been gathering momentum in the region over the past 20 years. Infrastructure development has likewise been a growing endeavour. All of these activities contribute to the revival of the ancient Silk Road in the modern age of globalization.

1.3 Trends in the Central Asia mountain regions over the past twenty years

To the people of the Central Asian mountain communities, the array of forces affecting their lives must seem at times as diverse and powerful as the mountains themselves. As a result of geopolitical forces, five new countries faced the transition to independence and national governance and all that that implies. The 20-year transition period coincided with a period of rapid technological development and globalization and a growing awareness of global environmental changes related to climate, biodiversity and land degradation. New requirements for security arose out of international and regional conflicts over governance, ethnic differences and resources. Socio-economic forces added to the mix as new demographic and labor market realities emerged, and changes in the ownership and control of land and other vital natural resources took effect. And all of this played out in the context of the environmental degradation and the limited capacity to respond that were the legacies of the former Soviet Union.

All of the changes resulting from these forces affect mountain communities. And everything, it seems, is connected. One example can demonstrate the point: Global climate change affects glaciers, precipitation patterns and the timing of snowmelt. The water resource consequences may entail disruptions in allocations and affect multiple users. This situation raises the issues of resource distribution and ownership, and poses challenges to governance and, in some cases, international relations. Water resource allocation decisions have implications for individual livelihoods and economic development in such sectors as tourism, energy production and agriculture. Competing demands may exacerbate urban–rural conflicts or conflicts over scarce natural resources.

The following subsections identify the trends at work in Central Asia, and make links among them. But as the climate change example shows, the connections are numerous, and any attempt to exhaust the possible permutations would be futile. Some of these trends will likely continue or intensify while others may fade.

Policymakers and stakeholders can decide for themselves the lessons to take from the events of the past 20 years as they try to adjust to the driving forces in order to maximize the benefits for mountain communities.

Arguably, the mountain communities of Central Asia are more sensitive to social, political and environmental changes than are lowland communities, and while they remain marginalized and remote, their self-reliance and resilience to the challenging mountain environment and conditions may help them seize the opportunities that changes bring. By becoming more proactive and communicating their views widely, and by learning from each other, mountain communities may be able to ride the wave of change to a more stable, prosperous and sustainable future.

Geopolitical Changes

1.3.1 Independence and the transition to national governance

Situated between the Russian Federation, Iran, Afghanistan and China, Central Asia was a unified area under the Soviet Union with a common heritage in terms of language (Russian in combination with national languages), culture, education and infrastructure, and with united energy, water, agricultural and industrial systems and road connections.

Following the disintegration of the Soviet Union in 1991, all the former Soviet Republics of Central Asia declared their national independence, thus ushering in a new political era characterized by diverse systems of national governance, inherited and emerging economic development bases and differing strategic visions. The task of political and economic transformation fell mostly on the same authorities who had been Communist party leaders and members. In 2011, all the Central Asian nations celebrated 20 years of national independence – a shared historical milestone. At the same time, they continue to develop at very different speeds along increasingly different paths.

Prior to 1992 the newly independent Central Asian nations had no experience with democratic governance or market economies. The energy-rich and industrialized countries – Kazakhstan, Uzbekistan and Turkmenistan – enjoyed large capital inflows into energy and industrial projects and invested new profits in the housing sector and infrastructure development, especially the expansion and rebuilding of the capital cities of Astana, Tashkent and Ashgabat.

In contrast, Tajikistan and Kyrgyzstan – as small, mountain, poor, geographically isolated and landlocked countries with predominantly agricultural economies and rural populations – were more impoverished and less industrially developed than their neighbours. These Central Asian republics had benefited from substantial budgetary support and the economic power and common markets of the Soviet Union, and Soviet policies had led to a high level of social and economic development and strategic support for the populations of Central Asia, particularly those in the remote mountain areas, in terms of security, jobs, food and fodder provision and energy supplies. The withdrawal of subsidies and the interruption of traditional trading links and markets led to rapid increases in unemployment and poverty, and dispelled illusions of an easy path to new and better lives. Poverty rates reached 60–80 per cent in both countries, and affected all remote mountain provinces. Over the last two decades, Tajikistan and Kyrgyzstan have remained Central Asia's poorest nations, though recent poverty rates declined to 40–50 per cent. At the same time, the total external debt increased.

Remote mountain communities in Tajikistan and Kyrgyzstan were particularly hit hard by the economic crisis and the downward development spiral that continued from 1991 into the late 1990s. For most of the 1990s, turbulent changes rocked the densely populated areas and spread to the mountain villages of Central Asia where economic collapse and the loss of job opportunities followed the end of orders and subsidies from the Soviet government. Gross national products fell in just five years almost 50 per cent by the mid-1990s, and the new states were unable to maintain funding for such priority needs as education, health and pensions. Only after 15 years of recovery have the economies approached their 1991–1992 levels.

Financial dependency on Moscow has been steadily declining, but Russia still plays an important role in the economies of Kyrgyzstan and Tajikistan both directly – through the provision of loans and funding for infrastructure and industrial projects – and indirectly through opening its markets for labour migrants and traditional agricultural products (wool, cotton, fruits and vegetables). Under the Soviet agricultural system, orders from central authorities determined agricultural specialties and crop patterns. After a period of disruption that included undernourishment in mountain villages, a new system of self-management took root, and in the last 5–10 years the mountain farmers have become more self-reliant. The Kyrgyz and Tajik economies have been growing over the last 10 years as a result of increased agricultural production, expansion of services and trade, favourable world markets for gold and aluminum and soaring remittances from labour migrants abroad. The transition to independence entailed a major change in the mentality of people and institutions in order to reduce dependency on the state, catalyze initiative and promote an entrepreneurial spirit.

A period of regional and global cooperation followed the post-Soviet era with Central Asian governments demonstrating a general willingness to cultivate closer relationships between each other and with their regional neighbours and global players. Participation in the United Nations, the Organization for Security and Cooperation in Europe (OSCE), the Shanghai Cooperation Organization (SCO), the Eurasian Economic Community (EURASEC), the Commonwealth of Independent States (CIS) and the International Foundation for Saving the Aral Sea (IFAS) are some examples of this wider cooperation, as is the progress toward World Trade Organization (WTO) membership. (In Central Asia only Kyrgyzstan is a WTO member, joining in 1998.) Through the initiative of Kyrgyzstan, the UN declared the International Year of Mountains in 2002, and through the initiative of Tajikistan, the International Year Freshwater in 2003.

Uzbekistan, of all the Central Asian States, is the one that has retained the most Soviet-style system of central planning and management. Strong political and economic control is still a dominant characteristic of the country, and the Uzbek government is striving to increase levels of international trade and aiming to become the regional leader in terms of population and agricultural and industrial production capacity, much like in the Soviet era.

Kazakhstan has similar aspirations. A country rich in oil, gas and mineral reserves, Kazakhstan has experienced an influx of foreign investment leading to a rapid rise in wealth that has brought both challenges and new opportunities. As the bridge between Europe and Asia, Kazakhstan is also working hard to raise the standing and prestige of the country on the international stage by chairing the Organization for Security and Cooperation in Europe in 2010, and by hosting events such as the 2011 Asian Winter Games, the 2010 Asia-Pacific and the 2011 Pan-European Environmental Conferences and other high-level business and political meetings. In addition, the ambitious strategic development plan, "Kazakhstan 2020", sets major economic and social targets for the country.

Turkmenistan's abundant hydrocarbon resources – chiefly oil and gas – are fuelling the country's rapid economic growth and modernization of the economy, including the textile, food and construction industries. The state controls strategic farming sectors such as cotton and wheat production, but private farmers grow most of fruits and vegetables, and herd livestock. Political and media freedoms, and civil society's participation in decision-making is tightly regulated.

As part of the transition from collective farming to a market economy, governments launched a land redistribution process that resulted in agricultural lands passing into private ownership and long-term private rental. This privatization turned formerly collective farms over to individuals, villages or groups, and the number of farming units skyrocketed. For the states, the fragmentation into many smaller farms represented a challenge to their management capacity. Kyrgyzstan left decisions on what to grow to the farmers while Tajikistan took a more prescriptive approach. Even so, mountain farmers in Tajikistan, far from the centre of government, enjoy a high degree of freedom.

The challenge for farmers was deciding what, and how much, to grow. With self-determination came personal considerations about food security and whether to cultivate for cash or for the flour that families needed to make their own bread since the state no longer provided it. These changes in the structure of agriculture conspired to constrict the options for crop rotation. Fragmentation and smaller farm size, climate, elevation, terrain and the imperatives for cash or flour all implied some limits on a farmer's latitude regarding crop selection.

Following the breakup of the Soviet Union all of the countries in Central Asia experienced a period of upheaval in the transition to market economies, but Kyrgyzstan is the only one to experience three periods of major political change: the demise of the government of President Askar Akaev in 2005; the demise of the government of President Kurmanbek Bakiev in 2010; and the establishment of a parliamentary democracy with the President having fewer powers than the Prime Minister and the National Parliament. Arguably, the demand for change that fuelled "the tulip revolutions" in Kyrgyzstan started in the Naryn and Talas mountains, where the people saw a role for themselves in decision-making at the individual, village and country levels. The open spirit that exists in the mountains provided an environment where the people felt free to express their ideas for reform, and the small population and its remoteness from urban centres meant that central government exerted little influence on mountain affairs. The rapid economic changes, including growing energy tariffs without adequate social safeguards for the impoverished mountain areas, and the widespread corruption of the central and provincial authorities further fueled the uprising. The benefits of political reform in Kyrgyzstan, however, have come at a cost – dozens of lives were lost, and in the absence of political stability investors were more likely to look for opportunities in countries with more stable regimes.

At present, some observers point out that Kyrgyzstan is more democratically advanced ("liberal") and decentralized than its neighbours. Political parties play a role in the parliament and government, and local and provincial authorities have the autonomy necessary to conduct their affairs. Government ministries are required to consult with public advisory councils, which include representatives of youth, non-governmental organizations, well-known experts, citizens and representatives from the private sector. These councils provide information to the ministries regarding government services and their participation may improve efficiency and increase accountability. Under the new system and the governing legislation, mountain communities can assert their preference that taxes raised on mining operations directly benefit, at least in part, the local communities.

Strict and effective enforcement of the central government prerogatives was a hallmark of the Soviet system, but the transition to independence came with an exodus from the new Central Asian republics of the European settlers (Russian, Ukrainians, Germans and others) who had managed the enforcement bureaucracy and chiefly guided industrialization. This loss of experienced managers and engineers led to some initial problems with both enforcement and engineering skills, but as new national managers and specialists gained experience, the situation began to stabilize. In Kyrgyzstan, the shortage of skills and money combined with major political shakeups meant that enforcement efforts could not keep up with the rapid pace of the new legislation passed to respond to evolving local needs and ambitions. One effect of this diminished enforcement capacity was that authorities, businesses and communities had difficulty keeping up with all the changes. As part of their expanding role, NGOs now initiate legislation and actively encourage enforcement of environmental laws on such matters as pastures, mining, forests, energy efficiency and environmental audits, among others.

Tajikistan, in contrast, continues to rely on a system with an authoritarian command-and-control approach to governing. The legislative process is less transparent and less inclusive, and has no practical mechanism for accepting feedback. Decentralization and self-governance in Tajikistan is not as advanced as in Kyrgyzstan, but stronger control and less diverse legislation make enforcement easier to manage.

The village councils that existed in the early 1990s were inherited from the Soviet era. With little experience in strategic management, these councils found their responsibilities in the new political and economic realities to be challenging. As the decade progressed, the village organizations evolved into stronger, though still informal, bodies for local decision-making on routine and strategic matters, and for planning village development. By the

turn of the century, village organizations had demonstrated their efficiency and effectiveness, and were becoming well established, especially in the Pamir Mountains of Tajikistan. They are now self-reliant and independent, and enjoy widespread support as they face the challenge of maintaining and improving the management skills necessary to respond to the rapidly changing world around them.

1.3.2 New international borders

The revision of national boundaries following the emergence of the independent states of Central Asia created new international border entry points, and the opening up of airspace increased the scope for international flights and international tourism. The visually apparent definition of borders became a top priority after independence, and with the new political landscape came more border restrictions – customs, immigration and security checkpoints. Security concerns led to an increase in defensive or fortified installations such as fences, trenches and even areas with land mines. These developments have constrained the movement of goods and people, especially the nomadic mountain people who have traditionally moved both vertically and horizontally through the mountains of the region.

The creation of new borders has also altered the ownership status of previously shared pastures, forests and watersheds. Moreover, Kyrgyzstan, Tajikistan and Kazakhstan, have given up parts of their mountain territories to China to settle border disputes, much to the consternation of the affected communities.

In some cases the new borders have resulted in increased travel time. Prior to independence, if the direct route between travelers' points of origin and their destinations crossed the borders of Soviet republics, the travelers could pass as if no border existed. Now, where international crossings are restricted, the same trips may entail long detours to avoid the borders. For poorer mountain countries and communities this change is more than an inconvenience. The new routes require expensive improvements in the existing road system or the construction of the new roads and tunnels, an economic burden the countries can ill afford. The longer distances simultaneously add to travel time and expense and reduce efficiency.

The increase in the number of borders has created a competitive disadvantage for the mountain countries in terms of international trade in perishable goods. Each border crossing entails customs clearances, adding time in transit, and the additional time – to say nothing of the costs – is particularly a problem in the export of fresh food where time is of the essence. The mountain countries are more affected because they face more border crossings to get their produce to foreign markets. Kyrgyzstan and Tajikistan share borders with China, and could avoid the multiple border problem with exports to the Chinese, but China is not recipient of Central Asian produce.

Mountain enclaves – essentially islands of one country inside another – first appeared on maps in the Soviet period, and existed only on paper. No one paid any attention to these borders, but they persist as a Soviet legacy, and are making an already difficult life harder. With the advent of border fences and land mines, these isolated communities have become even more isolated. The restricted access also affects movement in the surrounding country as travel within national boundaries now entails detours around the mountain enclaves.

One of the most problematic regions is the Ferghana Valley shared by Uzbekistan, Kyrgyzstan and Tajikistan, where people historically used to trade broadly across borders. With new restrictions, opportunities for local trade and labor market have significantly reduced, at the same time the corruption flourish due to growing shadow economy and illegal trade. Additionally, episodes of shelling of civilians by the border guards cause the wave of local public indignation.

Physical borders – fences and trenches, for example – restrict the movements of migratory animals, and may adversely affect the populations of some species as their migration patterns are disrupted. Conversely, where there are no physical borders, stock from one country may follow old grazing patterns that take them across the new borders into another country where they may be appropriated never to return to their owners. In places where border control is strict, the formerly common economic space, including agricultural land, is now divided, and one of the benefits has been the reduced pressure on pastures that no longer receive stock from

what is now another country. In addition, many small and large watersheds once held in common have become international, and what was once a matter for one country has become much more administratively complicated.

After the collapse of the Soviet Union, Russia continued for some time to protect the border with Afghanistan with the same level of guards and military presence as before, but gradually reduced its presence and military assistance. The richer lowland countries with gentle landscapes have been able to maintain a reasonably high level of border security, but the rugged mountainous landscape and limited financial and military resources of Tajikistan have meant that border protection between the Tajik Pamirs and the Afghan Hindu Kush remains a continuing challenge. Inadequate control in the mountain regions of the Tajik–Afghan border has led to increased security risks including the intrusion of armed troops and the trafficking in drugs. Joint efforts by the Afghan International Security Assistance Force (ISAF) and the Shanghai Cooperation Organization have improved border security, but drug trafficking remains a destabilizing force in the mountain territories.

These challenges to border security notwithstanding, Tajikistan and Afghanistan can celebrate the development of the friendship bridges between the two countries. These new bridges encourage the exchange of goods and services, and benefit both sides.

As part of its sensitivity to border issues with China and Afghanistan, the Soviet Union restricted movement near borders in the mountain territories. After independence, Kyrgyzstan lifted the restrictions, but they remain in force in Tajikistan where outside businesses and travelers need special permission to operate in the Pamir Mountains and non-local individuals need special access permits to travel there. This policy is a constraint on commerce.

1.3.3 Political and economic influences

China's rise on the global stage and its dominance in international trade has changed the patterns of business and trade in Central Asia. Foreign investment and infrastructure development projects increasingly come not from the West or from Russia, but from China, and political relations are changing in the region in concert with economic ties and trade. Among the technologies China now provides to the region are those related to mining, manufacturing, agriculture, solar power production and construction, and Chinese nationals are found among the mining communities and trade bazaars in the mountains. Some Chinese food exports now compete with specialized mountain products, and the lower cost and out-of-season availability of the Chinese products place mountain growers at a disadvantage. As an importer, China receives gold, raw materials and fossil fuels from the Central Asian countries.

Russia is a long-standing partner of the mountain countries of Central Asia. The main areas of cooperation cover peace-keeping and border security, trade and energy. Russia receives most of the labour migrants from Central Asia's mountain areas, and is as the main export destination for their agricultural products. Russia supplies Tajikistan and Kyrgyzstan with technology, fuel, wood and investment in hydropower projects, and provides soft loans. The Aga Khan Development Network (AKDN) and Switzerland have been the main sources of aid for the mountain communities of Central Asia from the beginning of the transition to independence up to the present, and although both sources have reduced their humanitarian aid from previous levels, they continue to provide follow-up assistance. The AKDN provided aid across a range of functions, and concentrated on mountain farmers in Tajikistan where they still provide food assistance and guidance on reforms. (See Part 2, section 2.6 for more information on the work of the Aga Khan in Central Asia.) Switzerland divided its attention equally between Tajikistan and Kyrgyzstan offering country-to-country aid on security, peace-building, disaster risk reduction, sustainable agriculture and forestry and economic development. Both players have also been proactive in mountain education, health and research. Switzerland has provided support to the Central Asian Mountain Partnership (CAMP), which over the last decade has influenced and promoted the exchange of local and national mountain development good practices and learning.

The European Union, the United States, Japan, Turkey, Iran and other individual countries have provided bilateral aid in the form of targeted interventions, and the Asian Development Bank (ADB), the World Bank

(WB), the Organization for Security and Cooperation in Europe and the United Nations have provided multilateral assistance for economic and social reforms at all levels, and for natural resource management in the mountains. The multilateral aid has contributed to the development of policies and institutions through sustainable development and sectoral strategies for agriculture, water and energy. The ADB specifically assisted in the development of national sustainable mountain development strategies and regional environmental action plans in the early 2000s.

Global Environmental Changes, Globalization And Technology

1.3.4 The effects of climate change and natural disasters

Climate change scenarios for Central Asia envisage a 1°C–3°C increase in temperature in the next two to four decades. If the global greenhouse gas emissions are unmitigated, scientists project that temperatures could exceed today's by 3°C–6°C by the end of the the twenty-first century. At the same time climate change is projected to reduce precipitation in southern parts of Central Asia. What exactly will the local impact be and when will these weather changes occur, especially in the mountains? This is still unknown.

Weather records confirm that the surface temperatures in Central Asia are growing. In the mountains of Kyrgyzstan and Tajikistan, temperatures have increased by 0.3–1.2°C in the last 50–70 years, depending on the location. Almost everywhere, climate warming in winter is more pronounced than in other seasons. A slight increase in precipitation has occurred in the mountains of Uzbekistan, the northern Tien Shan and the Western Pamir. In contrast, a negative change in precipitation is observed in central parts of the Tien Shan and the Eastern Pamir.

