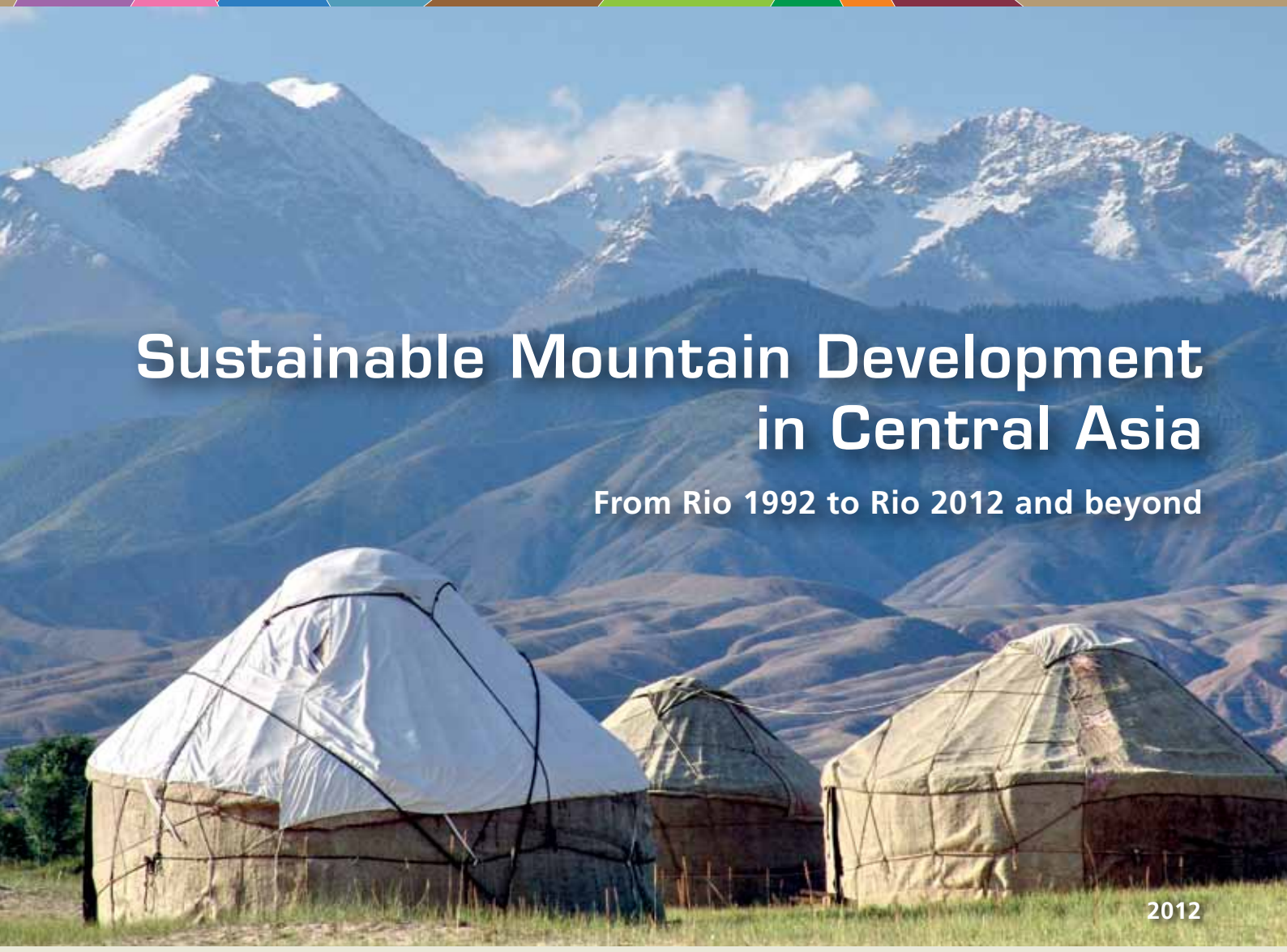
Regional Report

Sustainable Mountain Development in Central Asia

From Rio 1992 to Rio 2012 and beyond



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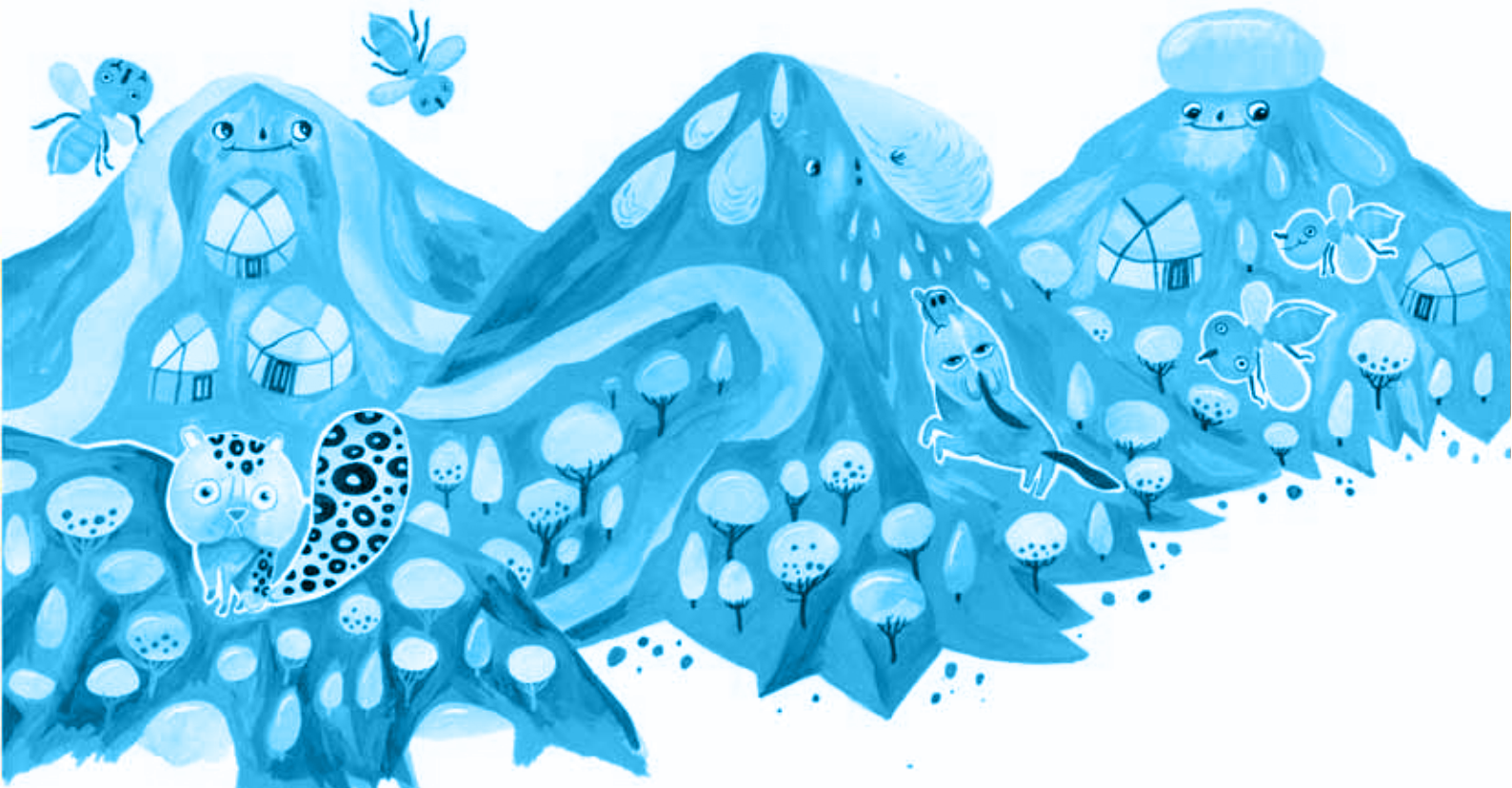
Sustainable Mountain Development
From Rio 1992 to 2012 and beyond

CENTRAL ASIA MOUNTAINS



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Executive Summary

Why the Central Asia mountains matter

The Central Asian mountains provide an astonishing array of essential ecosystem goods and services not only to mountain inhabitants but also to people in the lowlands and around the globe. These goods and services include the storage and release of fresh water; watershed protection; forest products and land for food production; habitat for flora and fauna of local and global significance; the regulation of natural hazards and climate; natural areas for leisure and recreational activities.