The effects of changing climate, especially since the 1950s, have had a negative effect on glaciers, snow cover and permafrost. Mountain dwellers and hikers report a visible change in frequently visited glaciers. Many mountain paths which were reliable 30 years ago have disappeared or changed beyond recognition. The surface of many glaciers has thinned and their ice bodies are increasingly covered with lakes and debris. Numerous small glaciers (smaller than 0.5 square kilometres) have totally melted. These trends are confirmed by the professional glaciological and meteorological monitoring.

Today's rate of glacier loss in Central Asia is 0.5–1 per cent per year. In the last 50–60 years, between 15 per cent and 35 per cent of the Tien Shan and Pamirs glaciers have melted, depending on the location, size and elevation. This worrying trend is comparable with ice reduction in the European Alps, the Caucasus or Himalayas.

The degradation, even slowly, of the largest glaciers of Central Asia – the Fedchenko in the central Pamir Mountains of Tajikistan and the Inylchek glacier in eastern Kyrgyzstan – provide vivid evidence of climate warming. The Fedchenko glacier, which exceeds 70 kilometres in length and two kilometres in width, shrank by one kilometre and substantially thinned. Another relatively large Zeravshan glacier in Tajikistan – a source of water for half a million hectares of irrigated lands and densely populated ancient oases of Samarkand and Bukhara in Uzbekistan – retreated by 2.5 kilometres.

In Kazakhstan, the surface and the ice volume of the Tsentralny Tyuyksu glacier, which is the only remaining reference site in Central Asia reporting to the World Glacial Monitoring Service (WGMC) in the Zailiysky Alatau range of the Tien Shan Mountains, shrank by more than 30 per cent in the last 50 years, receded by one kilometre and lost more than 40 million cubic metres of ice. This glacier is one of the main sources of water for Almaty, the largest city of Kazakhstan.

Petrov Glacier in the north Akshirak massif of central Kyrgyzstan, where the country's main gold mine, Kumtor, is located, shrank by almost two kilometres in the past 50 years. A large glacial lake with surface area of four square kilometres and water volume of 60 million cubic metres has formed on top of its terminal moraine and

is spreading steadily. If glacial dam stability, lake level and permafrost thawing are not addressed, the risk of flooding and impacts on downstream infrastructure in the upper Naryn river is high.

The mountain snow cover that plays a critical role in the water cycle and the existence of glaciers is also slowly disappearing. Over the past 20 years, the seasonal snow-covered area of the Tien Shan Mountains has decreased by as much as 15 per cent. In summer, rain instead of snow appears more often in the mountains, even in high-altitude regions.

The World Bank has recently given the highest vulnerability rank to the two mountain countries of Central Asia – Tajikistan and Kyrgyzstan – among 28 nations of Europe, the Caucasus and Central Asia. This is due to current climate variability and impacts on natural disasters (droughts, floods) that exacerbate sustainable development challenges in poverty and food security, infrastructure, energy and agriculture. Moreover, the high level of male labour migration abroad makes women in rural areas highly vulnerable to shocks from crop failures, heatwaves and natural disasters. A consideration of this situation led to Tajikistan's selection for participation in the Pilot Programme for Climate Resilience. (See Part 2 for details.)

In the health sector of mountain regions, climate warming and heat stress contribute to cardiovascular disease, increased risk of malaria outbreaks and intestinal infections (typhoid, salmonellas, dysentery, helminthiasis) due to heavy rainfall combined with inappropriate communal water supply and sanitation.

In scenarios of strong climate warming and lack of precipitation, water resources in the main rivers would fall by 15–40 per cent. With less fresh water and land suitable for agricultural use, people will have to move to places where they can survive. Droughts and crop failures will push inhabitants of the rainfed mountain areas and pastures towards cities and irrigated oases. Water is both a key resource for agricultural production and for electricity generation in the region. Competition for the control of this vital resource is likely to increase while the flow of the rivers may decline.

As mountain countries, Kyrgyzstan and Tajikistan will probably have enough water for their own needs but may not be able to meet demand in their role as regional water towers. Turkmenistan and Uzbekistan, as downstream states, with extensive irrigated agriculture and high dependence on external water supplies may suffer the most from a water deficit. In the longer term, regional water resources are under threat. In the next two to four decades the water flow of the Amu Darya and Zeravshan may be reduced by 10–15 per cent and the Syr Darya by five per cent.

So far, the good news is that, in spite of reduction in glacier size and volume, the flow of Central Asia rivers has not changed significantly. In selected river basins, the intensified glacier and permafrost melting has even increased discharge of rivers by 6–8 per cent, while runoff from glacier-free river basins has dropped slightly. But the current trend towards low-water years, as water levels are reaching extreme minimums, is worrying. Such a situation occurred in the Amu Darya basin in 2000, 2001 and 2008. The severe 2000–2001 drought in southern parts of Central Asia may serve as a model for the future. During that drought Tajikistan and Afghanistan experienced a failure in rainfed crops and pasture productivity, while water shortages affected the lower reaches of the Amu Darya, especially Karakalpakstan in Uzbekistan. In 2008, hydrological drought and extreme cold in Tajikistan and Kyrgyzstan, combined with vulnerability of energy sector, rising food prices and lower access to remittances, created a serious food security and energy crisis. Damages amounted to about US\$ 250 million in Tajikistan alone. Hydrological drought was caused by abnormally low precipitation (25–75 per cent of the norm), as well as excessive drawdown of reservoirs for the purpose of hydropower generation. In the context of changing climate and drought impacts, mountain countries are pursuing expansion of large and small water storage capacities.

Climate change is increasingly becoming a factor defining the future conditions of mountain ecosystems and adds to ongoing environmental pressures on sensitive habitats, flora and fauna. Vegetation succession can be observed at many alpine sites that were covered by glaciers until recently. Droughts, a more arid climate and the reduction of water flow in the rivers affect aquatic and tugai floodplain forest ecosystems. The areas annually affected by locusts (mostly in southern parts of Central Asia) significantly increased. Pest attacks in

southern Tajikistan in 2003–2005 halved the cotton harvest in the hardest-hit districts. The risk of forest fires and of spreading forest diseases has amplified. Scientists warn that mountain forests of Kazakhstan would be exposed to significant risks of forest fires in dry years due to the impacts heatwaves. The past 15 years featured particularly high numbers and large mountain areas affected by forest fires.

The Soviet Union used the mountains of Kyrgyzstan and Tajikistan around the Ferghana Valley as one of its main initial sources of uranium ore, mercury, antimony and other metals. The legacy of past mining operations remains in hazardous waste sites that are often located in weather-sensitive, flood-prone locations near towns and along rivers and drainage zones. Pollutant spills and natural disasters in this and other mountain areas could affect a population far beyond the people living in the vicinity, and could lead to profound transboundary effects.

In Tajikistan and Kyrgyzstan, average annual economic losses from natural disasters reach 1–1.5 per cent of GDP (equivalent to US\$ 25–30 million). Estimates foresee that in some years the impact will reach 5 per cent of GDP. A recent assessment of Kazakhstan's climate vulnerability indicates that areas most at risk from climate change and natural disasters are the mountains and adjacent lowland provinces. Mountain regions in Central Asia experience recurrent and devastating earthquakes: Almaty city in 1910, Ashgabat city in 1948, Tashkent city in 1966, and numerous high mountain villages of Afghanistan, Tajikistan and Kyrgyzstan have all suffered major loss of life and damage to property. Earthquakes cause the largest number of deaths from natural disasters in Central Asia, followed by floods and landslides, while recent droughts affected the largest number of people, causing substantial economic losses and food insecurity. Agronomic practices are often inappropriate for sustainable land management and drought resilience in mountains, and the lack of agricultural advisory services and adequate meteorological forecasts for the mountain areas hamper their development potential.

Climate change could amplify the risk of floods, mudflows and landslides in the mountains, including glacier-related hazards. There has been a series of glacial outburst floods in the mountains of Tajikistan, Uzbekistan, Kyrgyzstan and Kazakhstan, making it even more urgent to monitor these hazards. With glaciers melting, glacial lakes appear every summer in the mountains. Some of them grow significantly and, if contained by unstable moraines, they occasionally burst and release large amounts of water in destructive flash floods, sometimes with serious impacts on life and property.

Almost 1 000 glacial lakes exist in the mountains of Central Asia. Annually, dozens of potentially risky glacial lakes appear in the mountainous areas above Almaty, Bishkek and Tashkent cities, around Issyk-Kul Lake and the densely populated Ferghana Valley, and in the narrow Pamir-Alai valleys. Experts suggest that this number is likely to grow with climate change. There have already been deadly floods in the past 15 years, including the Shahimardan (Uzbekistan and Kyrgyzstan, 1998), Dasht (Tajikistan, 2002) and Issyk-Kul (2008).

Some large mountain lakes, such as Sarez Lake in Tajikistan which formed in 1911 as the result of a rock slide in the central Pamir mountains, represent a serious risk. Situated at an elevation of 3 000 metres, the lake is over 60 kilometres long, almost 500 metres deep and contains 17 cubic kilometres of water. A new rockslide into the lake could form a high wave, and depending on its volume, the season and the location of the slide, this wave could cause a destructive flood. The water level in the lake is likely to grow due to intensified glacier and permafrost melt caused by climate warming. Lake Sarez has received high international attention, and a sophisticated monitoring and early warning system has been installed with support from Switzerland and the World Bank.

As independence altered the political landscape, global warming is changing the physical landscape, and the points of reference that define some borders in mountain regions are on the move. In the Alps, for example, retreating glaciers, melting permafrost and the resulting landslides are changing the mountain morphology. Some of the glacial ridges and watercourses that were used as border-defining reference points have moved, and Swiss and Italian officials are working to redefine the border. Central Asian can expect similar changes throughout its mountain border regions.

The next decade or two offer a window of opportunity to sustainable mountain development more resilient to climate change by improving key sectors, such as water resource management, land use, biodiversity protection, addressing environmental pollution, and strengthening cooperation between states on forecasting and mitigation of disaster risks. Because most of climate change and natural disaster effects have transboundary dimensions spreading from mountains to lowlands there is need and place for regional cooperation involving state institutes responsible for disaster management, civil and scientific community of the Central Asian countries, and the international humanitarian organizations. Disasters pose a serious obstacle for sustainable development and could partially aggravate the existing social and economic constraints. Vulnerability reduction is considered as a key element of the sustainable development process.

Tajikistan and Kyrgyzstan hold the record for the lowest greenhouse gas emissions in Central Asia (1–2 tonnes of CO₂ per person), mostly because hydropower is their main energy source and they produce and consume only small amounts of fossil fuel. In addition, after the Soviet Union disintegrated in 1991, both countries experienced significant economic and industrial decline and an energy crisis. Their total greenhouse emissions in 2005 were reduced to 33–40 per cent of their peak emissions in 1990–1991. Mountain forests and tree plantations in Kyrgyzstan and Tajikistan annually absorb collectively more than 1.5 million tonnes of CO₂, which is about 10–15 per cent of country's total CO₂ emissions. The capital cities and densely populated valleys contribute most of the emissions in these countries. The mountain communities use biomass for fuel (both sustainably and not) and electricity, therefore their carbon footprint is limited. In contrast, energy-rich Kazakhstan, Uzbekistan and Turkmenistan have reasonably high greenhouse emissions per capita (12–14 tonnes of CO₂ per person), high total emissions and lower carbon absorption share. The total GHG emissions in Central Asia are projected to grow in the coming decade in almost all scenarios reported by the countries. From the perspective of mitigating global climate change this is an unfortunate development and more could be done to increase energy efficiency, promote the use of renewable sources of energy and efficient stoves and increase resilience to climate change through adaptation. Non-governmental organizations and projects of international organizations play significant roles in education and raising awareness among schoolchildren, farmers and other practitioners regarding affordable solutions to increase energy efficiency, improve local energy security and make greener the traditional ways of cooking, growing vegetables in greenhouses and the use of solar energy.

In view of the growing national and regional energy demands in Pakistan, India, China and Afghanistan, the mountain countries of Central Asian have chosen to increase their power generation capacities both using renewable (mainly hydropower) and non-renewable energy sources such as coal, deposits of which are accessible and affordable in mountain countries. For them, coal-fired plants would serve as a short term solution to overcome energy deficits and increase energy security. However, the emerging trend towards increasing use of coal for power generation, in cement production and other industries is a worrying since it adds to the national carbon footprint and cause local air pollution.

1.3.5 Dwindling biodiversity

It is alarming that the ecosystems of the mountain lakes in Kyrgyzstan, including its largest Lake Issyk-Kul (water volume 1 738 cubic kilometres, surface area 6 236 square kilometers), are threatened by over-fishing and alien species. Just four to five decades ago, Issyk-Kul was a flourishing fishing ground of Kyrgyzstan in addition to being the country's most popular holiday destination. In the last decade, however, fisheries declined to negligible levels and the government banned all fishing here in 2003. In spite of this, thousands of illegal fishing nets are detected annually. Endemic fish species previously abundant in the lake have now become nearly endangered. Issyk-Kul is on the Ramsar Convention's list of globally significant wetlands and forms the core of a biosphere reserve. Without restocking of the lake with juvenile endemic fish from hatcheries and tighter control of illegal fishing, restoration of the lake's ecosystem will be hard.

With the abrupt end of the Soviet era, the people in the Kyrgyz and Tajik mountains faced sudden poverty and the risk of famine, and responded by hunting wild animals for meat and trophies. The increase in hunting

placed a corresponding increase in the pressures on wildlife. The cessation of Soviet supplies of solid and liquid fuels to the Tien Shan and Pamir mountain communities had similar consequences – woody biomass and dried dung became major sources of energy for cooking and heating, and the widespread collection of slow-growing shrubs, such as artemisia and teresken (*Ceratoides papposa*), as well as forest cuttings throughout the 1990s and into the early 2000s have diminished mountain land cover and biodiversity. Fires and pest attacks on mountain forests due to limited controls and hot dry weather conditions destroyed and damaged significant forest-covered areas, especially in Kazakhstan.

Many grasslands have been affected by overgrazing twenty years ago. During the economic transition, number of livestock initially declined, and herding practices centred around settlements. This development led to over-use of so-called winter and autumn pastures in low mountains nearby populated areas as the regular fodder supply was no longer available or affordable to most households. At the same time, conditions of summer pastures in high mountains improved. Currently, throughout the region animal stock is raising. But the new pasture legislation and regulations developed in Kyrgyzstan that combine scientific approach (carrying capacity of pastures) with economic tools (pasture use tickets) and community participation pave the way for more sustainable approaches in livestock herding.

In the Soviet era, professional agronomists assisted mountain farmers in the selection, development and maintenance of agricultural species – both animal and vegetable – adapted for the local mountain environment. The enrichment of agricultural biodiversity resulting from these efforts is now threatened by the pressures to compete in global markets, and the genetic diversity of the local food base is at risk. Because the arable land is so limited, the promise of higher production and maximum output led to new species replacing old ones, and some of the old local varieties are disappearing or being underused. An untested new variety may be vulnerable to a crop disease that could wipe it out, and the unavailability or loss of the old variety leaves the farmer with limited options.

Each new variety requires maintenance, and some new varieties work out and some do not. In the absence of rigorous maintenance, the risks and uncertainties are growing. In addition, some crop varieties new to the mountains may require chemical fertilizers to thrive in the environment, adding environmental pressures, production costs and reducing profits.

In the Kyrgyzstan stock sector, which benefited from the special attention of the Soviets, some sheep species have disappeared in the switch from wool to meat production over the last 10–20 years. On the other hand, milk- and meat-producing cattle have been replaced by breeds better adapted to mountain conditions. In the 1980s, in an effort to crack down on the problem of alcoholism, and at the initiative of the Soviet leader Mikhail Gorbachev, many vines and some gardens were eliminated in Kyrgyzstan. Plantations in Tajikistan also suffered. The echo of that campaign still sounds today.

Alien species and genetically modified organisms (GMOs) are threats to biodiversity everywhere, but mountain environments, in view of the narrow range of habitats, are particularly vulnerable. The introduction of alien species is a risk associated with the increasing accessibility of roads, higher levels of trade and globalization, and farmers may introduce GMOs unintentionally or in the interests of higher production. In neither case do mountain communities have the capacity to detect the problems that may ensue or to manage the situation. Habitats may change in response to the introduction of alien species or GMOs, to new grazing patterns or crop selections and even to new ownership, and any of these changes to habitats affects biodiversity.

The region is taking a strong positive step with the United Nations Convention on Biological Diversity 10-year strategic Aichi plan for enhanced cooperation on biodiversity and benefit-sharing. The plan aims to preserve natural areas and to protect endangered species.

1.3.6 Land degradation

Concerns over food security promoted growth in rainfed crop cultivations in the mountain areas, especially in Tajikistan, which often increased soil erosion on steep slopes. Overgrazing near mountain villages across

Kyrgyzstan and collection of teresken bush for fuel in the Eastern Pamirs exposed these mountain territories to high risk of desertification. Soil compaction, reduction of vegetative cover and increased erosion of mountain slopes is also a factor contributing to higher sediment formation and silt loading of the rivers with implications for the lifetime and effectiveness of the reservoirs and irrigation canals and operation of hydro-electric turbines.

1.3.7 Roads, rail and international trade

The expansion of the road system through the improvement of national roads and the addition of new international roads has increased the accessibility to remote mountain areas. This new accessibility has brought both additional pressures from visitors and from business development, and new income opportunities in terms of tourism and hospitality and the trade of native products. The increase in the number of people who have cars has improved mobility and connectivity, but has also brought increased risks to previously unreachable mountain ecosystems, and the additional traffic has contributed to environmental noise and air pollution. Moreover, traffic accidents on the roads of Tajikistan and Kyrgyzstan result in 500–2 000 deaths per year and in numerous injuries.

Better construction technology has produced less expensive and more reliable roads as well as new tunnels that provide mountain communities with year-round access and that reduce commuting time – in some cases by as much as half. These improvements mean that mountain communities can now rely on outside suppliers even in winter. It is a dramatic improvement, considering that only 15–20 years ago Tajikistan was isolated into three parts in the winter due to lack of year-round roads and difficult alternative routes. Most of this new expansion is sponsored by Chinese investment or the Asian Development Bank, and conducted by Chinese companies. In Kyrgyzstan, the main roads are rapidly improving, but marginal and remote mountain districts – such as the Chatkal Valley – remain isolated. Local communities hope that with the mining boom in the area, infrastructure and valley's accessibility will gradually improve.

Air access in the mountains was better in the Soviet era when fuel was cheaper and small aircraft were in service. The infrastructure for this air service is still available, but it is no longer a cost-effective way to travel or transport goods. An exception to this trend is the Issyk-Kul airport, which Kyrgyzstan recently completed to serve the international tourism that is growing in importance.

Mountain countries are also seeking the development of rail systems both for transport independence and for international trade. Transit countries – those between two destinations – stand to benefit from China's growing role in the region. Both Kyrgyzstan and Tajikistan are discussing the possibilities of rail connections with China, but controversies have arisen. One option is for the countries to finance the developments with loans that may strain national budgets. The cost of a 270-kilometres railroad from the Chinese border through Kyrgyzstan to Uzbekistan is estimated at US\$ two billion. A second option is for the governments to give up mineral deposits to China in exchange for rail (and road) investments. Here the controversies are whether the exchange can be of equal value and whether the local communities involved would prefer to retain the land for traditional purposes.

Another controversy is over the dimension of the rails – whether to follow the Chinese (and Western European) standard or the Soviet standard already in place in Central Asia. This matter is currently subject to expert discussions and lively public debate. The determination of this issue will in all likelihood also determine who provides the equipment and maintenance for the new system. If these issues are not enough of a challenge, there is the technical challenge that the mountains in this region are moving at a rate of several centimetres per year. The implications for rail and tunnel construction and maintenance are apparent.

The Central Asian mountain countries seeking to develop international trade by expanding roads and rails may find support for their rationale in the Swiss experience. Switzerland has built tunnels and improved roads largely for the benefit of international trade.

In Kyrgyzstan, the opening of roads to China, in combination with attractive local conditions with regard to labour, taxes, customs, liberal trade regulations and connectivity, led to the development about 20 years ago of the Dordoi market near Bishkek. Currently the largest market in Central Asia, Dordoi covers 100 hectares, and offers 10 000 containers with 40 000 trading outlets. The local employment generated by the market is hard to estimate, but probably exceeds 50 000 jobs. The current total turnover surpasses US\$ 330 million per month, or US\$ 4 billion per year. In the suburbs of the southern Kyrgyz ancient trading city of Osh, the second largest market, Kara-Suu, has 10 000 trading outlets and turnover of US\$ 0.8–1 billion per year. Before the global financial crisis of 2008, the annual turnover of the Kyrgyz bazaars reached US\$ 7 billion per year. Almost anything that is used by individuals is traded here – from cheap Chinese-made clothing and electronics to cars and name-brand products. Markets in Kyrgyzstan are not just major shopping and employment centres, but also the main transit points through which goods from China move to Kazakhstan, Russia, Uzbekistan and Tajikistan. This re-export is one of the largest economic activities of Kyrgyzstan and in recent years imports from China to Kyrgyzstan climbed to US\$ 5–9 billion per year, exceeding the country GDP.

By 2020 China could become the largest economy in the world. Rapid growth in wealth and consumption in neighboring countries such as Russia, Kazakhstan, Uzbekistan and Turkmenistan could further opportunities for trade, transit and labour for mountain countries. By taking advantage of this trend and offering competitive environmentally friendly food, original textile products, rapid and reliable logistical services, skilled and low-cost human resources and by sharing valuable mountain ecosystems goods and services, they have good prospects for channeling their development in sustainable way.

The success of the Dordoi market and the rise in international trade have boosted the textile industry in Kyrgyzstan. The industry now employs some 300 000 workers, mostly women, in the production of clothing, carpets and other traditional products.

International trade has played an important role in Kyrgyz agriculture as well. In one notable development, approximately 15 years ago in the Talas Valley, Turkish interests identified the possibilities for producing beans of good quality in an environmentally sensitive way. Now the entire valley specializes in bean production, and trade has expanded to Russia, Kazakhstan and other countries. Beans are a nitrogen-fixing crop so the ecological concerns regarding monoculture are less a factor with beans than with other crops, but there are economic vulnerabilities. Currently the economic benefits are substantial, but the risks of crop or market failures are more severe when a region relies on only one crop. Similarly, Tajikistan has recently initiated the substantial expansion of orchards, mainly in mountain areas, to diversify and increase export potential of its agricultural sector and supply growing markets in Russia and across the region.

1.3.8 The expansion of mobile communications and information technologies

The Central Asian region is experiencing a significant upward trend in the availability and affordability of communication technology such as mobile telephones and Internet access. The use of the Internet in mountain countries has grown substantially over the past decade and many highland hotels, other tourist-related businesses and increasingly farmers are now able to advertise their products and services and conduct business online. Online education and distance learning are also becoming popular and increasingly available options, and consumers can now order mountain eco-produce online. The introduction of information technologies in the banking sector have lowered the costs and increased the efficiency of labour remittances, which now pass through banks rather than being transferred through friends.

This same communication technology is benefiting the mountain environment as blogging and social media raise awareness about environmental issues, and the sophisticated technology helps a new generation develop a better understanding of ecosystem degradation and environmental protection measures. The more advanced technology and the use of mobile communications for scientific observations are also improving the study of weather patterns and the prediction of natural disasters. Mobile communication technology allows for the more cost-efficient and rapid collection of climate and weather conditions, and improves the prospects for

effective early warnings. Mountain weather stations increasingly use mobile networks to transmit data and exchange information.

Mountain communities are also improving the communication of public information by providing better media access for news reporting, and by establishing small local data bases of special information of interest to certain users. More data on mountains are available on Websites, and there is an increasing trend among mountain provinces to issue regular environmental reports online. These developments are all steps toward the greater decentralization of information availability, and are expanding the opportunities for public participation in decision-making and governance.

1.3.9 New opportunities in tourism

Uzbekistan has always had more capacity than its neighbours to manage tourism, and its historical role as the hub for cultural and mountain tourism in Central Asia continues to this day. This dominant role is sometimes viewed with criticism by the mountain people and tourist firms of the destination countries. With the independent countries now managing their own economies, the mountain communities of Kyrgyzstan and Tajikistan want to control their tourism by themselves. The new tourism opportunities in the region provide Kyrgyzstan and Tajikistan the chance to compete with Uzbekistan, and to cooperate on the development of Silk Road tourism ventures. Chatkal and Alai mountains in south-western Kyrgyzstan and Fann and Gissar mountains in western Tajikistan with numerous cultural and historical sites are among the promising regions for cooperation with Uzbekistan.

The Central Asian mountains have long been famous for summer tourism, but until recently the potential for winter tourism had been underutilized, a situation that is starting to change with the 2011 Asian Winter Olympics, recently held in Kazakhstan, and new developments in Kyrgyzstan. Hosting a Winter Olympics comes with a major investment in facilities and infrastructure that endure long after the games are over, and Kazakhstan now has venues and systems that can support the development of a winter tourism industry. The Swiss experience shows that mountain sports development can bring risks of ecological damage, and can mean a change of livelihoods for local residents. But the economic benefits can be significant, and Central Asia is well situated to explore the possibilities for attracting local, national and international tourists.

Tourism is not currently a large part of the GDP of any Central Asian country, but given the remoteness of mountain communities and the limitations of mountain agricultural production, tourism offers a promising source of alternative livelihoods for local operators and related businesses. In addition to developing winter tourism, Central Asian countries have an opportunity to further develop cultural tourism, particularly in the summer months. Kyrgyzstan, which generated US\$ 500 million in the tourism sector in 2010, is currently working on this prospect, while Tajikistan may be underestimating the potential. As Central Asia becomes increasingly accessible to outsiders, international tourists may show more interest in learning about the various mountain cultures by visiting the places where those cultures exist.

Shortly after independence, Kyrgyzstan recognized the potential of tourism, and established a ministry of tourism to exploit those possibilities. The increase in privatization has gradually reduced the original role of the ministry, but Central Asian countries would do well to explore new roles for government in the promotion of tourism in the new economy. In many western countries, governments regulate the tourism industry and promote it for the benefits that accrue to the nation as well as to the local communities and operators who host the tourists.

1.3.10 The gold rush and other mountain mining developments

Kazakhstan is the regional leader in minerals production and processing, while Uzbekistan is the ninth largest gold producer. But most of their mining development projects are located in the remote desert areas. The development of the mining sector in the mountains has also been significant over the past decade, particularly in Kyrgyzstan and Tajikistan. At the end of the Soviet era and into the 1990s, there was almost no gold mining in either country, and little state or international interest. With gold prices reaching record levels over the past

20 years, however, both local and global investors have become interested in developing even low-grade deposits. Now, mining and metallurgy industries are the major cash sources for national budgets, contributing up to 50 per cent of the national export earnings in Tajikistan (aluminum and gold) and Kyrgyzstan and up to 30 per cent (mainly gold from the Kumtor mine).

Kyrgyzstan, which foresaw the mining and energy sectors as having significant development potential, moved to create conditions favourable to mining operators by enacting economic reforms and by allowing access to geological information. Currently almost of all of its territory is licensed for mining activities. Tajikistan, in contrast, continues to consider its geological information confidential, as in the Soviet era, and its legislation and the ease of doing business currently lags behind Kyrgyzstan's. As a result, Tajikistan has attracted fewer investors, and where Kyrgyzstan's mining sector has advanced, Tajikistan's remains stagnant. The World Bank is assisting both countries in reducing barriers in mining sector.

The influx of new mining technologies and the launch of new projects have given rise to both opportunities and difficulties for governments and local communities. A reluctance on the part of governments and mining companies to share gold-mining profits equitably and a lack of transparency in decisions have led to feelings of discontent among poor and vulnerable groups in the mountains. Indeed, the benefit-sharing arrangement between mining projects, central government and local communities remains a lingering cause of resentment. The conflict between the use of land for traditional pasture and grazing, nature conservation and for mining activities is also a source of friction in Kyrgyzstan.

The experience of the Kumtor gold mine in Issyk-Kul Province in western Kyrgyzstan has influenced all the developments that followed. In 1997, with the support of Canadian investment, operations started at the Kumtor mine, which now produces 90 per cent of Kyrgyzstan's gold, about 15–20 tonnes per year. Kumtor tax payments contribute substantially to the national budget, and the mine provides significant employment opportunities to communities throughout the area. In addition, Kumtor sponsors local social development programmes such as schools, kindergartens and summer camps, and has introduced a local development fund that is increasingly considered as a model by other mining companies.

Kumtor maintains high safety standards, but a transport accident resulted in a spill of cyanide into a local river. The toxic material dispersed quickly causing some environmental damage, but the psychological perception was significant and long-lasting. The accident galvanized local resistance to mining whether or not cyanide would be used in operations, especially in areas with no mining history. The abandoned Soviet mining legacies across the country exemplify possible grim scenarios. Mining operators now encounter local opposition wherever they go, and find that environmental impact statements and the necessary permissions do not overcome the hostility and distrust they face.

The central government's failure to understand local demands and its slow response to adjust mining regulations complicate the situation. The mining sector is important nationally, and the central government has been the main beneficiary of the taxes from mining operations. The locals want a fair share, and because they view the mining operators as more capable than the central government they increasingly seek more benefits from the companies. Rather than step into the breach to negotiate with the parties, the central government has essentially left the mining operators and the locals to their own devices.

Local resistance and dissatisfaction continue to grow as mining operators fail to communicate their environmental protection strategies with local communities, and then fail to meet the obligations they do make. The companies that operate the mines change frequently, and the commitments of one company may no longer be honoured by the next. Broken promises, inequalities of salaries, dubious local staff hiring procedures and potential environmental damage have hardened local opposition, and the central government continues to ignore the discrepancies between its plan for the mining sector and the reality that has ensued. Fortunately, NGOs have been quick to see the problems and have initiated dialogues between operators and locals, in particular in Chatkal and Naryn regions.

Regulations on mining are sometimes contradictory to environmental protection priorities: mining is allowed in river beds and sometimes even in the buffer or main zones of nature protection areas. Local communities oppose mining developments in or near nature reserves and along rivers and springs where ecosystem damage caused by industrial operations could have negative implications. Residents fear their valleys will become polluted and people will stop buying their vegetables and other agricultural produce. Some companies have extensively developed alluvial deposits in sensitive ecosystems that provide clean water, and geological prospecting has affected high mountain pastures. But in a number of situations, speculations on environmental grounds seems to be whipped up by local elites with the goal of extracting a bigger share of future profits or taking over and reselling the mining license. Tension between local environmental interests and the mining sector mirrors the experience in Western countries in previous decades. If political stability and consensus on social-environmental issues in the Kyrgyz mining sector are addressed, the country's gold production could double within the next few years.

Tajikistan has had a less favourable business climate than Kyrgyzstan, but the Tajik government, with the assistance of international organizations, is currently working on reforms that may lead to a mining boom in the future. Tajikistan has been famous for silver mining from ancient times, and a recent geological audit suggests that it has probably one of the largest silver reserves in world. The government has officially announced a request for international tenders for the development of these deposits. Recently announced plans of Tajikistan to develop its own alumina mining and expand cement production capacities will be supported by Chinese investments and technology.

Of the international developers active in the mining sector in the Central Asian mountains, the Russian and Kazakh mining companies have enjoyed the most success, especially at the community level, largely because language barriers and limited integration into the local context have blocked the progress of Western and Chinese companies. The Kyrgyz experience may be instructive as Tajikistan moves forward with development in the mining sector.

Kyrgyzstan has taken the lead in promoting an international initiative on transparency in extractive industries, and is working to involve as many mining companies as possible. The transparency initiative requires financial disclosure that shows how mining activities benefit governments. The initiative does not, however, require disclosure of how the activities may or may not benefit local communities.

In both Kyrgyzstan and Tajikistan, the environmental problems associated with the increase in mining and related activities are offset to some extent by the declines in all other industrial sectors. While the increase in mining increases potential threats to the environment, the reduction in industry reduces other threats. High gold prices may help Kyrgyzstan, with support from international community and private sector, to take steps in phasing out its state-owned primary mercury mining that started 70 years ago as the main source for the Soviet Union. Mercury has high local and global environmental impact, and therefore replacement of mercury mining with gold extraction or pre-processing is considered one of environmentally and socially responsible alternatives to continuation of mercury production.

Finally, both mountain countries have experienced boom in small scale mining for placer gold, particularly Kyrgyzstan. Artisanal miners are a heterogeneous group of men aged from 16 to 60+ years and the reasons for mining are variable. For some mining was and still is the main source of cash income. Gold saved help them to survive in the turbulent economic transition period of 1992-2000. For others it is an income supplement in winter months when agricultural activities are limited. In any case artisanal gold mining is beyond control of central and local authorities and with increasing degree of labor mechanization and mercury application for fine gold extraction, threats to the mountain environment are growing.

1.3.11 Tapping the vast potential of energy resources

Over the past 20 years, national energy resources in Central Asia have attracted international investors. Oil, gas, uranium and hydropower are proving to be lucrative sources of economic development. In light of this growing trend, the mountain countries in the region have become both locations and transit routes for energy

resources, mainly electricity. Years of intense exploitation of uranium, however, has had a detrimental impact on the mountain environments and economies of Kyrgyzstan and Tajikistan. Ensuring the sustainable use of natural resources is therefore another important consideration for the region.

Both Kyrgyzstan and Tajikistan have large hydropower potential, and both countries are working on policies and strategies to develop that potential on all scales. International organizations including the World Bank and the Asian Development Bank have demonstrated much more interest in the energy sector than in mining, and are active in promoting markets for energy generation and transfer. Energy-hungry neighbours, China, Pakistan, India and Afghanistan, are also interested in the prospect of benefiting from the development of Central Asia hydropower through Central Asia-South Asia Electricity Trade and Transmission (CASA-1000) or other projects. Currently, mountain countries use less than 10 per cent of the technically feasible hydropower potential. Russia, China and Iran are interested in investments in the hydropower sector. Planned and ongoing projects aim to further expand hydropower capacity on the rivers with existing power cascades, chiefly Vakhsh in Tajikistan and Naryn in Kyrgyzstan. Additional plans and projects discussed for non-modified major rivers such as the Panj, Zeravshan and Obihingou in Tajikistan and the Susamyr and Saryjaz in Kyrgyzstan.

Finally, country-wide and frequent shortages of fossil fuels, chiefly gasoline, diesel and natural gas, which are imported from Russia and Uzbekistan, push mountain countries to develop alternatives. Moreover, prices for fuel in Central Asian mountain countries are very high and constrain the local business profits. Kyrgyzstan sees biofuel plantations and its own production as a solution. The country's biofuel strategy foresees the initiation of biofuel crops from 2012 and onwards. Currently, populations in the mountains often uses dry biomass (wood and dung) to meet the local energy needs.

Like in the mining sector, the development of the energy sector is rife with controversy and competing interests – upstream and down, local and international. The Rogun Dam on the Vakhsh River in southern Tajikistan is a case in point. Slated to rise more than 300 metres high, the Rogun Dam is a source of tension between Tajikistan and Uzbekistan. To facilitate the development of the project and to attract international investors, the World Bank is providing assistance in the technical-economic and socio-environmental assessments. In the absence of international investors, Tajikistan sought to develop the project as a state-owned venture financed out of the national budget and through shares that it obliged its people to purchase. The people found this heavy-handed approach to be stressful, and are skeptical of the prospect of paying for a dam that would benefit the export market but that would not necessarily provide electricity to those local people living without service.

The focus on large-scale projects has left governments and the international development banks vulnerable to the criticism. The massive projects are a drain on national resources, a source of international tensions and a cause of resentment among the local communities that may share the costs, but may never share the benefits. Small projects with local beneficiaries do not enjoy the economic and other incentives of the large projects, and rely on individuals, NGOs and donors for sponsorship. The high potential of hydropower overshadows the potential of the geothermal, wind and solar energy that could also increase the provision of energy at the local level.

Security and Tensions

1.3.12 Conflict and the need for hard security measures

The mountain countries of Central Asia have not enjoyed the same level of prosperity and stability as their lowland neighbours, and the highland regions thus tend to be more susceptible to discontent and violence. Civil war, armed conflict and insecurity wracked the mountainous regions of Tajikistan for the entire decade of the 1990s. In Kyrgyzstan, violence in densely populated northern and southern areas widened the ethnic (Kyrgyz-Uzbek) and geographic (north-south) divides.

As soon as it became independent, Tajikistan plunged into a civil war that resulted in the death of over 50,000 people. An agreement brokered by Russia and the United Nations brought peace, but sporadic violence and recurring insecurity continued until as late as 2010. The country has undergone a slow and sometimes painful process of reunification and reconstruction. Tajikistan has not yet recovered from the civil war's impacts on the economy, infrastructure and families, and poverty remains widespread. The Tajik President has suggested that the civil war damage and the loss of opportunities for the national economy could be as high as US\$ 10 billion.

Kyrgyzstan witnessed violent Kyrgyz–Uzbek inter-ethnic clashes in its southern Osh province as early as in 1989 and in 1999 armed groups again entered the southern area of the country (now the Batken province). Resentment at widespread poverty, nepotism and ethnic divisions between north and south occasionally erupt in violence, and the country's first two post-Soviet presidents were swept from power by popular discontent. Economic damage from the events of April and June 2010 in Kyrgyzstan exceeded US\$ 70 million, excluding impacts on investment and business environment.

Conflict and insurgency in mountainous areas are much more difficult to combat than those in the flat land and desert countries of Kazakhstan, Uzbekistan and Turkmenistan, all of which are also more prosperous. Rugged mountain terrain provides effective hide-outs for fighters thus making combat more challenging.

Warfare in mountainous countries does not just have a serious social and economic impact but also an environmental one. Conflicts in the mountains have directly affected progress on the implementation of Agenda 21. The 1999 treacherous invasion of the armed groups into the Batken region of Kyrgyzstan, for example, destroyed the globally significant and unique Abramov Glacier monitoring station. The Uzbek national hydrometeorological service – Uzhydromet – had been operating this strategically located station on the border with Tajikistan for over thirty years. Similarly, security concerns stemming from the conflict in Afghanistan have limited access to the Panj/Amu Darya River, which forms the border between Tajikistan and Afghanistan, and have precluded water monitoring and flood warnings on this major cross-border river of Central Asia. Civil conflict in Tajikistan has virtually devastated populations of endangered animals in the Romit strict nature reserve and valley in central Tajikistan and has adversely affected the Beshai Palangon strict nature reserve.