Central Asia's mountains modulate the climate across wide areas, and are important reservoirs for the storage of carbon, but global warming is slowly decimating mountain glaciers, affecting snow reserves and at the same time increasing the water requirements of basic agricultural crops. The downstream and lowland water resource disruptions challenge governments and, in some cases, international relations. Tensions between highland and lowland countries often centre on the issues of energy accessibility and water usage. Almost 90 per cent of the population of Central Asia relies on water that falls in the mountains. Lowland agriculture needs water in the summer and fall, and the mountain countries need the water for power generation primarily in the winter. Finding the balance between energy generation, such as large-scale hydropower, and water provision for large-scale agriculture is difficult and politically sensitive. As the demand for energy and food continues to grow, tensions surrounding water and energy may escalate.

The Central Asia mountains are crucial to the maintenance of natural and agricultural global biodiversity, and host at least 20 distinct ecosystems and thousands of species of vascular plants, many of which are unique to the region. They are home to globally significant fruit-and-nut forests comprising walnuts, almonds, pears, apples, cherries and pistachios.

Where the mountains of Central Asia were once barriers to trade, they are now becoming important hubs. Tourism, mining and trade have been gathering momentum and the supporting infrastructure has developed accordingly. In Central Asia the mix of traditional skills and modern practices are contributing to the revival of the ancient Silk Road in the age of globalization.

The mountains of Central Asia provide a profound sense of place, a source of inspiration and a rich cultural heritage.

The future we want for the Central Asia mountains

The mountain regions of the world have much in common, and while the future we want for Central Asia shares many hopes with other places, what we envision for Central Asia mountains is specific to that region.

The Central Asia mountain report team recommends the exploration of two ideas that have increasingly become part of the discussions on sustainable mountain development in the region:

- The creation of a mountain countries group under the auspices of the United Nations
- The exchange of external debt for an equivalent investment in sustainable development.

Linking strategies for mountain development with broader agreements on trade, economic development, conflict resolution and resource management may enhance the efforts. International organizations can build on the subregional experience exchanges by providing assistance at the community level, and subnational governments may exercise their power to determine the future of their communities.

Climate change

The lowland countries that are affected by climate change in the mountains are well advised to account for mountain ecosystems in their planning. The mountains have a vast potential for carbon storage through afforestation projects, and sustainable land use practices will benefit the entire region. Mountain regions have the opportunity to build water storage facilities that can release water to downstream regions in drought years.

Water and energy

Investing in more efficient water use is not only cost-effective but necessary to avoid conflicts. Small-scale water management solutions should be promoted. Principles for the pricing of resources and services provided by mountain areas to downstream regions should be established, tested and introduced in practice. The potential of hydropower in the mountain countries provides the opportunity to combine progress on the goals of energy security, climate resiliency and economic development.

Biodiversity

The expansion of protected areas creates a foundation for further biodiversity protection. And new pasture regulations that combine a scientific approach with economic tools and community participation pave the way for others to adopt sustainable approaches in livestock herding.

Tourism, mining and trade

Central Asia governments can broaden the opportunities for a community-based tourism. In the mining sector, governments need to promote responsible mining and to ensure that the local concerns are aired and respected. The mountain regions of Central Asia are strategically positioned to create in the heart of Eurasia rail and road links that would benefit their economies and raise their regional importance.

Education, institutions and the preservation of cultural diversity

Governments and other active players should encourage the trend in the mix of traditional skills and modern practices. Central Asian universities are now specializing in mountain development issues, and higher education institutions have an additional opportunity to focus on the preparation of the next generation of managers in tourism, mining and infrastructure development. An integrated approach to sustainable mountain development provides a regional cooperation model that institutions and non-governmental organizations can follow.