The ongoing conflict in Afghanistan and drug trafficking also raise continuing security issues. The United States and her allies have long expressed concern about the possibility of infiltration between Afghanistan and the Central Asian states, and border control – particularly for the mountain countries – remains an important issue. Both the United States and Russia have established military presences in Kyrgyzstan and Tajikistan, and what happens in Afghanistan will certainly have implications for Central Asia and mountain development.

Frictions and conflicts have depleted mountain countries of Central Asia. Unity, rule of law, justice, and consensus would strengthen nations and substantially contribute to sustainable mountain development.

Finally, the Chinese province of Xinjiang, as the main physical connection between China and Central Asia, is an area of economic and political importance, and ongoing conflicts there may impede progress towards better integration of the Central Asian countries with China. Xinjiang refugees seeking protection in Central Asia have prompted stricter border security.

1.3.13 A new era in highland–lowland relations

As the independence era has unfolded and new political realities have set in, interstate tensions and diverging priorities over the use of water resources have started to dominate the political, economic and environmental agenda in the region. The last decade in particular has been characterized by an increase in disputes over water usage, particularly in countries dependent on agriculture. A lack of political will and the absence of any effective mediation mechanisms have only exacerbated the problem. Tensions between the highland countries of Kyrgyzstan and Tajikistan and the lowland countries of Uzbekistan, Turkmenistan and Kazakhstan have largely been generated by disparities in levels of prosperity and stability, energy accessibility and different priorities for water usage.

Water for irrigation is crucial to the agricultural communities in the lowland countries. The mountain countries, in contrast, often face significant electricity and fuel shortages, especially during the winter period, and therefore require water reserves for power generation. In line with population growth, energy demands have grown substantially over the past 20 years. Finding the balance between large-scale energy generation, such as hydropower, and water provision for large-scale agriculture is proving very difficult and politically sensitive. As the demand for energy and food continues to grow, tensions surrounding water may escalate.

The Soviet-era agreements and structures related to water allocation and supply for agriculture have generally stayed in place across the region, but the barter system of energy-for-water exchanges is no longer in effect. This has meant that mountain countries, which have limited fossil fuel resources, are now exploring alternative ways to meet their energy requirements. The development of the hydropower sector in upstream states is a leading example of this shift towards energy self-sufficiency but has been met with concern by the lowland countries fearful of the impact on their own water supplies needed for agriculture. An increase in mining operations in mountain watersheds, largely in response to international demand for the region's gold and uranium reserves, is also contributing to the growing friction between the highlands and the lowlands.

Facilitating cooperation between the concerned parties is an important element of resolving disputes of water usage. The ongoing cooperation between Kyrgyzstan and Kazakhstan over the Chu-Talas River Basin, assisted by the Organization for Security and Co-operation in Europe, the United Nations Economic Commission for Europe and the United Nations Development Programme is an encouraging example of modern cooperation.

But despite these welcome efforts to reduce tensions in the region, the agriculture-water-energy nexus is poorly managed and has the potential to escalate into further conflict or economic blockage to stop the energy development projects of the mountain countries. International organizations such as the Asian Development Bank, the World Bank and the United Nations are among a number of external parties that have been involved in facilitating dialogue between the governments of the highland and lowland countries. But progress has been limited, not only due to a lingering lack of trust and political will, but also due to practical problems such as lack of the modern technology necessary for progress in the agricultural and energy sectors.

The emergence of China as a dominant regional player and a major water and energy consumer is also altering the political, economic and environmental landscape of the Central Asian region. Similarly, earlier agreements on water allocations during the Soviet period did not factor in Afghanistan, whose interests in the basin have only recently begun to gain prominence.

1.3.14 Soft security for stability and conflict avoidance

The term "soft security", as used here, describes the non-military factors that support stability and help avoid conflict. In Central Asia, particularly in the remote and largely impoverished mountain communities, the principle soft security factors relate to energy and food security.

The tangible and detrimental impact of conflict on both mountain populations and the surrounding environment highlights the urgent need for more sustainable development of highland communities. By minimizing the root causes of discontent and insecurity, such as poverty, the unequal distribution of land and water, unaffordable food and energy, lack of job opportunities and basic education, the risk of conflict can be lessened and the chances of sustainable development of mountain environments and the well-being of mountain communities can be increased. The potential for local conflict over pasture and water use in border and densely populated regions has increased throughout the last decade. The support of NGOs and improvements in governance have recently reduced anxieties.

While the demand for affordable energy has increased with population growth, the withdrawal of support from Moscow has left the region with outdated and limited energy infrastructure. This in turn has led to a hike in energy prices with the result that, for poor communities in Central Asia's mountain regions, electricity and fuel supplies are prohibitively expensive. Local initiatives have given rise to a number of generators and other small-scale power supply facilities, but the state generally still holds firm control of national power resources.

The rising cost of fuel is also influencing the rising price of food in the highlands. Since Soviet times, the Central Asian mountain nations have relied on imports of food products, particularly non-mountain products such as sugar, flour and cereals. Now, with higher fuel costs, such basic staple goods are more expensive, and mountain populations are at risk of malnutrition and related health issues.

Local Dynamics

1.3.15 Natural resource ownership, management approaches and property rights

Prior to independence, all land, property and means of production rested solely in the hands of the ruling Soviet authorities. Since 1991, the rules on the ownership rights for land, gardens, livestock, pastures and forests have generally been relaxed across the region, and the market structures for agricultural and other mountain-related products and services have evolved into a free and competitive market system. The corruption of local officials, however, marred the transition as those in power sought the best land for themselves, or sold favour to those seeking land of their own. Although official private ownership is still not common, systems such as long-term individual leasing are now widespread.

Rural dwellers in Kyrgyzstan and Tajikistan (70 per cent of the total population) rely substantially on their own agriculture production for food and income. Animal husbandry, which has historically played a more important economic role in Kyrgyzstan than in Tajikistan, has declined as a share of agricultural production in both countries. Wool production has suffered the highest percentage declines. In recent years, however, livestock production has increased steadily in both countries. In 2010 the Tajikistan animal husbandry sector (meat production, eggs, milk) exceeded its 1991 levels, while Kyrgyzstan's sector still lags behind previous levels. Honey production in Tajikistan substantially increased over the same period, and reached Kyrgyzstan's level of 2,500–3,000 tonnes per year. In contrast, Kyrgyzstan honey production declined.

During the initial transition period, 1,500 Soviet collective farms in Tajikistan were transformed into more than 37,000 individual farms, while 500 Soviet collective farms in Kyrgyzstan were transformed to more than 70,000 individual farming units and 700 agricultural associations and cooperatives. Currently, the number of private farming units exceeds 400 000 in Kyrgyzstan, and 50 000 in Tajikistan.

Prior to the Soviet era, the mountain communities of Kyrgyzstan and Tajikistan practiced primarily subsistence-based agriculture – livestock production in the Kyrgyz Tien Shans, and the mixture of crop cultivation, gardening and livestock breeding in the Tajik Pamirs – with some trade between home-based agriculturalists and nomadic pastoralists. During the Soviet period the agricultural sector was transformed from a household-level system to a centrally planned large-scale production system. Over the last 20 years, the agricultural sector has reverted to household-level agriculture, but with more reliance on trade than in the pre-Soviet period.

1.3.16 Demographics and labour migration

Over the past 50 to 60 years, population growth and an increase in life expectancy have led to dramatic demographic changes in the mountain regions of Central Asia. The population in Tajikistan, for example, increased from 2.1 million in 1960 to 7.5 million by 2011 (including 1.6 million since 1990). In Kyrgyzstan, the population increased from 2.2 million in 1960 to 4.4 million in 1990, and then to 5.3 million by 2011. Overall, the total population of Central Asia increased from 24.4 million in 1960 to over 60 million in 2011.

Labour income and social transfers (pensions, aid) remain important income sources for households in Kyrgyzstan and Tajikistan, and income from the sale of foodstuffs and local produce accounts for a similar share. The role of remittances has increased dramatically over the last decade and has become the major source of income as well as the safety net for most households. The construction and urban service sector in Russia and Kazakhstan are major sources of employment for labour migrants coming from Tajikistan and Kyrgyzstan.

Unemployment and subsequent urban migration has changed the social fabric of many mountain communities. The Soviet withdrawal led to a major deficit of jobs, meaning that many young men from mountain communities now travel to capital cities or to Russia or Kazakhstan to find work. This drain of young and middle-aged men from traditional mountain communities has had an impact on family structures with women increasingly taking the lead in households and village elders having to take on the roles usually played by younger men. In some poverty-stricken areas, women who are heads of households have also joined the labour migration. Civil unrest, political instability and ethnic issues have also contributed to the emigration of skilled workers from the Central Asian region generally. According to official data and expert estimates, up to one million residents of Tajikistan and 500 000 residents of Kyrgyzstan now work and live abroad.

Tajikistan now has more than 800 000 men working in Russia alone, and the evidence suggests that the temporary migration of one individual can lead to the permanent migration of entire families. Remittances sent home by migrants constitute a large financial inflow into their home countries and often exceed the amount offered in international aid. The amount of remittances to Tajikistan officially reported by banks in 2010 exceeded US\$ 2.5 billion, which constitutes half of the national budget. In Kyrgyzstan, the amount of remittances is lower than in Tajikistan, but still significant – US\$ 1.0 billion.

Within its borders, Tajikistan also experienced a migration in the opposite direction: from lowlands and urban areas back to mountains. During the 1950s and the 1970s, the Soviets orchestrated two periods of resettlement from the mountains to the lowlands for the purposes of land development and cotton cultivation. Some of the migration was forced, and some voluntary, but in any case, whole mountain communities were abandoned for many years. At the time of independence, about half of these migrants from the resettlement programme went back to their old villages. Civil war and the availability of energy resources for heating were additional factors encouraging people to return to the mountains.

Real incomes of households in Tajikistan and Kyrgyzstan grew rapidly over the past decade, leading to an equivalent growth in private consumption, and a nearly 50 per cent reduction in poverty. These trends are largely attributable to the gradual increase in transfers from labour migrants. While ten years ago remittances accounted for 5–10 per cent of GDP in both Tajikistan and Kyrgyzstan, by 2010–2011 the proportion rose to more than 40 per cent of GDP. In 2008, Tajikistan topped the world with remittances as a proportion of GDP at over 50 per cent.

Remittances maintain national economies and are key factors for economic and social stability. The growing importance of remittances as a source of foreign exchange is reflected in the fact that cumulatively they have outpaced foreign direct investment and official development assistance during the past 10 years. The officially reported figures on remittances no doubt underestimate their full scale, since remittances through informal channels are not counted in the financial statistics. Excessive dependence on remittances, on the other hand, has economic and social drawbacks. The national economies of Tajikistan and Kyrgyzstan are ever more dependent on the economic and labour conditions in the countries receiving migrants. The effects of the 2008–2010 global economic crisis on Russia and Kazakhstan have already negatively affected the flow of remittances. The disruptions to family and village life lead to increases in the number of divorces and other personal problems. Labour migrants abroad are sometimes subject to exploitation and abuse. This is mainly due to the fact that most of them work illegally, do not speak Russian, have no awareness of labour regulations and have low qualifications. In this context, plans for tightening Russia's immigration policies on temporary labourers could push back home many unskilled migrants, especially those with limited command of the Russian language and the lack of basic skills and vocational education.

1.3.17 Education and health: investing in human capital

The health implications of mountain-to-lowland migration and vice versa are subject to research that was started by the Soviets and that continues today. The findings demonstrate that long-time lowland residents who move to the mountains have diminished performance. The same outcome follows when the move is in the other direction. The adaptation period is long, and the migration may shorten longevity. At very high elevations

– 3 000 metres or higher – life expectancy is 48 years (Murgab district in Tajikistan's Eastern Pamir) compared to 70 years at lower elevations.

The decline in Soviet support for mountain communities has affected not only the economy and opportunities for employment, but also the levels of basic education and healthcare. Literacy and the education of children living in rural and isolated mountain communities were Soviet priorities, but the withdrawal of funding from Moscow has left many of the newly independent states of Central Asia with insufficient funds to maintain the same levels of education. Public expenditures on education and health are less than one quarter of the Soviet levels. As a percentage of GDP, current spending on health and education (3–4 per cent) is also considered very low. The privatization of the traditional summer mountain camps for children has further limited the access of poorer children from rural areas to educational and health restoration opportunities. Many rural mountain schools are without an adequate number of teachers (due to low salaries and lack of teachers), and the number of doctors per resident and the number of hospital beds have declined by half. In healthcare, in particular, the remoteness of mountain communities only exacerbates the problems associated with inadequate staff and facilities.

The official literacy rate is high (98 per cent) and is comparable to advanced economies. Indeed, the population is a relatively well-educated, which is the admirable heritage of the Soviet era. But increasingly, mountain countries face the crucial situation in education when its declining quality becomes an obstacle for sustainable development. The number of students and universities have increased three- to five-fold in the last twenty years, but the quality of graduate and post-graduate teaching, especially in natural sciences and engineering, has deteriorated.

Competitiveness of countries in today's high-tech and globalized world is dependent on investment in human capital. Nurturing and comprehending nature management skills, maintaining a responsible attitude and having knowledge of and respect for mountain ecosystems are key factors for success in pursuing sustainable mountain development agenda.

Kyrgyzstan has taken active steps to join the Bologna Process to adjust its higher education to international standards, but vocational education and professional development courses still lag behind the realistic needs. Starting from 2012, Tajikistan is planning major reforms in basic education by introducing a 12-year study cycle with options for specialist courses and certified technical training. The Karakol State University in Kyrgyzstan and the Khorog State University in Tajikistan currently lead in mountain-focused higher education. The University of Central Asia is now working to multiply the focus on mountains, and organizations such as the Aga Khan Foundation are providing assistance to mountain societies in their endeavor and passion for traditional and modern knowledge. (See Part 2 for more detailed information.)

As industrial and agricultural practices have changed, the environmental health risks from the associated pollution have decreased, but the growth of populations in mountain valleys has come with increased risks from biological pollution. The majority of these populations take their water from open sources, and are thus exposed to microbial and bacterial contamination. Inadequate wastewater-processing facilities increase the risks, and natural disasters such as mudslides and earthquakes can introduce even more contamination into water sources and thereby increase the risk of water-borne disease outbreaks.

Child mortality rates are falling, but the risk of malaria, tuberculosis, HIV/AIDS and other dangerous diseases remains high, and increases with poor living standards, high migration and inadequate preventive measures and health services. Tajikistan is the only country in world where polio is on the rise. About 450 confirmed cases have been reported in 2010 in the country, compared to 900 cases worldwide. Kyrgyzstan faces health risks from epizooties (such as brucellosis, foot-and-mouth disease, anthrax) in the southern mountain areas and domestic animals are sometimes poisoned through grazing on the Soviet era-polluted lands.

1.3.18 Religion, culture, ethnicity and traditional knowledge

The Tien Shan nomadic communities have deep roots in Tengrism, an ancient religion that incorporates elements of shamanism and animism, and that focuses on living in harmony with nature. Sulaiman-Too Sacred Mountain in Osh, Kyrgyzstan, is a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage site. Mountain areas XXXX are among the many distinguished pilgrimage sites in the region.

Houses in the Tajik Pamirs have distinctive architectural elements combining pre-Islamic and Islamic traditions and values. Made of stone and mud, these houses have main living rooms with columns named after a saint, and symbolize faith, peace, purity, friendship, love, loyalty and protection. In contrast, the nomadic populations in the Kyrgyz Tien Shan often live in traditional yurts – easy to assemble and transport houses with wooden (willow) structures, wool coverings and colourful carpets. The dome of the Kyrgyz yurt is displayed on the Kyrgyz national flag. While yurts are widely used across Kyrgyzstan and in other parts of Central Asia by pastoral communities, the majority of the rural population lives in modern houses. Because the Tajik Pamir dwellers raise more crops than livestock, they eat mainly vegetables, legumes and foodstuffs such as bread and noodles made from wheat flour. The diet of the Kyrgyz Tien Shan dwellers has a high proportion of meat and horse milk. Economic transition changes produced an effect on nutrition and led to considerable reduction in food variety. Consumption of meat products, fruits and vegetables generally declined, while consumption of bread, potato and dairy products increased.

Independence saw the rise of Islam in Central Asia, particularly in Tajikistan and mountain regions where the roots of the religion go deep. Differences in belief regarding whether government should be secular or theocratic have been a source of civil conflict and difficult relations between countries. Extreme Islamic groups across Central Asia have used the mountains as hiding places. In Uzbekistan, where government repression has led to opposition to the regime, extremists have resorted to hiding in Tajikistan from which they launch attacks into Uzbekistan. This situation has strained relations between the countries.

From the beginning of the transition to independence, His Highness the Aga Khan, the forty-ninth hereditary Imam of the Ismaili Muslims, has been active in supporting development in the Tajik Pamirs. In the tradition of service in international affairs, the Aga Khan has provided development assistance to Tajikistan through the Aga Khan Foundation (AKF) and the Aga Khan Development Network. (See Part 2 for a description of the activities and accomplishments of the AKF Mountain Societies Development Support Programme.)

The rise of Islam in the region corresponds with a fall in pork production and consumption, as well as with a decrease in the hunting of wild boars in Tajikistan and Kyrgyzstan. As a result, the wild boar population has increased. The consumption of alcohol also appears to be falling, but no reliable statistics are available to confirm this impression.

Since independence, the Central Asian states have begun to reassert their identities, drawing upon the indigenous culture that had often been overlooked during the previous era. Families have always been an important part of social networks in the region, and with the end of Soviet support have taken a major role in supporting children and the elderly. The role of families is often underestimated, but is crucial in a culture where social security is a private responsibility.

In similar fashion, the lack of resources has led mountain communities to resume traditional practices or to adapt modern ideas to the resources available. Energy shortages have limited the opportunities for food-processing, for example, and the mechanical solutions are too expensive, so some mountain communities have tried to reestablish water mills. In the Soviet era, there was no demand for the animal hides and wood-carving products traditionally made in the mountains, and the skills in those traditional crafts significantly diminished. Now, however, with the new market opportunities and the growth of tourism in the region, the traditional mountain crafts are experiencing a resurgence, and some communities are specializing in traditional crafts.

Traditional music of enormous diversity has long been an integral part of life in Tajikistan and Kyrgyzstan, and with independence only became more important and more diverse. Their music incorporates a range of

instruments from the simple and traditional to the electronic, and shows little influence from western sources. The Aga Khan supports the further development and dissemination of Tajik music traditions through programmes at the University of Central Asia.

The recently deceased Kyrgyz writer and philosopher, Chingiz Aitmatov, was a Central Asian cultural hero whose work was translated into more than 150 languages. His evocative descriptions of the mountain environment and his advocacy for mountain ecosystem conservation brought attention to the issue, and his career demonstrates how one man can influence an entire region through his cultural contributions.

After independence, the exodus of Russians and Europeans from Kyrgyzstan and Tajikistan changed the proportions of the countries' populations in terms of national ethnicity: with fewer outsiders, higher percentages of the populations are Kyrgyz or Tajik. A related factor – place of origin as distinct from ethnicity – affects personal lives and politics throughout the region. North–south differences are quite pronounced in Tajikistan but geographic divisions are also important in Kyrgyzstan. The exploitation of these place-of-origin differences can lead to political and social unrest and conflict.

1.4 Soviet environmental legacies and emerging conditions

The trends discussed in the previous section all have a bearing on the environmental, economic and social conditions in Central Asia, as do the environmental legacies left by the Soviets. This section is not an exhaustive assessment of those legacies, but rather a consideration of the more visible and pressing concerns of public and private interest. The institutional and governance aspects of sustainable mountain development, discussed in the next section, fit within the context of the trends and the legacies.

Abandoned mines, hazardous industrial waste sites and mine tailings – mostly legacies of the Soviet period – continue to be a major environmental concern for the mountain countries of Central Asia. Although their reserves are not large in modern terms, Kyrgyzstan and Tajikistan were among the pioneers in developing the uranium mining sector. When the Soviets left, they simply abandoned the mines and tailings with no remediation. These hazardous sites remain obstacles to sustainable development, environmental protection and population security in Central Asia.

The cost of remediation is prohibitive for the countries, and in the absence of legislation or financial resources to undertake the task, Kyrgyzstan and Tajikistan have no remediation plans in place, but are looking to international partners for assistance. Abandoned mining sites pose as much or more danger to neighbours in the event of a flood or other mine failure, and regional cooperation is one prospective solution. As the owner of the legacy, Russia has not assumed responsibility, but is participating in negotiations and may commit to helping resolve the problems.

In Kyrgyzstan, uranium tailings are a national priority both politically and environmentally, but because of the scale of the problem the resources needed are overwhelming, and no progress has been made. Continued efforts at cooperation with Russia and the other Central Asian countries is a promising path, as is the prospect of private sector involvement. Private firms may be interested in reopening some mines or in re-mining some tailings, but if they have to assume responsibility for the cleanup, they will not be able to turn a profit.

The Central Asian mountains also have rich mercury and antimony deposits that were mined for Soviet industrial purposes. Kyrgyzstan still operates a former Soviet mercury mine, and while the operation is inefficient, it is import to the local economy. The United Nations Environment Programme is currently working on a mercury convention that would limit mercury production, and the international community should look for opportunities to help Kyrgyzstan phase out its mercury mining without damaging the country socially or economically.

The independence era has seen a dramatic reduction in water pollution as a result of changes in industrial practices and the ending of some industrial and mining operations. In Kyrgyzstan, for example, the production of animal skins no longer employs the toxic chemicals that killed almost all the fish in some areas, and fish stocks are slowly recovering as a result of the changes in business operations and land use. Similarly, the water

quality in Issyk-Kul Lake is improving as a result of reductions in fertilizer use because the agricultural runoff no longer carries away high levels of chemical residues.

Another positive environmental development in the independence era is the expansion of protected areas – a doubling in the size of the total area protected, and the application of particular types of protection, such as buffer zones and corridors, to particular circumstances. Where the Soviets maintained strict natural reserves that excluded visitors, the new states – underfunded and with less experience – are developing national parks, a new concept in the region, and one in keeping with the spirit of Rio. They are also creating reserves for special purposes such as watershed protection or forestry without necessarily restricting access for recreation or other compatible uses.

In the Soviet era, the state owned the forests and managed the planting programmes, and used afforestation primarily for river bank and slope protection. Now, individual planting programmes are investments in the economic and environmental future and are targeted to a range of specific applications – visual amenity benefits or fuel, for example. Forest managers assist in the natural regeneration of forests, and, on the premise that the community cares more than the central government, communities are now managing local nut forests.

In some ways, water protection in the Soviet era was better, particularly in the exclusion of riparian areas from any other uses. Now, the absence of controls and the diversity of land uses have meant less protection. Water resources have become more vulnerable to physical use and damage, and the associated ecosystem services have become diminished.

In agronomy, the results of the transition to independence are mixed. The Soviets took an advanced scientific approach to plant development and species selection, but their introduction of species was inadequate and they often ignored traditional practices. Now the botanical gardens, which had been closed, are open to commercial and public use, but the overall effort has been reduced dramatically. A combination of the best aspects of each approach would improve the situation.

1.5 Institutions and governance in sustainable mountain development

The period of glasnost and perestroika started by Mikhail Gorbachev near the end of Soviet era raised public awareness about the environment and led to the strengthening of environmental institutions and legislation in the Central Asian countries and across the former Soviet states. Governments were quick to develop National action plans, programmes and strategies on environmental protection in general, as well as on specific environmental issues such as climate change, desertification, biodiversity, persistent organic pollutants and others. All countries of Central Asia are signatories to the three "Rio" Conventions: the UN Framework Convention on Climate Change, the UN Convention on Biological Diversity and the UN Convention on Combating Desertification. In addition, numerous multilateral and regional environmental agreements have been signed or ratified. Considering that countries have taken different development paths, their strategies and approaches to sustainable mountain ecosystem management developed differently. With the launch of a mountain partnership in Central Asia, Kyrgyzstan and Tajikistan prepared sustainable mountain development strategies, but the shortage of resources over the two last decades resulted in poor implementation, especially at the local level. Environmental institutions or scientific groups often designed and implemented these strategies, while the key stakeholders in agriculture, water, energy and others remained preoccupied with their own development priorities. Most economic, social and environmental development strategies in the years of independence focused on densely populated, industrial or agricultural regions, and failed to consider the specific circumstances of the mountain communities. The growing number of obligations under multilateral environmental agreements, national legislation and programmes, were not matched by the increase or efficiency reforms in institutional capacity and financing priorities. The deterioration of management and enforcement capacities at both the central and local levels further constrained implementation. Stakeholder acceptance of new mining, water, forestry and pasture programmes and strategies varied from support to strong opposition.

The high level of poverty and the growing vulnerability of the ecosystems impacted by the unsustainable use of natural resources by local communities demanded urgent interventions. In 2000 the Government of Switzerland launched the initiative of Central Asian Mountain Partnership (CAMP) in Kyrgyzstan, Tajikistan and Kazakhstan with an aim to promote sustainable mountain development by encouraging a more economically, ecologically and socially sustainable use of mountain resources. Such management of resources should lead to better living conditions for poor majority of mountain people in the countries covered by the project activities. There was a shift of thinking from waiting to acting – civil society started to think that they can participate in the process of development. In 2002 by the initiative of civil society and NGOs and with support of Swiss Agency for Development and Cooperation the new program was launched as an association of rural communities who could get needed information and knowledge and exchange the experiences for the participatory solving of common local problems. And in 2003 the Alliance of Central Asian mountain communities (AGOCA) was formally created and registered in Kyrgyzstan. The overall goal of the organization was developed together with its founders: to assist the sustainable development of Central Asian mountain regions and, thereby contribute to improving the living standards of the local population.

New laws appeared in the beginning of 2000 gave an impulse to the moving to the decentralized government system.

Thanks to the active distribution of this Law among the population, Kyrgyzstan was the leading state in the process of making decentralized government in two other countries: Kazakhstan and Tajikistan. Since 1998 Kyrgyzstan began to attract the attention of international governmental and non-governmental organizations to mountain development. This resulted in the UN declaration of the International Year of Mountains in 2002 and the Bishkek Global Mountain Summit. One of the positive outcomes of both events is an improved international cooperation and partnership between major groups that resulted from the Bishkek Mountain Platform. It was at the Bishkek Summit that the International Partnership for Sustainable Development in Mountain Regions (known as the "Mountain Partnership") was reinforced. The FAO's offer of hosting the Secretariat was welcomed. Since its establishment, the Mountain Partnership Secretariat has been advocating strongly the integrated approach to sustainable development in the world's mountain regions. Tajikistan focused its attention on regional freshwater water resources and glaciers and conducted numerous regional and national activities highlighting the importance and crucial role of Central Asia mountains as "water towers". Kazakhstan has recently established the Regional Centre on Glaciology under UNESCO auspices to promote exchange of scientific knowledge and popular information about conditions and trends of mountain glaciers across the region.

An Interstate Commission for Sustainable Development (ICSD) has been established to coordinate the planning and implementation of sustainable development programs. In 2007, the Central Asian Sub-Regional Strategy for Sustainable Development was developed and put into action. The ICSD supported the initiative of Kyrgyzstan and Tajikistan to establish the Regional Mountain Centre of Central Asia (RMCCA) with headquarter in Bishkek, in order to promote cooperation in the Central Asia region for mountain ecosystems conservation and the sustainable use of natural resources, and to improve the socio-economic conditions of the population in mountain areas through the provision of scientific and information support and training.

With the aim of promoting education and communication among mountain populations and ultimately applying new technologies to promote sustainable mountain development in the Central and South Asia regions, an Information Mountain Centre was created at the International University of Kyrgyzstan in 2003 supported by the National Centre on Mountain Development.

1.6 Monitoring and research

Environmental monitoring and research provide an essential base for sustainable mountain development. The collection and analysis of hydrometeorological observations enable the weather and climate forecasting that benefits farmers and that supports disaster risk reduction. The monitoring of glaciers and permafrost tracks the progression of climate change, and helps scientists predict the downstream implications of a changing

mountain environment. Research and conservation related to biodiversity and land resources help ensure the continuing provision of valuable ecosystem services. And geologic and seismic research encourage the development of mineral resources and lessen the potential impacts of natural disasters.

1.6.1 Hydrometeorological observations

During the Soviet era, meteorological monitoring received extensive support from the state and was an important aspect of environmental planning across the Central Asian region. The Soviet hydrometeorological service was strategically important, but its high level of staffing and funding were beyond the means of the new countries, and over the past 20 years, the quality of the stations and the equipment have declined sharply, and the vast majority of former monitoring sites are in a state of neglect. This is due in part to the failure of the newly independent states to recognize the importance of meteorological forecasting and data and to ensure that environmental monitoring remained a priority on the national agenda. The high costs of maintaining and servicing weather monitoring stations, particularly in mountain countries also contributed to the decline in investment in meteorological services.

Over the past decade, attitudes and perceptions have started to change in this regard, with both governments and international donors such as the World Bank, the United States Agency for International Development and the Swiss Development Cooperation recognizing the benefits of having reliable weather forecasting systems in place across the region. The role and impact of the weather on agriculture, notably crop production, is one aspect that has captured the attention of many governments in Central Asia. Equipped during Soviet times to monitor the surrounding vegetation and land, the meteorological stations proved extremely useful for the forecasting of summer grass growth and the conditions for pasture grazing. The benefits of this agricultural meteorology are once again being recognized, and investment in the necessary infrastructure should be encouraged. Seasonal weather forecasting – the prediction of weather patterns for the coming months – is a particular challenge and requires further improvement.

The replacement of manual monitoring with modern technology and the corresponding reduction in the reliance on human manpower are other important trends in meteorological observation in the region. These developments permit more efficient and consistent monitoring of weather conditions in remote and inhospitable mountain areas, but local institutions have often greeted the introduction of new technologies with hostility and distrust. This situation is changing and automatic weather stations are getting integrated into daily operations and use. In addition, the monitoring equipment provided by donors is often specific to the country of origin, and requires specialized training as the technology varies across the region. A more coordinated approach by donors is needed in this regard.

1.6.2 Glacier and permafrost monitoring

During the Soviet era, the high mountains of Central Asia were home to 12 major glacier monitoring sites, two of which – in Kazakhstan and Kyrgyzstan – were of global importance. Most of these stations ceased operation in the post-Soviet period, and only the major glacier observation site in Kazakhstan at Tuyksu glacier remains active, albeit in an outdated and underfunded state.

Glaciers have, however, become a hot political topic over the past few years, with heads of national governments and donors increasingly highlighting the melting of glaciers as a consequence and indicator of climate change. Central Asia's glaciers, some of which are the largest in the Eurasia, are also proving to be a popular tourist attraction, putting glaciers and their protection back on the national agenda.

All Central Asian countries with glaciers (Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan) are in the process of compiling glacier inventories through a combination of field research and satellite imagery. Given that the last such assessment was done in the 1970s, this is a timely development. Since 2008, international donors, have established two new monitoring sites – one near Bishkek at Adegyne glacier and the other on the largest glacier of Kyrgyzstan – Enylchek. These new multi-purpose sites are equipped to measure not just glacier activity, but also weather patterns, mountain lakes and even the movement of tectonic plates.

The methodology and approach to glacier monitoring has changed significantly since the end of Soviet rule, bringing both benefits and drawbacks for the region. On the plus side, there is now a greater involvement of local scientists in glacier monitoring activities, as opposed to the dominant involvement of experts from the central institutions in Moscow or Tashkent. On the downside, the growing autonomy of countries within Central Asia has led to a diverse array of glacier monitoring and assessment methodologies and a subsequent lack of regional coordination and compatibility. In an attempt to overcome this, the long-standing glacier monitoring center in Kazakhstan, in collaboration with UNESCO, is starting to hold regional glacier-focused conferences to encourage better regional coordination. Kazakhstan and UNESCO have recently established regional glacier centre in Almaty.

In response to the increasing impacts of climate change, a number of global researchers are heading to Central Asia to undertake ice-drilling and glacier measurement activities, a practice the Soviet authorities never extensively pursued. With the use of advanced technology, many scientific researchers are now able to drill down to depths of 1,000 metres and are developing a deeper understanding of the impact of climate change on the region's glaciers. High levels of competition between the various glacier research groups is, however, a persistent problem. The concealment of glacier data and the limited exchange of information can result in a repetition of activities and be detrimental to the development of effective measures. Moreover, deliberate attempts to ensure glacier monitoring activities are kept confidential can provoke feelings of resentment and hostility within local communities and among experts. In one instance, local glacier experts and scientists only found out that international researchers were ice-drilling in their area a year after the operation had begun.

1.6.3 Maintenance of mountain biodiversity and land resources

In Central Asia, mountain biodiversity conservation is carried out in three key ways – through the upkeep of botanical gardens, animal reserves and nurseries; in specialized wild nature conservation sites; and through monitoring stations in mountain regions and through nature parks and nature reserves, which are usually funded by both national institutions and through international projects and bilateral cooperation channels. The Pamir botanical garden near the Tajik town of Khorog is the second highest botanical garden in the world (at an elevation of 2 000 metres), and now a popular tourist destination. Diminished funding and local capacity, however, have resulted in a decline in the maintenance levels of many of the region's botanical gardens and natural parks. Similarly, small mountain research centres have virtually disappeared over the past 20 years, mainly as a result of privatization or poor budget management.

Nature parks have generally been retained and protected throughout the independence era, with many flora and fauna conservation programmes being carried out by scientific and public institutions across the region. While this is a welcome development, these programmes are becoming outdated and should be reassessed to account for modern trends and challenges such as climate change and an increase in invasive species. Inventories of mountain forest areas should also be carried out in a more systematic way, especially given that forest protection also directly benefits lowland areas. Kyrgyzstan, with the help of the Swiss government, is the only Central Asian country to have completed an up-to-date inventory of mountain forests and offers hope that other countries will do the same. On the positive side, heightened global awareness and interest in the region's snow leopard and other endangered species has led to an increase in state and donor funding for biodiversity conservation.

Local authorities are starting to take more control over what was a poorly monitored and unregulated system of land use and conservation. In the immediate aftermath of independence, a chaotic period of illegal land grabbing ensued, and the central authorities were unable to trace and follow-up on the use of land plots. Over the past five years, governments and donors have begun to pay more attention to ensuring that land is used sustainably and to invest in systems to monitor soil erosion and the quality of crop production. Land inventories do not exist in the region, but steps to improve this system are welcomed, despite the slow level of progress so far.

Finally, governments in Central Asia are looking to follow the lead of the United Kingdom and other countries in formally evaluating the monetary value and benefits of their national ecosystems. This kind of assessment will help in determining how much should be invested in future nature protection initiatives and may also encourage further funding. If mountain regions can prove both the value and critical importance of their existence, downstream countries may also be encouraged to invest in highland areas. These activities are in line with the Nagoya Protocol and are beneficial in ensuring that the genetic resources of countries are valued, recognized and invested in accordingly.

1.6.4 Geology, seismic research and natural disasters

As a result of state-funded geological research, deposits of various precious minerals were found in significant quantities across Central Asia during Soviet times. Under Soviet rule, however, only a small number of mining facilities, notably in Kyrgyzstan, were given the green light to exploit the sites. Now in Kyrgyzstan the private sector is taking over geological research and developing the country's mining sector. The nature of the private geological research is proving to be more detailed than in Soviet times and more oriented towards attracting global interest to Kyrgyzstan's mining sector. In contrast, Tajikistan – despite being on the path to a market economy and democratic reforms – remains reluctant to encourage private or foreign investment in the country's mining sector, and its geological research remains under-developed and lacking capacity. Kyrgyzstan provided its skilled labour force with incentives to stay in the geological research sector, but many skilled workers from Tajikistan have left the country in search of better pay and working conditions.

The infrastructure, resources and facilities needed for seismic research have largely remained in place in both Tajikistan and Kyrgyzstan. But although the equipment and technology has undergone a degree of modernization, routine testing at the local level has become less frequent, and the results of seismic research remain disconnected from practical implications for community facilities such as housing. In this regard, there is still a need for those involved in business development plans to take into account the potential consequences of seismic activity.

The governments of Central Asia are increasingly better equipped to manage emergency situations. In the wake of the devastating tsunami that struck Japan in March 2011, however, and the nuclear crisis which ensued at the Fukushima nuclear plant, Central Asian countries need to review the security conditions of their industrial facilities. Given that the region is at particular risk from flash flooding and landslides, measures to prevent accidents involving industrial facilities such as mines (and tailings), dams and power plants should be put in place.

Part 2: Case studies: Progress, changes and lessons learned

The problems constraining sustainable mountain development are formidable, among them: environmental challenges and poor natural resource management; limited infrastructure and local development opportunities; poor economic performance and governance inefficiencies; poverty; and the erosion of education. The demand and the will to tackle these problems are on the rise and are genuine. Some demands have roots in the previous high standards and levels of education, security, energy and food sufficiency.

Over the past 20 years the Central Asian mountains have benefited from numerous sustainable development projects and initiatives. The sponsors and participants have included governments, international organizations, NGOs – both global and local – and educational and scientific institutions. This part of the report presents excerpts from case studies on selected sustainable development projects in the region. The cases are a selection of stories outlining the progress, challenges and lessons learned on the path towards sustainable mountain development in Central Asia. Individual cases demonstrate how the environmental, social and economic aspects of sustainability connect and overlap, and taken together the cases show the progress made in the mountains in this critical period of adjustment. The case study projects typically relate to one or more of the trends discussed in Part 1.

2.1 Food and forestry

The first case in this group of four is a kitchen garden project from Kyrgyzstan. The next two cases consider pasture management in the mountains. The first pasture project, also located in Kyrgyzstan, takes a community-based natural resources management approach, and works at the watershed level. The second is a cross-border collaboration between Kyrgyzstan and Tajikistan on regional cooperation for sustainable resource management. The final case in this group is a Kyrgyz–Swiss collaboration in sustainable forestry.

2.1.1 Kyrgyz kitchen gardens

The Kyrgyzstan Mountain Societies Development Support Programme (MSDSP KG) used a multi-input area development approach in a kitchen gardens project that combined market development, natural resource management and health promotion:

The kitchen garden project links with Village Health Committees (VHCs) and works within a challenging context where villagers commonly express disbelief in the potential for vegetable cultivation in high-altitude mountain communities. Kyrgyzstan's high mountain communities have low population densities and limited market access. District center markets generally operate only once a week, and due to high transportation costs, vegetable prices are at least three times higher than in urban areas.

In 2005, an initial baseline survey of health conditions in MSDSP KG target regions revealed that the vast majority of health problems suffered by women and children in the Alai and Chong-Alai districts were related to nutrient deficiencies and malnutrition.