Contents

Findings and observations

For the five countries of Central Asia – the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan, Turkmenistan and the Republic of Uzbekistan – the sustainable development movement launched in Rio in 1992 has played out in the context of the 1991 collapse of the Soviet Union. The transition from a planned to a market economy and from totalitarianism to democracy and independence was a rocky period of geopolitical changes that coincided with rapid technological development and globalization and a growing awareness of environmental changes related to climate, biodiversity and land degradation. Regional tensions and conflicts gave rise to new security requirements. New demographic and labour market realities and changes in the ownership and control of natural resources created shifting social dynamics.

This report analyses the region's progress in sustainable mountain development over the past 20 years, and examines how the forces and trends affecting Central Asia create both challenges and opportunities for the new countries and their people. The Lucerne World Mountain Conference in October 2011 issued a call for action for the protection of water supplies, the reduction of poverty and the unlocking of the economic potential of the mountains of the world. A summary of how Central Asia is performing against the Lucerne call for action follows:

- Compared to other mountain regions, Central Asia lacks experience in mountain governance, but the 2002 Bishkek Global Mountain Summit, which concluded with the formation of the Bishkek Mountain Platform, marks a turning point, and provides a strong basis for further improvements.

- In the energy, mining and tourism sectors, the challenges regarding the equitable sharing of benefits are substantial, but so too are the opportunities, and numerous efforts are underway to unlock the economic potential for the benefit of all the affected parties.

- The decentralization that has occurred as part of the transition to independence has increasingly involved mountain people in the decision-making that affects their lives and communities. The region has experienced an impressive growth in the number of Village Organizations and Civil Society Organizations whose participation has influenced countless decisions.

- In many instances of transboundary or highland–lowland tensions, the political will to resolve mutual problems is missing, but international aid organizations such as the Aga Khan Foundation and regional institutions such as the Interstate Commission for Sustainable Development are working on capacity-building and on the generation and exchange of knowledge, expertise and innovation in mountain development.

- Organic agriculture and small hydropower offer promising avenues for private sector investment in sustainable development in Central Asia, and the region's strategic location is a built-in incentive for private investment in trade and public investment in the transport infrastructure. Commitments to mountain development may change with the political winds, and mountain advocates may find more consistent public support for their concerns by working to integrate mountain issues into the Rio conventions and the associated country plans and programmes.

- All of the Central Asia countries recognize the vulnerability of their mountain ecosystems, but the protection of these ecosystems could benefit from linking the strategies for mountain development with other, broader agreements on trade, economic development, conflict resolution and resource management.

- The Global Environment Facility supports the preparation of reports and plans related to the Rio conventions, and funds projects from the local to the regional level in Central Asia. The mountains could benefit from more explicit inclusion in other development projects, and the countries of the region may want to consider debt exchange – a mechanism that redirects debt repayments to sustainable mountain development.

- With more than 90 per cent of their national territories considered as mountainous, Kyrgyzstan and Tajikistan are mountain countries, while Uzbekistan, Kazakhstan and Turkmenistan – with smaller mountainous regions – are countries with mountains. The mountain regions of these latter three countries are no less important, but this report necessarily devotes more space to the main Central Asian mountain regions, which lie in Kyrgyzstan and Tajikistan.

The findings of this report fall within four broad categories – people; infrastructure; ecosystems; and institutions, governance and knowledge. The effects of the forces and trends at work have been both positive and negative, sometimes both at the same time, and progress in the mountains of Central Asia can be characterized as a series of forward and backward steps.

People in the mountains
(one step forward, two steps back)

- Border security concerns have constrained the movement of goods and people, especially the nomadic people and those living in or traveling around mountain enclaves.
- Public expenditures on education and health are less than one quarter of the previous (Soviet) levels. The official literacy rate is high, but the declining quality of education in mountain countries is becoming an obstacle to sustainable development. Child mortality rates are falling, but the risk of malaria, tuberculoses, HIV/AIDS and other diseases remains high.
- The rules on ownership rights have relaxed across the region, and a free and competitive market system has evolved, but corruption marred the transition.
- Tajikistan's animal husbandry and food production exceed 1991 levels, and honey production has substantially increased. Kyrgyzstan's food production has increased, but its animal husbandry and honey production lag behind previous levels.
- Large-scale hydroelectric 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.
- A reluctance on the part of governments and mining companies to share profits equitably, and a lack of transparency in decisions, have led to discontent among groups in the mountains.
- Civil war and armed conflict wracked the mountainous regions of Tajikistan for the entire decade of the 1990s. In Kyrgyzstan, violence widened the ethnic and geographic divides.
- Women have become heads of households as a result of the labour migration of men. In rural areas they are highly vulnerable to crop failures, heatwaves and cold waves, droughts and natural disasters.