In 2006, the MSDSP KG Health Programme launched a project to address the poor nutritional status of women and children by introducing kitchen gardens in the high-altitude communities (2,000-3,100 m) of Alai and Chong-Alai, areas that have not traditionally grown vegetables. The introduction of vegetable cultivation is encouraged through direct training and the provision of instructional booklets, high quality seeds (tomatoes, carrots, sweet peppers, red beets and cabbage), and materials to build greenhouses.

The overall objective of the project was to improve access to fresh vegetables in high-altitude communities. The expected outcomes included:

- An improved nutritional status among women and children resulting from reduced susceptibility to vitamin and mineral deficiencies
- A paradigm shift changing the perceptions of high-mountain communities about the possibility of growing vegetables in high-altitude climates

- Alternative income-generating opportunities for poor, remote mountain-dwelling households.

Since 2006, MSDSP KG has established 310 kitchen gardens in 28 villages in Alai and Chong-Alai, or 35 per cent of the villages in the districts. In 2011, the kitchen gardens were studied to analyze the results of the kitchen garden initiatives, to identify the challenges faced by the beneficiaries and to discover opportunities for marketing vegetables.

Access to high-quality and climate-appropriate vegetable seeds remains one of the main challenges for 12 per cent of the project participants. There is a need to develop small seed shops locally because many kitchen gardeners from remote areas of Chong-Alai reported travelling 300 kilometres to Osh city to locate seed vendors. Despite the relatively low concentration of pests at high-altitudes, farmers are still challenged by the unavailability of insecticides and herbicides locally for their high-altitude farming practices. Vegetable pests disrupted the production and yield of 18 per cent of the project participants.

Additional marketing skills are needed for kitchen gardeners who intend to increase vegetable production and serve their villages as well as neighboring ones. For instance, farmers from Jekendi and Karamyk villages of Chong-Alai can make a wider variety of vegetables available to communities in Kashka-Suu subdistrict, which is more than 2,800 metres above sea level where growing vegetables such as tomatoes and sweet peppers is difficult and arable land is limited.

Village Health Committees disseminated information and played a strong organizational role from the very beginning. Kitchen gardeners have since become more independent and need less support from VHCs. The Training and Extension System (TES) Centre and Osh Rural Advisory Service conducted training on making compost, conserving vegetables and preparing fresh salads and juices to obtain the maximum nutritional benefit from harvested vegetables. The TES Centre also helped develop a manual with this critical gardening information and the measures to avoid bacterial contamination (particularly botulism) during the process of canning vegetables. Local government, including *Aiyl Okmutus* (AOs) and Village Organizations, assisted in collecting information and identifying candidates for participation. The Kyrgyz Republic Ministry of Agriculture, through its district agricultural departments, benefits from the increased production in their districts in line with their mandate.

On average, each kitchen gardener generated US\$ 280 in additional income from selling vegetables. Of the 21 kitchen gardeners interviewed, 13 (62 per cent) produce enough vegetables (cabbage, tomatoes, carrots) to be able to sell a part of their harvest. In contrast to the land-use practices of typical households, this crop diversification strategy promotes the use of crop rotation, which prevents the degradation of soil quality, excessive erosion, insect and disease problems and phytotoxic effects. According to 2008 government data, potatoes were cultivated on 3,074 hectares of land in the Alai and Chong-Alai districts. Almost every kitchen gardener participating in the project attested to growing solely potatoes before the intervention. Therefore, the crop diversification and rotation practices promoted as a fundamental aspect of this project, support the practice of sustainable use on three hectares of high-mountain arable land.

Most of the kitchen gardeners (90 per cent) were able to preserve vegetables for the winter period from vegetables they had grown. On average, each household preserved 30–50 liters of vegetables. Socially, this improved their community standing and ability to meet the demands of holidays and receiving guests. Both the seasonably fresh vegetables and preserved vegetables contributed to the improved health status of project participants. Of the participants surveyed, 56 per cent reported improvements in health, especially in the health of women and children.

Overall, the change in attitudes was the most difficult objective to attain, and the most significant outcome of this project. Kitchen gardeners – and their many neighbours who witnessed the successful growing of vegetables – now believe that vegetables can be grown in high-altitude mountain

communities. The successes of the kitchen gardens of 310 project-sponsored households affected the attitudes and beliefs of 9,174 households in 28 villages.

The project had no negative environmental effects, but there is the potential for future damages to soil content and pasture quality if crop rotation practices are not maintained. In order to ensure their maintenance, MSDSP KG plans to increase the capacity of local governments and District Agricultural Departments to serve as advocates of this environmentally sound approach.

As the success of the kitchen gardens reduced the demand for valley produce, the negative economic effects of the project fell on those businessmen who earn money transporting vegetables weekly from valleys to the mountain regions. The negative social effects were limited to a lifestyle adjustment. Traditional Kyrgyz mountain communities sustained themselves primarily on livestock. Many semi-nomadic communities travel to summer pastures at high altitudes and have been doing so for generations. Vegetable cultivation requires close care and interferes with the semi-nomadic lifestyle traditionally practiced in the region.

The 2005 baseline health survey demonstrated an apparent need for improved access to nutrient-rich diets to mitigate anemia especially among mountain-dwelling mothers and children. Only after such fundamental surveys should the implementation of broad interventions take place. Moreover, the kitchen gardens were initiated with a very small pilot sampling of households – just six groups (two in Alai, four in Chong-Alai) of less than 60 households. The present number of 310 kitchen gardening households was achieved incrementally, and specifically based on best practices as assessed annually. This methodology was a key factor of the project's success. An overall assessment of the project brings to light the successful combination of environmentally sound technologies, including climate and altitude appropriate techniques, which proved to coalesce for a net benefit: improved health status, improved soil quality and income generation.

Village Health Committees are independent institutions comprised of volunteers elected by the villagers themselves, and are usually headed by a medical professional. There are currently 26 VHCs in Chong-Alai and 69 in Alai with the primary responsibility of disseminating information on the prevention of common diseases, the advantages of proper nutrition and adherence to standards of sanitation and hygiene through mass campaigns and public meetings. When the VHCs have enough funds to do so, they also conduct immunizations, assist in the transportation of ill or pregnant patients, and purchase essential medicines for poor families. The involvement of VHCs was a key project component, but the surveyed participants overwhelmingly (86 per cent) responded that they have not worked with the VHCs. The VHC health specialists need to reach out to the kitchen gardeners to identify how they can be resources for one another and/or for their communities.

The Village Health Committees often suffer from low capacity because they rely solely on contributions of community volunteers. In order to address this institutional shortcoming, the project was designed to provide financial sustainability to VHCs. Participants make small, yearly payments to return a portion of the provided seed and material cost (30 per cent of the value in the first year, 50 per cent in the second and 70 per cent in the third year). The project subsidized 70 per cent of the total cost for each villager interested in starting a kitchen garden and the villager was expected to pay back 30 per cent to the project to be shared between the Village Organization and the VHC. But repayment rarely occurred on time leaving these stakeholders empty-handed. Currently, this poor mechanism for the collection and disbursement of seed costs undermines the relationship and trust between kitchen gardeners and stakeholders. The VHCs are supposed to collect and manage the funds, but gardeners are resistant to pay because they do not have a clear understanding of the intended use of the money. Village Health Committees – and local governments, for that matter – lack the transparency needed to operate such a system. The system needs to be reevaluated and remedied. Village Health Committees should also be

connected to each other in an association to build their capacities and to allow for the sharing of best practices among villages.

Land holdings in high-mountain communities are often very small, and also vary significantly from household to household. As the project evolved, market development opportunities were identified, but this indicator needs to be used sparingly. Where land holdings do not permit the sale of excess harvest, the original goal of the project is still realized. More households (at least 310) have improved access to nutrient-rich diets.

The project is active in 35 per cent of the villages in the Alai and Chong-Alai districts. The initiative will be expanded to other villages where communities traditionally have not grown vegetables. Upon the availability of funding, greenhouses will be demonstrated among farmers in Chong-Alai. Further plans are being developed to organize exchange visits to other high-altitude farming environments where market approaches have been successfully integrated – in China, for example. Additionally, project evaluations suggest that kitchen gardeners would greatly benefit from improved links to input supply chains. After the violent June 2010 events in southern Kyrgyzstan, many market links were destroyed, including seed stores. A nationwide MSDSP KG programme to increase the capacity of private veterinary services could enlist these services providers to facilitate access to seeds and fertilizers, for which there is a high demand.

Additionally, the project will seek to expand the involvement of stakeholders in multiple stages of implementation. Specifically, the AOs and District Agricultural Departments need further training so they can play a more active role as a resource and work towards institutionalizing the healthy development of their citizens. Local government members can be invited to kitchen garden trainings and learn to facilitate the promotion of access to high-quality inputs.

2.1.2 Sustainable pasture management at the watershed level: CAMP Alatoo

One of the organizations in the Central Asian Mountain Partnership network is CAMP Alatoo, an NGO that promotes sustainable development in the mountains of Kyrgyzstan. The importance of livestock grazing for mountain livelihoods and the degraded conditions of Kyrgyz pasture land prompted CAMP Alatoo to initiate a project on sustainable pasture management at the watershed level:

The project covered an area of 200,000 hectares of pasture land in the watersheds of the Zhergetal and On-Archa Rivers in the mountainous Naryn region of Kyrgyzstan. Villages from five *ayil okrugs* (rural administrative districts) participated in the initiative. The *ayil okrugs* and the number of residents in each are as follows: Zhergetal (5,420); Minbulak (5,123); Onarcha (3,138); Kazankuigan (1,130); and Emgekchil (3,025).

The collaboration between CAMP Alatoo and local pasture users started with awareness-raising workshops conducted for local communities. These training sessions helped to identify the village activists with whom CAMP Alatoo continued to work, building their capacity as members of “pioneer” pasture committees well before the new Pasture Law came into force. The collaboration also involved local authorities, as well as pasture departments at the village and district levels. The field office in the Naryn region maintained vertical liaison with all local stakeholders. A network of local pasture committees and microfinance agencies was created to disseminate sustainable pasture management tools developed by CAMP, and to encourage replication in other regions. Initial investments were made in repairing the pasture infrastructure and in increasing winter feed production.

The goal of CAMP’s sustainable pasture management effort was to improve resource management practices through participatory and community-based processes. Addressing pasture management in all its complexity enables herders – the primary user groups – to make well-informed decisions on herd size and pasture resource management. The objectives were to enable herders to join the efforts for collective actions on the maintenance of pasture infrastructure; to improve their capacity for assessment,

planning and monitoring; and to achieve the sustainable use of the common resources in a sustainable way. Reaching these objectives would improve the productivity and profitability of the livestock sector and thereby reduce poverty.

Initial investments were made in repairing the pasture infrastructure and increasing winter feed production. In each pilot village a micro-credit agency was established to support sustainable pasture management initiatives. This is an ongoing process, not an easy one given the difficulties of crippled infrastructure, destroyed extension services and livelihood challenges. Mobilizing herders for the co-management of resources was one of the project's biggest challenges. It took time to convince the herders of the need to change grazing practices, and to provide training in the skills necessary to maintain pasture resources and to manage herd size and quality. Prior to the 2009 Pasture Law, local institutions had no authority to manage pasture resources, and the institutional split among local, district and regional authorities often created more challenges regarding land tenure and land use in near-village, intensive and remote pastures.

As the resource base for the livestock sector is better managed, the benefits can be seen in improved environmental quality for pasture with more areas restored. The reduced pressure on grazing land resulting from the introduction of improved breeds, together with a flexible pasture management system, improved the environmental quality of pastures and enabled the restoration of more areas. The monitoring data that pasture users were trained to collect can be used as indicators for the environmental outputs in succeeding years. The yields in terms of economic profits are visible when the herds are better managed through focusing on herd quality. Timely pasture rotation results in better fattening of the herd, thus producing more profits and preferred quality of meat from open range grazing in high mountain pastures.

In addition to reduced poverty and increased food security, the social aspects of the project are evident in the decentralization process that reached the village level with the establishment of democratically elected Pasture Committees. In the pilot area three Pasture Committees were established and the project supported the development of local pasture management plans that include activities for pasture infrastructure improvement. During the last three years, one bridge and 63 kilometres of roads to remote pastures were restored for public use.

A heightened sense of community and sense of responsibility for the stewardship and ownership of resources is apparent when herders and community members sit together to coordinate their moves to summer pastures, repair bridges by mobilizing their own resources or develop and implement pasture use plans. The project's participatory and inclusive processes of negotiation, reporting and accountability contributed to local community empowerment and capacity improvement at all levels. Ulan Bakaev, 36, from Zhergetal village described his experience this way:

"The CAMP Alatoo project changed my life and helped to improve the well-being of my family. A few years ago I used to be one of the village jobless trouble-makers, spending days in pottering around the village and drinking. Driven by poverty and desperately seeking for the ways to support my wife and kids, I even decided to go to Russia for earnings...But then CAMP Alatoo launched their project in our *aiyl okrug*, and I joined those folks who attended their trainings and became actively involved in the project activities... Now I am a member of the local Pasture Committee, I am respected by my community, they even put forward my name in the elections for the village head last year... The knowledge and skills gained in CAMP Alatoo project helped me to improve my farming management skills and earn more money. I've got skills on artificial insemination and improve not only my livestock quality, but provide services to other villagers..."

2.1.3 Pamir-Alai Land Management and regional cooperation in mountainous countries

A transboundary initiative of Kyrgyzstan and Tajikistan, the Pamir-Alai Land Management (PALM) project is funded by the Global Environment Facility and numerous national and international partners. The project considers the link between poverty and land degradation, and seeks to restore, sustain and enhance the mountain ecosystems to the benefit of the economic and social well-being of the rural communities:

The project area focuses on the High Pamir Mountains in Tajikistan and the Pamir-Alai Mountain ranges in Kyrgyzstan. The region is highly diverse. It contains within its borders a great variety of climatic, topographic and ecological conditions, leading to different forms of land use and to livelihood systems based on natural resources. The area can be divided into three broad subregions differentiated on the basis of topographic, climatic and socio-cultural and land-use differences.

Given that all land resources are legally the property of the state, the lack of clarity regarding private user rights for individual farm plots, together with de facto common property resources (e.g., pastures, wildlife, woodlands), encourage short-term resource exploitation rather than long-term conservation. The results include a lack of stewardship, a deterrent to invest in conservation and disputes over occupancy and resource use rights within and between local communities and local and central government authorities. Due to the uncertainties of climate and fluctuations in distant and local markets, local communities require secure resource rights, and long-term security of land tenure and occupancy rights if they are to adopt sustainable land management practices and assume responsibility for ecosystem protection.

The issue of pasture rotation is extremely important. A successful pasture rotation programme would allow animals to graze on remote pastures for longer periods of the year and could contribute to remediating the land degradation due to overgrazing close to the villages while at the same time increasing the quality of the livestock.

In combination with pasture management, work is needed to restore the degraded land. Most urgent is the recovery and re-establishment of shrubby vegetation and forests. This has long-term positive effects on the sustainable supply with fuel wood, on regeneration of biodiversity and wildlife and on carbon sequestration in the region.

As part of the PALM project, targeted communities in the Alai mountains in Kyrgyzstan and in the Pamir mountains in Tajikistan are developing their own land-use plans and implementing specific micro-projects incorporating sustainable land management.

Beyond the local level, PALM supports the strategic and policy environment for sustainable land management on regional and national scales. In parallel, research and advisory agencies are working with local communities on targeted approaches — such as introducing improved fodder cropping and improved goat husbandry — as well as on assessing global price trends and demand for wool and berries.

Jamoats in Tajikistan and *aiyl okmots* in Kyrgyzstan, are distinct administrative, legal and political entities at the lowest level of local government. Each of these subdistrict units contains 2–6 settlements that, while forming separate communities, usually have some common social ties based on ethnicity, geographic location and ecosystem resource use.

Each *jamoat/aiyl okmet* community land-use plan and sustainable land management strategy includes a portfolio of micro-projects for those agreed priority component activities that require external investment funding. To be eligible for financial support from the project, a micro-project must be one with a need identified through the community land-use planning process. The project's implementation must also be expected to make a positive contribution to reducing poverty while restoring, sustaining and enhancing the productive capacity and protective functions of the ecosystem resources of the High Pamir and Pamir Alai Mountains. The concept of environmentally sensitive tourism is worth pursuing as a potential future income-generator.

2.1.4 Sustainable forestry

The Kyrgyz–Swiss Forestry Support programme (KIRFOR) was launched in 1995 to develop and maintain forest sector reform in Kyrgyzstan with a focus on productive and sustainable forest management. Funded by the Swiss Agency for Development and Cooperation, the KIRFOR programme was implemented by Intercooperation – a leading Swiss non-profit organization – and by the Swiss Foundation for Development and International Cooperation:

The problems resulting from human impact on the forests of Kyrgyzstan prompted the adoption of urgent measures to implement a comprehensive policy of multilateral cooperation in the sustainable development of forests. The goals included the improvement of the quality of life, the strengthening of local economies and the conservation of natural resources.

From the outset, institutional reform was a priority. The KIRFOR programme began at the field level with the reform of forestry practices then extended to the national level and included an intersectoral approach.

The basic approach to the development of national forest policy in Kyrgyzstan is a working partnership involving stakeholders from state agencies, forest management, science, local communities, the private sector and civil society in a "bottom-up" approach. The development of the forestry sector of Kyrgyzstan was viewed as a constant process of reform through the optimization of control systems, the improvement of relationships and the introduction of modern technologies, all coupled with capacity-building.

The current national forest policy in Kyrgyzstan provides a systematic examination of the problems of the forest based on three elements: "Forest-Man-State". "Forest" includes the imperative of stability of forest resources and biodiversity. "Man" in forest policy reflects the need to involve local communities and the private sector in forest management, and to account for their influence and interests in forest management.

The role of "State" in the forestry sector is changing with the course of social development. Under the provisions of national forest policy, the state reserves the controlling and regulating function and passes the production functions of forest management to local communities and the private sector. Together these three elements are intended to create a sustainable forest management system that preserves and increases forests while contributing to socio-economic development.

The need to develop new approaches for forest resources is due to the real environmental situation and the dynamics of socio-economic development. The main threat to the stability of forest ecosystems has come from the growing pressure on local populations forced to make use of natural resources in their lives. Prohibitions on forest use have only created conflict. Today, the centralized system of forest management, due to lack of resources, cannot fully ensure the sustainability of forest development. Therefore, a sustainable forest management community is the most promising management option for forest conservation and renewal.

Based on the study of traditional forest management schemes, Kyrgyzstan introduced community forest management, an experimental approach that engaged community groups and local authorities to manage forests. The development of cooperation between the forestry sector and *ayil okmotu* has created a framework for information sharing, planning and decision-making.

A positive result of the efforts in the development of a new national forest policy for Kyrgyzstan was a package of documents designed to create the conditions necessary for the preservation, growth and sustainable use of forests, and in sustainable forest sector development:

- The concept of sustainable development of forestry until 2025, approved by the government in 2004

- The National Forest Programme 2005–2010, approved by the government in 2004
- The National Action Plan for Forestry Development 2006–2010, approved by the government in 2006
- A new plan for 2011–2015, pending approval by the government
- An Action Plan to strengthen law enforcement and governance in the forestry sector, approved by the government in 2009.

Despite the success of the KIRFOR programme, implementation of sustainable forest management is far from complete.

2.2 Networks

Three of the case study projects demonstrate the benefits of networking among groups working on mountain sustainable development – the Central Asian Mountain Partnership network, the Alliance of Central Asian Mountain Communities experience exchange and the Interstate Commission on Sustainable Development in Central Asia.

2.2.1 The Central Asian Mountain Partnership network

The Central Asian Mountain Partnership (CAMP) focuses on institutional development for civil society organizations:

Started with action-oriented research and baseline studies in three Central Asian countries, CAMP consisted of small-scale projects on natural resource management; livelihood and village development; community mobilization; and the introduction of participatory mechanisms. This initial work was undertaken jointly with the Centre for Development and Environment supported by the Swiss Agency for Development and Cooperation. This project became especially relevant in the wake of the year 2002, which was declared the International Year of Mountains by the United Nations. At that time Central Asian states received a rare opportunity to attract the world's attention to the problems of rural people living in mountain areas.

The network aimed at promoting sustainable development in the mountainous regions of Central Asia, and soon spun off successor organizations – CAMP Alatau in Kyrgyzstan, CAMP Kuhiston in Tajikistan and CAMP Consulting in Kazakhstan, all part of the CAMP network. These newly established agencies faced the immediate challenge of strengthening their own capacity and securing institutional stability.

Civil society in Central Asia has developed significantly since 1991. A more open and enabling environment, and the urgent need to plug gaps in social services left by the withdrawal of state support, have led to the mushrooming of civil society organizations (CSOs). In Tajikistan, for example, by 2011 the number of CSOs reached 2,350, up from 141 operating in the 1990s. Governments of the newly independent states have recognized the role and contribution of CSOs to democratic transformation and socio-economic development. Kyrgyzstan and Kazakhstan, in 1999 and 2001, respectively, adopted laws that regulate the various forms of CSOs. Activities being undertaken by local and international organizations contributed to building the financial and technical capacity of civil society actors, particularly emerging CSOs.

The institutional growth for the CAMP agencies took place in parallel with the formation and growth of local institutions supported under the program: the Territorial Public Self-governance bodies (TPSS) at the village level, and the Alliance of Mountain Communities of Central Asia and the Mountain Villages Partnership and Development Foundation at the regional level. Thanks to successful partnerships, the geographical focus of projects has been expanded and sustainability ensured. The projects on energy efficiency, pasture management and local risk management have been implemented in all three countries.

The main outcome of the CAMP network effort is seen in the local capacity-building for integrated management of the natural resource base. Capacity-building efforts including the well-known training modules such as “Learning for Sustainability” helped to introduce participatory management and partnership principles, thus empowering local communities and fostering a new generation of local leadership and community-based institutions safeguarding environmental sustainability in conjunction with economic profit.

The program mobilized local communities to take ownership of their own destinies instead of maintaining a passive, anticipatory position. As the CAMP network interventions are guided by the integrated and holistic approach to local development, many of initiatives have been replicated and scaled up by others.

Eleven years of institutional sustenance also demonstrates the growth in terms of local capacity and leadership. The geographic focus for the CAMP projects and programs and their high degree of relevance and responsiveness to local needs have been built on strong linkages with mountain communities. The platforms on water and mountains, such as Dom Gor and Vody, and annual CAMP forum networking events provide opportunities for sharing experiences and fostering dialogue between the concerned stakeholders and the general public. They bring forward the voices of mountain communities to the national and regional levels and show the importance of working together for a common goal.

2.2.2 Experience exchange: The Alliance of Central Asian Mountain Communities

The Alliance of Central Asian Mountain Communities (AGOCA) was founded in 2003 with the overall goal of assisting in the sustainable development in the Central Asian mountains. The AGOCA approach to its goal entails training and the exchange of information and experiences:

At the foundation of the Alliance, 10 pilot villages were selected from three countries – Kyrgyzstan, Tajikistan and Kazakhstan – to develop the AGOCA mission. The main expectations of the communities was that AGOCA provide updated mountain-related information to its members as well as regular exchange-of-experience visits among the villages and countries. Since 2003 AGOCA has carried out practical and theoretical workshops and trainings in such areas as:

- Making solar cabinets for cooking
- Processing of dairy products at home
- Willow-twining
- Processing wool.

To date, more than 2,500 villagers have participated in AGOCA training and have acquired skills and knowledge that enhance their capacity and increase their opportunities. From 2003 to 2009, twice-annual national meetings in the three countries focused on the exchange of communities’ experiences and discussions of realized projects and plans for the coming year. Members who attend the exchange-of-experience visits pay only their transportation costs one way, while AGOCA covers the other way and the hosts provide meals and lodging.

The annual AGOCA Conference, rotated among the member countries, serves as a general assembly meeting of AGOCA members and Territorial Public Self-governance bodies, and is the Alliance’s main decision-making body. Thanks to AGOCA training, the leaders of the TPSs have won a high degree of respect in their communities: four have become deputies in local self-governments and two have become heads of their villages.

The publishing of White Books – collections of successfully realized AGOCA projects in Kyrgyzstan, Tajikistan and Kazakhstan – was a significant achievement. With the aim of broader dissemination of good practices among our villages and abroad, the White Books were published from 2004 to 2007 in five languages: Kyrgyz, Tajik, Kazakh, Russian and English. Once a year AGOCA also publishes its own magazine

in the five AGOCA languages. Distributed through AGOCA members and partner organizations to all the countries of Central Asia, AGOCA magazine covers projects from planning to implementation, and includes recommendations and lessons learned.

2.2.3 The Interstate Commission on Sustainable Development in Central Asia

The Interstate Commission on Sustainable Development in Central Asia (ICSD) coordinates and manages regional cooperation in environmental protection and sustainable development in Central Asia.

2.3 Climate change: Pilot Program for Climate Resilience in Tajikistan

The Pamir-Alai Land Management Strategy considers the effects of climate change. These effects potentially include risks to the ecosystem goods and services provided by mountains, not least those associated with water storage and regulation and with biodiversity. Oxfam GB in Tajikistan funded and coordinated this study of climate change investment:

The Pamir-Alai Land Management (PALM) Strategy provides a roadmap to restore, sustain and enhance the productive and protective functions of the transboundary ecosystems of the High Pamir and Pamir-Alai mountains of Tajikistan and Kyrgyzstan so as to improve the social and economic well-being of the rural communities and households utilizing the region's ecosystem resources to meet their livelihood needs, while preserving the unique landscape and globally important biodiversity.

This study analyses the Pilot Program for Climate Resilience (PPCR) in Tajikistan. The goal of the PPCR is to help countries adopt a climate-resilient development path that is consistent with national poverty reduction and sustainable development goals. The main goals of the study are to identify lessons learned and to make recommendations for channeling climate change adaptation funds in the context of Tajikistan. The study is based on interviews and focus group discussions with stakeholders. Participants included representatives of government institutions, international and local NGOs, academia, bi-lateral and multi-lateral donors and civil society.

The results of the study were published as a report (in English, Russian and Tajik) and presented to the public and relevant stakeholders in order to address the gaps and lessons learned in the first phase of the PPCR. The report is available online at: <http://www.oxfam.org/en/policy/climate-change-investment-resilience-tajikistan>.

The lessons learned and recommendations include:

- PPCR-funded projects should address the needs of those most vulnerable to climate change and contribute to the sustainable development of the country
- The Government of Tajikistan should be the primary actor in designing, implementing, and channeling resources for national climate change adaptation strategies.
- Civil society and communities should be guaranteed meaningful participation throughout the process of planning and implementing climate funding
- Capacity-building should accompany climate funding
- Climate funding processes should be transparent and accountable to the people of Tajikistan
- Gender equality and women's participation should be central to climate funding
- National climate funding approaches should be informed by existing models.

The PPCR process faced high expectations from a wide range of interested parties and could not hope to meet all of them. Thus far in Tajikistan, PPCR decisions have been largely made by staff of multilateral development banks with insufficient consultation with those who will be most affected by climate change. The PPCR could have provided, and still should provide, a real opportunity to pilot ways of reaching those most impacted by climate change in ways that could radically improve their quality of life.

2.4 Tourism

The prospects for tourism in Central Asia have improved since independence, and Kyrgyzstan in particular has worked to develop the sector. Ecotourism and cultural tourism, generally regarded as sustainable development activities, offer significant opportunities at the national and local levels. The experience of Bokonbaevo Village, Issyk-Kul Province, Kyrgyzstan, demonstrates some of the possibilities:

Based on the idea that ecotourism ensures the protection and careful use of natural resources and benefits the local population, and in light of the importance of tourism in general, the Alliance of Central Asian Mountain Communities provided training to its members on “Sustainable Use of Natural Resources: Techniques for Receiving Tourists”. More than 70 participants from seven villages attended the training sessions. As a result, five Territorial Public Self-governance bodies initiated ecotourism developments that are now functioning in their villages. The TPS of Bokonbaevo in Issyk-Kul Province, Kyrgyzstan, is an example of a successful project that contributes to the improvement of local ecological and economic conditions.

This initiative was launched with the aim of reviving forgotten kinds of tourism and introducing visitors to the national customs and games. It emphasizes activities such as hunting, riding and living in traditional Kyrgyz yurts. An information centre and Website (www.eco-tourism.kg) provide information about various tours and their services.

The TPS of Bokonbaevo, in cooperation with other local self-government bodies, organizes annual festival with such themes as:

- Promotion of embroidery
- Demonstration of Kyrgyz horses
- Beach and lake clean-up.

The local communities have actively participated in all these activities and in cooperation with the TPS and local self-government have developed tours that include the historic and holy places in Issyk-Kul and Naryn Provinces. The TPS reports that over the past four years 550 foreign tourists visited the area, and that local communities earned more than US\$ 10,000.

2.5 Science and education

The last two case studies concern developments in the areas of science and education. The Central Asia Cross-Border Natural Disaster Prevention (CASCADE) project focuses on capacity-building in the area of disaster risk reduction, specifically earthquake risk reduction. The University of Central Asia is a multi-campus regional institution with ambitions to become a global leader in higher education.

2.5.1 Earthquake risk reduction: The CASCADE project

Initiated by the German Foreign Office in 2008, CASCADE is implemented by the German Research Centre for Geosciences (GFZ)–Helmholtz Centre in Potsdam and the Central Asian Institute for Applied Geosciences (CAIAG):

The representatives of Central Asian agencies involved in disaster risk management, among them decision-makers from Ministries responsible for emergency response and leading seismologists from Germany and Central Asia, met together to confirm their readiness to join efforts in earthquake risk reduction in Central Asia, to establish the platform for political and scientific cooperation and to implement the coordinate concept of seismological monitoring in Central Asia.

The project objective was to strengthen international and regional cooperation in disaster prevention and risk management in order to minimize the consequences of earthquakes. One part of the project concentrated on science and one part on capacity-building.

The scientific component included:

- Installation of a cross-border seismic network

- Seismic microzonation
- Assessment of building vulnerability.

Experts from GFZ, CAIAG and the national institutes of seismology in five countries established the Central Asian Real Time Monitoring System. Six seismic stations, located in Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan, operate within this network, and the last seismic station is scheduled to be installed in Uzbekistan in the fall of 2011. The main feature of this network is real-time data flow. A seismoComp3 system was installed in the data centres of each partner allowing local scientists to receive, analyse and archive the continuous data streaming from different countries in Central Asia.

The CASCADE project devoted strong efforts to collect data about the seismic vulnerability of the building stock in different countries, and worked with local partners on the harmonization of the vulnerability classification, converting, as a first step, the original local classification to a common scale. The information will be exploited in future collaborations to improve the development of seismic risk scenarios for Central Asia.

In developed countries, earthquake risk reduction strategies are not centred as much on forecasting as on earthquake-resistant construction. Scientists and regulators use seismic microzonation to develop building codes that contemplate the specific seismic characteristics of an earthquake-prone area in defining the specific construction requirements. Microzonation is basically site-specific risk analysis that considers the geophysical qualities of a given area in order to understand the potential consequences of an earthquake. The project's seismic microzonation of Bishkek, for example, allows analysts to quantify the expected differences in earthquake hazards within the city based on local site effects. The Bishkek experience highlights the need for similar studies in the main cities of Central Asia, especially in light of population growth and urbanization.

The project did not focus on technology alone. Capacity-building and awareness-raising activities targeted scientists and engineers as well as decision-makers, regional planning authorities, educators, civil society representatives and the mass media. Central Asian scientists were trained in the use of modern seismological equipment, in the newest technologies for data processing and analysis and on advanced techniques for estimating site effects in urban areas. Overall, the capacity-building effort trained more than 200 persons.

2.5.2 The University of Central Asia

Founded in 2000 to promote Central Asian social and economic development, the University of Central Asia (UCA) is a secular and private institution established by the International Treaty and Charter signed by the Presidents of Tajikistan, the Kyrgyz Republic and Kazakhstan, and by His Highness the Aga Khan:

Whether through its academic, research and professional and continuing education programs, or through activities associated through the construction of the university campuses, UCA is addressing, or will address, all areas of sustainability. The primary theme, however, is education and research (which aim to build Central Asian capacity to address the critical issues of development in the region).

The University's campuses are located in the mountain regions of Central Asia. At full capacity, UCA will target students and issues from a "catchment area" that will include the mountainous areas of Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, Northern and Eastern Afghanistan, Northern Pakistan, and Western China. The University will have residential campuses in Tekeli (Kazakhstan), Naryn (Kyrgyz Republic), and Khorog (Tajikistan). The UCA School of Professional and Continuing Education has learning facilities in these locations as well as in the region's capital cities and other locations, including Northeast Afghanistan. Other UCA programs, including the Aga Khan Humanities Project, are working with more than 30 universities throughout Central Asia.

The conceptual framework for UCA was developed between 1996 and 1998, at a time of intensive transition of the economic, political and higher educational systems of the former Soviet Central Asian

Republics. The Soviet Union established higher education in the region, including its mountain areas, with the primary goal of meeting the labour needs of the centrally planned economy. University education was highly specialized, and research was generally carried out through the Academy of Sciences with an emphasis on basic over applied research. And while Soviet education included and was empowering to women in Central Asia, it generally remained an elite phenomenon until the end of Soviet rule.

Higher education in the region has experienced numerous reforms since independence. The number of universities expanded greatly, especially in urban areas. More generalized curricula have been developed and partnerships between Central Asian universities and institutions in Europe, North America and elsewhere have emerged. Despite these changes and attempts to preserve the best practices of the Soviet past, the quality of higher education in the region is highly variable. Corruption is commonplace, and despite the continued existence of Soviet era universities in mountain regions, better quality higher education is available primarily in urban areas.

Through relevant and responsive education and research programs, UCA promotes the social and economic development of Central Asia, particularly its mountain societies, while at the same time helping the different peoples of the region to preserve and draw upon their rich cultural and natural heritage as assets for the future. The University aims to do so through three schools (a Graduate School of Development, an undergraduate School of Arts and Sciences and a School of Professional and Continuing Education), a Research Program (including the Mountain Societies Research Centre and Public Policy Centre), a Central Asian Faculty Development Program and a Humanities Program. The University also aims to develop and maintain itself in a manner that benefits the social and economic development of nearby communities and the region as a whole.

These programs and approaches aim to assist the region, and especially its mountain societies, to take better advantage of emerging market-based developments, to develop the human capital necessary for nation-building, to provide high-quality post-secondary education, to promote knowledge of foreign languages to enable participation in a globalized economy and to address the specific challenges and opportunities of mountain societies in the region.

The need for UCA is based on decades of experience of the Aga Khan Development Network (AKDN) engagement in the region. A commission of leading international and regional scholars, government representatives and other relevant experts met extensively between 1995 and 1998 to refine the concept of UCA. The presidents of Kazakhstan, Kyrgyzstan and Tajikistan and the Aga Khan signed the international treaty and charter that established the university in 2000. The treaty was ratified by the respective parliaments and registered with the United Nations.

As one of more than a dozen institutions within the larger Aga Khan Development Network, UCA connects directly with mountain societies through AKDN agencies such as the Aga Khan Foundation and the Mountain Societies Development Support Program in Kyrgyzstan and Tajikistan and the Rural Support Program in Pakistan and Afghanistan. The University also works with the Pakistan-based Aga Khan University, the Aga Khan Trust for Culture and various other AKDN agencies.

The University collaborates with a wide range of government agencies and departments. Existing professional development programs are currently supported by more than 40 memorandums of understanding with its three Founding States. Critical to UCA's programs are its relationships with universities in Europe, North America, and elsewhere in Asia. Also, UCA is the host of the Central Asia regional hub of the Mountain Partnership and Mountain Forum as well as the Swiss-based National Centre for Competence in Research North-South.

Since 1995, more than US\$ 70 million has been invested in the development of UCA. The governments of each of the three countries provided land for their campuses and the Aga Khan has contributed initial investments for the development of the campus sites, early educational programs and the design and development of the campus facilities. Several multilateral and bilateral donors have also invested in UCA.

The University is a permanent institution in the region with a minimum of a century-long time frame, and is currently finalizing a 15-year development strategy and negotiating with donors on the implementation of that strategy. Certain UCA programs are currently operational, while others, including the undergraduate and graduate programs, are in the planning stages. The UCA School of Professional and Continuing Education has been operational since 2006. The Research Program has been operational since 2008 and the Mountain Societies Research Centre within the Research Program was launched in 2011. The Aga Khan Humanities Project was initiated in 1997 and has been subsumed within UCA. The academic degree programs are planned to commence in the next four to five years.

The University is currently supporting 35 Central Asian Faculty Development scholars to pursue post-graduate studies at international partner universities. These scholars will return to UCA to serve as faculty. These scholars are part of a program to help UCA achieve its aim of having 80 per cent of its faculty be from the region and with doctoral degrees earned at universities meeting international standards. At the School of Professional and Continuing Education, more than 30,000 learners have participated in externally certified short courses including Accounting; Information Technology; Applied Languages; Entrepreneurship and Microfinance; Tourism; Public Administration; and Technical and Vocational Education. Some graduates are envisioned to serve as support staff for the university in the future. More than 154 trained instructors at 35 universities in the region are using the Aga Khan Humanities Program (AKHP) curriculum and are reaching 7,500 learners annually. The AKHP curriculum was developed to provide non-ideological humanities education that promotes principles of pluralism, ethics, democratic values and social justice. The University employs 400 full-time staff (more than 95 per cent Central Asian) and is creating jobs in rural communities in an era of labour migration and urbanization. The University also trains and temporarily employs 400–450 staff annually in activities associated with the construction of the university campuses. The number of construction staff is expected to increase dramatically with the initiation of major construction of the three campuses in 2012.

Possible negative impacts of UCA are less a result of what has been done than what has not been done. The founding in 2000 raised many expectations in the region and around the world about the impact UCA would have on higher education, the opportunities it would provide for students in the region and the social and economic impact it would have on the local economies surrounding the three main UCA campuses. Significant components of UCA have been developed and are operational, but UCA's undergraduate and graduate programs are still four to five years away from being operational.

Several key factors have enabled UCA's early achievements and have laid the foundation for long-term success. First, the Aga Khan and the Aga Khan Development Network have made a long-term commitment to establish UCA not as a project, but as a permanent institution. University planners have the benefit of knowing that UCA will receive financial and technical support in the early years to establish its financial footing. Second, UCA is nested within AKDN and benefits from the Network's decades of experience in the Central Asia region. Third, the concept of UCA was developed over a number of years by leading international and regional intellectuals, practitioners and other resource people. This in-depth analysis of the need for and role of UCA established a solid conceptual foundation for the university. Fourth, while making the commitments from the international treaty operational has sometimes proven challenging, the existence of the treaty represents the high-level political commitment necessary to achieve the grand ambitions of UCA. Finally, the regional presence of UCA with its three campuses is a unique characteristic that has been attractive to international educational institutions and funders that want to expand their reach to the region through dealing with one institution.