Infrastructure in the mountains
(two steps forward, one step back)

- The expansion and improvement of the road system have increased the accessibility to remote mountain areas. The increase in the number of people who have cars has improved mobility and connectivity.
- The use of the Internet and mobile technology in mountain countries has grown substantially. Online education and distance learning are increasingly available options.
- Information technologies in the banking sector have lowered the costs and increased the efficiency of labour remittances.
- The quality of traditional hydrometeorological observations and equipment has declined sharply. At the same time, the usage of automatic hydrometeorological and environmental monitoring stations has expanded.
- Kyrgyzstan enacted economic and structural reforms, became a World Trade Organization member and allowed access to geologic information to promote development in the mining sector. Tajikistan and some other countries lag behind.
- Kyrgyzstan and Tajikistan are working to develop their large hydropower potential, less than 10 per cent of which is used.
- Tourism offers a promising source of alternative livelihoods. Central Asian countries have an opportunity to further develop winter sports and cultural and health tourism in their mountain regions.
- The establishment of a green economy and the further pursuit of good governance are relevant and necessary steps for successful sustainable mountain development in Central Asia. The greening of the energy, agriculture, forestry, tourism and water sectors will not only provide environmental safeguards, but also give the countries a competitive advantage economically and promote the equitable distribution of social benefits.

Mountain ecosystems
(one step forward, two steps back)

- The increased use of cars has increased the risks to previously unreachable mountain ecosystems.
- Tajikistan and Kyrgyzstan have the lowest greenhouse gas emissions in Central Asia.
- In the last 50–60 years, between 15 per cent and 35 per cent of the Tien Shan and Pamirs glaciers have melted.
- The use of woody biomass and dried dung as major sources of energy, combined with forest cuttings and the widespread collection of slow-growing shrubs have diminished mountain biodiversity.
- Fires and pest attacks on mountain forests due to limited controls and hot, dry weather conditions have destroyed and damaged significant forested areas, especially in Kazakhstan.
- Lake Issyk-Kul fisheries have declined to negligible levels, and previously abundant endemic fish species have become endangered.
- The enrichment of agricultural biodiversity resulting from the efforts of Soviet agronomists is threatened by the pressures to compete in global markets, and the genetic diversity of the local food base is at risk.
- The growth in rainfed crop cultivation in the mountain areas has increased soil erosion on steep slopes.
- Overgrazing and the collection of bush exposes the mountain territories to a high risk of desertification.
- Protected areas have doubled in size over the past 20 years, and include buffer zones, corridors and national parks, but underfunding and inexperience limit the effectiveness of the protection.

Institutions, governance, knowledge
(one step forward, one step back)

- "Electronic government" systems promote more efficient and decentralized governance, and increase public access to government information and services.
- Mountain countries and provinces are providing better media access, establishing small local data bases and issuing environmental reports online, thus expanding the opportunities for participation in governance.
- Kyrgyzstan passed new laws promoting decentralization and the use of natural resources and energy. The process reached the village level with the establishment of democratically elected Pasture Committees.
- Mountain-focused NGOs advocate for open processes of policy formulation and act to bridge any gaps between new legislation and strategies and the realities in mountain communities.
- In Kyrgyzstan, enforcement efforts could not keep up with the rapid pace of the new legislation passed to respond to evolving local needs and ambitions.
- Tajikistan continues to rely on a command-and-control approach to governing. The legislative process is less transparent and less inclusive.
- The 2002 Bishkek Global Mountain Summit generated momentum for regional cooperation on mountain issues, but the impetus has diminished and the cooperation has been inconsistent.
- The potential for local conflict over pasture and water use has increased, but the support of NGOs and improvements in governance have reduced anxieties.
- The continuing improvement in the efficiency and effectiveness of institutions will aid in the development of a green economy and in the progress towards good government.