Regional institutional arrangements such as UCA bring great potential benefits of collaboration across borders. Such collaboration is particularly important in Central Asia where the porous borders established in the Soviet era have solidified as barriers to trade and justifications for nationalism. The University of Central Asia was established as a regional institution with an intention to transcend boundaries, celebrate pluralism and take advantage of the many economic and social benefits of connecting isolated mountain

areas. There are, however, costs of collaboration. These costs are often in the form of longer time frames. As a regional initiative with political commitments at the highest levels, UCA must progress evenly in the three countries in which it has campuses. The pressure to progress evenly can make it difficult to experiment and innovate in one country and then spread the lessons learned to the others.

In the construction and maintenance of UCA's physical infrastructure and in the content of its research and future curricula, UCA emphasizes the need to account for the true costs of development, to support environmentally sound technologies, and to reconcile social, environmental and economic goals, all of which are pillars of a green economy.

2.6 Complex mountain development

Since 1992 the Aga Khan Foundation (AKF) and the Aga Khan Development Network have worked in mountain communities in many regions of Tajikistan. Collaborating with individual agencies in such areas as economic development, education, cultural revitalization, health care and financial services, the AKDN seeks to build institutions and programmes that respond to the challenges and opportunities of social, economic and cultural growth in Tajikistan. The Mountain Societies Development Support Programme (MSDSP), sponsored by the AKF, works in several areas in rural development – community development, enterprise development, natural resource management, engineering and policy and evaluation. The programme operates in 18 districts in three regions (Gorno-Badakhshan Autonomous Province, the Rasht Valley and Khatlon Province) of Tajikistan, with a target population of more than 730,000 people:

Since 1998, MSDSP has been working with local community-based organizations to strengthen their capacity to identify, prioritize and realize their development agendas. The programme supports communities to establish their own community-based groups and provides them with institutional support in the form of training, capacity-building and community development funds. At the local level, these organizations are called Village Organizations (VOs), and at the subdistrict level, Social Unions for the Development of Village Organizations (SUDVOs). To date, MSDSP has supported over 1,150 VOs and 60 SUDVOs with a total of 132,705 active village members, 47 per cent of whom are women.

Since 1997, MSDSP has supported the construction or rehabilitation of 402 water and sanitation projects, 864 irrigation projects, 270 road and bridge projects, 280 health facilities, 158 schools and 28 mini *hydels* (hydropower projects). Alongside every project, the MSDSP Community Development Unit enables community-based organizations and local governments to ensure their maintenance over the long term through special interest groups, such as Water User Associations and Parent Committees.

The Aga Khan Development Network established the First MicroFinanceBank of Tajikistan (FMFB) in 2003, the first fully licensed commercial bank in the country to have a principal focus on micro-credit lending. One of the most important products that FMFB offers is a group loan, aimed at the poorer segments of Tajik population who have difficulty providing collateral to the Bank. Based on the principle of group solidarity, the loan is given to a group of 3 to 10 individuals and repayment becomes a collective responsibility; each member effectively guarantees the repayment of the other members. Group loans are often offered to groups of women, usually for small business start-up costs or to support small-scale agricultural production.

A core MSDSP strategic direction is to increase rural incomes and employment by strengthening the emerging private sector. This aim is achieved primarily by fostering micro- and small-enterprises and by facilitating access to business development services and capital. Within MSDSP, the Enterprise Development Unit (EDU) is responsible for facilitating this process, guided by two main pillars: first, to facilitate access to business development services through an enabling environment that enhances the entrepreneurial culture of target groups; and second, to facilitate access to capital and new technology in order to consolidate economic development.

The programme has identified agricultural processing and tourism as strategic areas for development, while offering support to other entrepreneurs who are themselves able to provide important business services

absent in rural areas, such as the provision of Internet and legal services. Currently, EDU activities in local markets are benefiting more than 3,000 people, approximately 30 per cent of whom are women.

The Aga Khan Health Services Community Health Project works to empower community members and community-based organizations to address their own healthcare needs. The project trains volunteer Community Health Promoters (CHPs) to serve as communication and advocacy links between communities and local governments. Part of a CHP's role is also to refer community members to appropriate health facilities when needed. Since its inception, the Project has trained over 400 CHPs in Gorno-Badakhshan Autonomous Province (also known as GBAO) and 100 in the Khatlon region of Tajikistan.

The Nursing Development Project (NDP) aims to improve the education of nurses in Tajikistan. In partnership with the World Health Organization, the NDP has developed and implemented a new four-year nursing curriculum in all medical colleges of Tajikistan. Teachers from nursing institutions throughout the country are now trained in an expanded range of disciplines including sociology, psychology, research methods, nursing management, family health, communication, health promotion and safe motherhood.

In 2001, the Aga Khan Fund for Economic Development (AKFED) launched the Indigo mobile telephony company in Tajikistan as part of an effort to improve service and spur competition in the country's mobile services industry. In March 2010, the company announced the change of its brand to Tcell. Today, Tcell is the largest mobile operator in Tajikistan by revenue, with annual figures in excess of US\$ 110 million, and by subscriber base, with a 35.5 percent market share in 2010 (over 2 million subscribers), and it has become an exemplar in the country for its corporate practices and customer service. The company now provides coverage to over 90 per cent of Tajikistan's population, which has given the country an economic and social boost, especially in rural areas.

Following the collapse of the Soviet Union in 1991 and civil war, Tajikistan's electrical infrastructure was in need of significant investment. Among the most affected areas was the Gorno Badakhshan Autonomous Province, where economic and human development was stifled during the cold winter months as a result of a lack of electricity for heating and the consequent closure of schools, health centres and businesses. Many of the region's 200,000 residents resorted to wood fuel for their heating and cooking needs during the winter, resulting in the decimation of local forests.

The Aga Khan Fund for Economic Development, in partnership with the International Finance Corporation, formed the PamirEnergy Company in 2002 to address the situation. Some US\$ 26.8 million has since been invested by the company to repair the electrical infrastructure of GBAO and expand hydroelectric capacity. In the wake of these efforts, almost 90 per cent of the region's inhabitants now have access to electricity while tariff subsidies have ensured that even the poorest households are able to access power.

The AKDN sponsors enterprises that take advantage of the opportunities afforded by markets along the Tajik-Afghan border. Providing communities on both sides of the border access to an expanded market drastically increases the potential for income generating activities and improved livelihoods. Cross-border activities began in December 2006, when MSDSP procured permission for Afghan women to enter Tajikistan at Darvaz in order to exchange ideas and lessons with their Tajik counterparts and promote gender equality. Afghan traders were also provided with the opportunity to visit the Bazaar in Darvaz. A cross-border market now operates on Saturdays, and given the overwhelming success of initial operations, openings on additional days are expected in the near future. The cross-border markets are also intended to be expanded to other border communities, including Shugnan, Ishkashim and Shurabad.

Part 3: Opportunities and the prospects for a green economy

The trends enumerated in Part 1 have influenced, and continue to influence, the development of the new Central Asian countries – for better or for worse. The countries may seem at times to be at the mercy of the geopolitical, socio-economic and global forces at work, but the trends associated with these forces provide an array of opportunities as diverse and profound as the forces themselves. The governments, communities and people who take advantage of the opportunities afforded by the trends stand to benefit for years to come. This part of the report offers suggestions on where the best opportunities may lie and on how the people of Central Asia might seize them to their advantage.

The transition to independence required the new countries to establish their own governments and economies without their former reliance on the Soviets for administration, planning and finance. The end of dependence on the Soviet state paved the way for self-reliance at both the state and individual levels. With greater exposure to the international community and more responsibility for their own destinies, the new countries are learning to tackle their own problems. The progress in responding to the depletion of mountain resources, for example, is an area where the advice and assistance of the international community over the last twenty years has helped develop the knowledge and skills necessary for the task, and has created the opportunity for continuing success at the state, local and individual levels.

As the countries have developed their own legislation and the corresponding enforcement regimes, they have replaced the former centralized and subsidized system. Continuing this work, and strengthening what now exists on the basis of their own resources, will help the countries establish the rule of law. At both the national and local levels there are opportunities to develop governance that lead to greater stability, prosperity and sustainability.

Even today, almost twenty years after the Rio 1992 Summit, which highlighted the importance of mountain ecosystems in Agenda 21, the national development strategies in key socio-economic sectors do not fully consider mountain ecosystem services and sometimes lack consistency with national environmental and sustainable development strategies. By truly incorporating environmental and sustainable development considerations into the national strategies, the countries can seize the opportunity for better coordination and efficiency among their planning efforts, and can realize the synergy that comes with the participation of all the relevant players.

At the beginning of independence, the Central Asian countries placed a high priority on the definition of the new international borders and the development of new border controls. In the mountains, where the terrain is complex and travel is difficult, the new border controls have worsened the situation by further restricting the movement of goods and people. The establishment of travel corridors that easily accommodate the movement of goods and people would enable commerce to the benefit of the states and to the people who live near the borders. All the Central Asian countries would stand to gain from the improvement of travel corridors, and the situation is ripe for international cooperation in the development of mutually beneficial solutions.

The political and economic assistance to Central Asia has come in the form of multilateral and bilateral aid from a variety of sources. While traditional cooperation across borders is normally a bilateral endeavour between countries, there are an increasing number of sub-national efforts occurring at city and regional levels. These efforts offer the opportunity to explore more fully the benefits of experience exchanges and direct cooperation on mutual concerns. International organizations with specific expertise, through better coordination of their work, could build on this experience with programmes that provide assistance at the community, rather than at the national level, and that link lowland benefits to mountain projects and vice versa.

Climate change and natural disasters require responses at a national level, but there are also opportunities for regional cooperation across Central Asia. Currently the countries of the region conduct their own research and devise their own climate change policies and disaster risk reduction strategies. A lessening of the political barriers among the countries could encourage collaboration and the exchange of knowledge that could lead to

a more effective regional response to climate change and natural disasters in the lowlands as well as in the mountains. While the mountain communities do not contribute significantly to greenhouse gas emissions, the mountain regions will benefit from any progress on mitigating climate change. The mountains have a vast potential for carbon storage through afforestation projects and sustainable land use practices to enhance this potential will benefit the entire region.

Disaster risk reduction strategies need to contemplate the links between natural and industrial hazards both within and between countries. Where existing resources are inefficiently spent, there are opportunities for greater cooperation among the ministries and institutions that have responsibility for seismic and flood monitoring, industrial risk analysis and disaster relief.

Mountains are complex environments with complex climates, and the response to the effects of climate change requires a greater effort to consider the specific mountain conditions. Flatland approaches may not apply, and targeted research and interventions are necessary for an effective response. The lowlands are affected by climate change in the mountains, and the lowland countries are well advised to account for mountain ecosystems in their planning. Mountain environments are particularly sensitive to climate change, and are often the first place where the effects are visible – in shrinking glaciers, for example. This sensitivity and visibility create the opportunity to increase awareness of climate change in the mountains, and to build support for an effective local, national and regional response.

The expansion of protected areas in the independence era, including cross-border natural parks and biosphere reserves, has created a foundation for further protection of the region's rich biodiversity. Special reserves for watershed protection or forestry afford the opportunity for stronger measures to protect native flora and fauna, especially in the mountains.

The mountains are a warehouse of genetic resources related to agriculture, and as such offer an opportunity for further promotion and research. Governments can provide incentives, such as discounts or local produce promotion, to farmers to maintain local varieties alongside other crops, and international organizations may be able to influence the direction of mountain agriculture and to help improve local varieties and breeds. The mountains would also benefit from the more careful control of invasive species and genetically modified organisms, along with more bio-friendly methods of crop production.

The number of domestic animals already exceeds the high levels attained during the Soviet era, and this agricultural achievement should be viewed not only from an economic angle but also in the context of the Soviet experience – the serious land degradation that occurred then may occur again. Now, however, local innovative practices and sustainable pasture management may accommodate the greater number of stock without the degradation of the land resulting from overgrazing.

Excess irrigation also leads to land degradation in addition to great losses of water in agricultural sector, and the irrigation systems in Central Asia need to adjust to modern standards. Similarly, the expansion of rainfed agriculture on steep mountain slopes needs to be monitored, and crop rotation needs to be encouraged, to prevent land degradation from water and wind. Governments and local communities can work to create favourable conditions, and the more rational use of water for irrigation can benefit the entire region.

The development of roads and rails throughout Central Asia, while a boon to trade and commerce, may have negative environmental implications that deserve careful consideration. The mountain countries, surrounded as they are by big players and big consumers, are strategically positioned to create rail links, the development of which would benefit their economies and raise their regional importance. Similar benefits would accrue if the countries become energy hubs and develop their power infrastructure. The mountain countries could also pass legislation to make themselves more competitive in encouraging the regional trade that help their economies.

The expansion of mobile communications and information technologies has already benefited the region in numerous ways. Mountain businesses can further this progress by increasing their use of the Internet for

advertising, and communities can communicate the trade and tourism opportunities in their areas. As remote mountain areas link to the rest of the world, they can develop educational and professional opportunities, promote ecosystem awareness, contribute to environmental knowledge and communicate their concerns.

The tourism sector in Central Asia has expanded in the independence era, and governments now have a chance to provide incentives to broaden the opportunities for a community-based tourism that relies on a traditional style of modest accommodations and quality service. Winter tourism that focuses on activities other than skiing (with its high capital and operating costs) could help mountain communities by providing seasonal employment at the time of year it is most needed.

The resolution of the continuing controversies in the mining sector require creativity and perseverance. Governments need to ensure that the local concerns are aired and respected in order to reduce the tensions that are currently preventing mining operations. In addition, governments need to bring artisanal mining practices into compliance with modern standards by ensuring that competent authorities provide the necessary monitoring and oversight. In their efforts to clean up the abandoned mines and tailings left over from the Soviet era, governments would be wise to seek opportunities to develop economically viable ways to rehabilitate the sites through partnerships with potentially affected countries, international organizations and private enterprise.

The huge potential of hydropower in the mountain countries provides the opportunity to combine progress on the goals of energy security, climate resiliency and economic development. Investments in large projects need to consider the environmental and downstream effects. By balancing local, national and international interests in energy development, the countries can secure power for their own people, and sell power to their neighbours. Modernization of the power system may require higher tariffs, but governments should take account of income levels, especially for those living in the mountains, in devising a fair tariff system.

In the development of biofuel production programmes, governments should learn from the experiences of others, balance the requirements of both the economy and the environment in determining the crops to use and recognize the environmental challenges in deciding how much biofuel to develop.

The cooperation on intelligence exchange and border controls currently in place in Central Asia forms a solid foundation on which to build a stronger system that is adequate to the actual threats. All the participants will benefit from better security arrangements, especially in the mountains where potential hideouts are plentiful. At the national level, a dialogue between ethnic and religious groups may help build the trust necessary to achieve internal security, maintain stability and reduce the potential for conflict.

Tensions between the highland and lowland countries often centre on the issues of energy accessibility and water usage, and are evident in the absence of trust in the economic and environmental assessments of power and water projects. Comprehensive and transparent assessments may help, but absent the political will to change, a breakthrough is unlikely. All of the regional players need to recognize the role of mountain ecosystems with respect to water resources in Central Asia, and to cooperate on the investment in, and maintenance of, mountain ecosystem services.

Food, energy and water security are crucial to the maintenance of stability in the mountains and the neighbouring regions. In light of their marginal existence and the scarcity of resources, mountain communities may need the support of outsiders to provide these essential elements of soft security.

As resource ownership in Central Asia has slowly moved from state to private hands, the increase in efficiency has been apparent in such areas as tourism, mining and agriculture. But property rights are not yet well respected, and legal uncertainties undermine the sense of responsibility that normally follows from ownership. In addition, there are growing inequities between rich and poor. Governments need to establish fair resource distribution policies and encourage the efficiencies and responsibilities that come with property ownership.

The remittances that come from labour migrants have become a crucial source of income for families, and the governments need to recognize the situation with new policies that establish the legal framework and official

services that migrants and their families need. The prospect that unskilled workers may no longer be welcome in recipient countries suggests that governments need to invest in education and language skills, and to work collaboratively with international partners. In recognition of the changing status of women as heads of household, the governments also need to consider labour regulations and other approaches that help lift the burden on women.

As educational opportunities have increased in the independence era, the quality of education has declined, and realistic literacy rates are falling. Reversing this trend requires a greater investment in human capital, more innovation and an increase in the number of teachers. That Central Asian universities are now specializing in mountain development issues is an encouraging trend.

In health, many trends are similarly encouraging – decreasing child mortality and greater access to safe drinking water, among others. These advances in public health are a good base for the development of stronger environmental health protection. The complex changes in the mountain environment, however, require more attention to the associated environmental health risks.

The mix of traditional skills and modern practices represents a flourishing trend in mountain trade and services, and governments and other active players should encourage the conditions that enable the trend to grow and spread to other regions. The production of authentic, high quality products should be a source of pride in the countries where they are made. The ongoing reanalysis of history and culture and traditions should continue to support this revitalization and celebration of mountain culture.

Provisional list of visuals:

- 1) Mountain trends (synthesis matrix by mountain ranges/countries)
- 2) Central Asia mountains overview - schematic map
- 3) Pamir and Tien Shan - shaded topomap
- 4) Kopetdag - topomap
- 5) Political / economic transition map series
- 6) Borders theme map
- 7) Financial assistance / investment graph
- 8) Climate change synthesis map
- 9) Maps of temperature and precipitation change
- 10) Graphs of temperature and precipitation change
- 11) Graphs of glacier change
- 12) Graphs of water change scenarios
- 13) Map - Mountains as "water towers" and graph of water consumption (?)
- 14) Graph - Fish catch in Issyk Kul Lake
- 15) Map of protected areas, including UNESCO sites - Kyrgyzstan
- 16) Map of protected areas, including UNESCO sites - Tajikistan
- 17) Scheme - Pressures/drivers on mountain ecosystems
- 18) Table - Mountain ecosystem services
- 19) Map - Endangered species habitats
- 20) Map -Roads and trade
- 21) Graph - Internet and mobile phone use
- 22) Map - Tourism opportunities
- 23) Map - Mining prospects and conflicts
- 24) Map - Energy prospects
- 25) Graph - energy production and consumption
- 26) Map - impacts of conflict
- 27) Map - mountain agrobiodiversity and nature/land resource use
- 28) Graph - agricultural trends (livestock, wheat, potato, gardens)
- 29) Graph - growth of private farmers
- 30) Graph - population growth since 1950s
- 31) Graph - population pyramid
- 32) Map - migration flows
- 33) Graph - remittances flow
- 34) Graph - child mortality, other health indicators
- 35) Map - mining tailings around the Ferghana Valley
- 36) Map - meteorological and glacier monitoring
- 37) Map - seismic risk and monitoring stations
- 38) CASE-STUDY map - kitchen gardens (locations, altitude scheme)
- 39) CASE-STUDY map - pasture management (locations)
- 40) CASE-STUDY map - community based tourism
- 41) CASE-STUDY map - seismic risk zoning
- 42) CASE-STUDY map - UCA campuses
- 43) Overview map - Issyk-Kul biosphere territory
- 44) Overview map -Tajik National Park

References:

Main background documents:

Additional references:

Online databases and information sources:

Abbreviations:**Glossary:**