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.

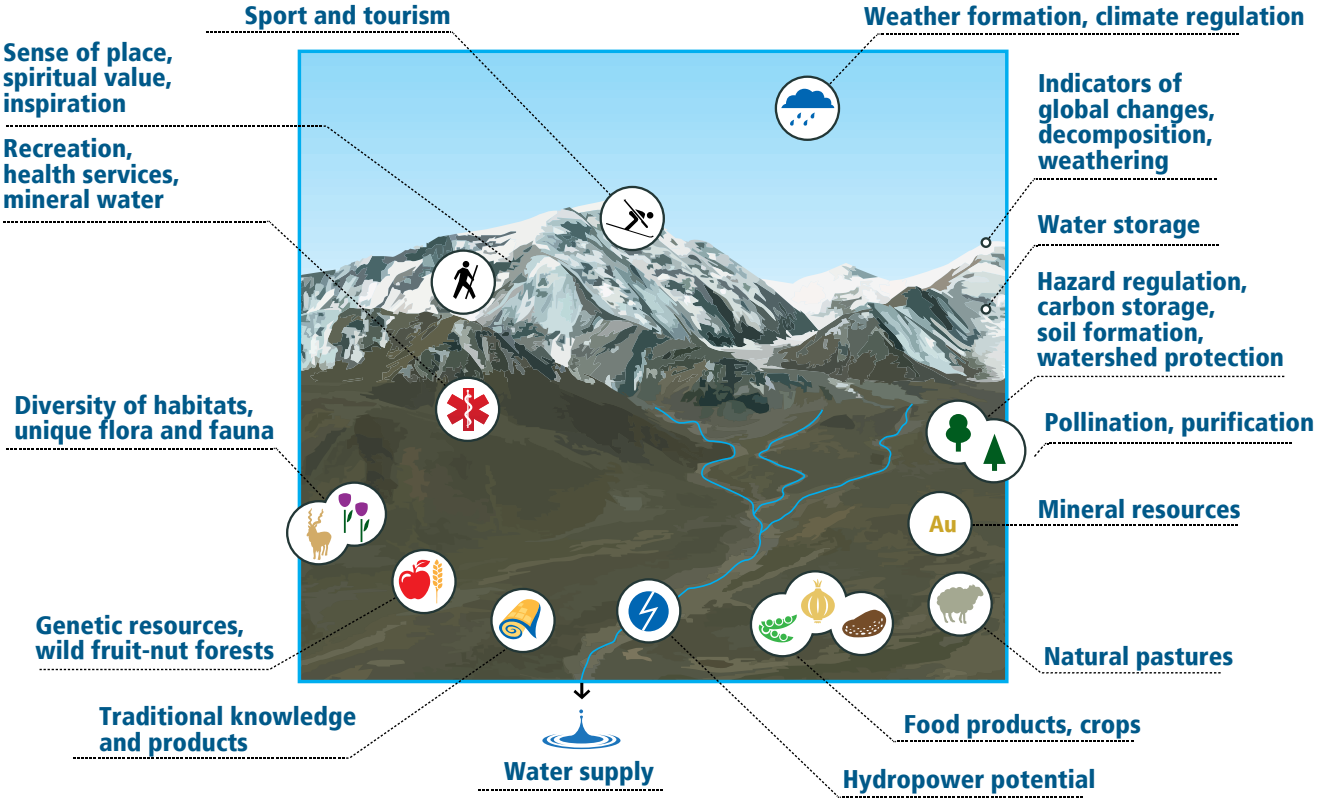
Diverse mountain ranges described by the early Persians as the "Roof of the World" and by the Chinese as the "Heavenly Mountains" have always played a pivotal role in this vast area comprising five countries – the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan, Turkmenistan and the Republic of Uzbekistan. Agenda 21 recognizes the mountain environment as nothing less than "vitally necessary for the survival of mankind." In 2002, the halfway point between Rio and Rio+20, the International Year of Mountains culminated with the Global Mountain Summit in Bishkek, Kyrgyzstan. The Bishkek Summit coincided with an economic upturn in Central Asia, and marks an important moment in sustainable mountain development in the region.

Mountain ecosystem goods and services

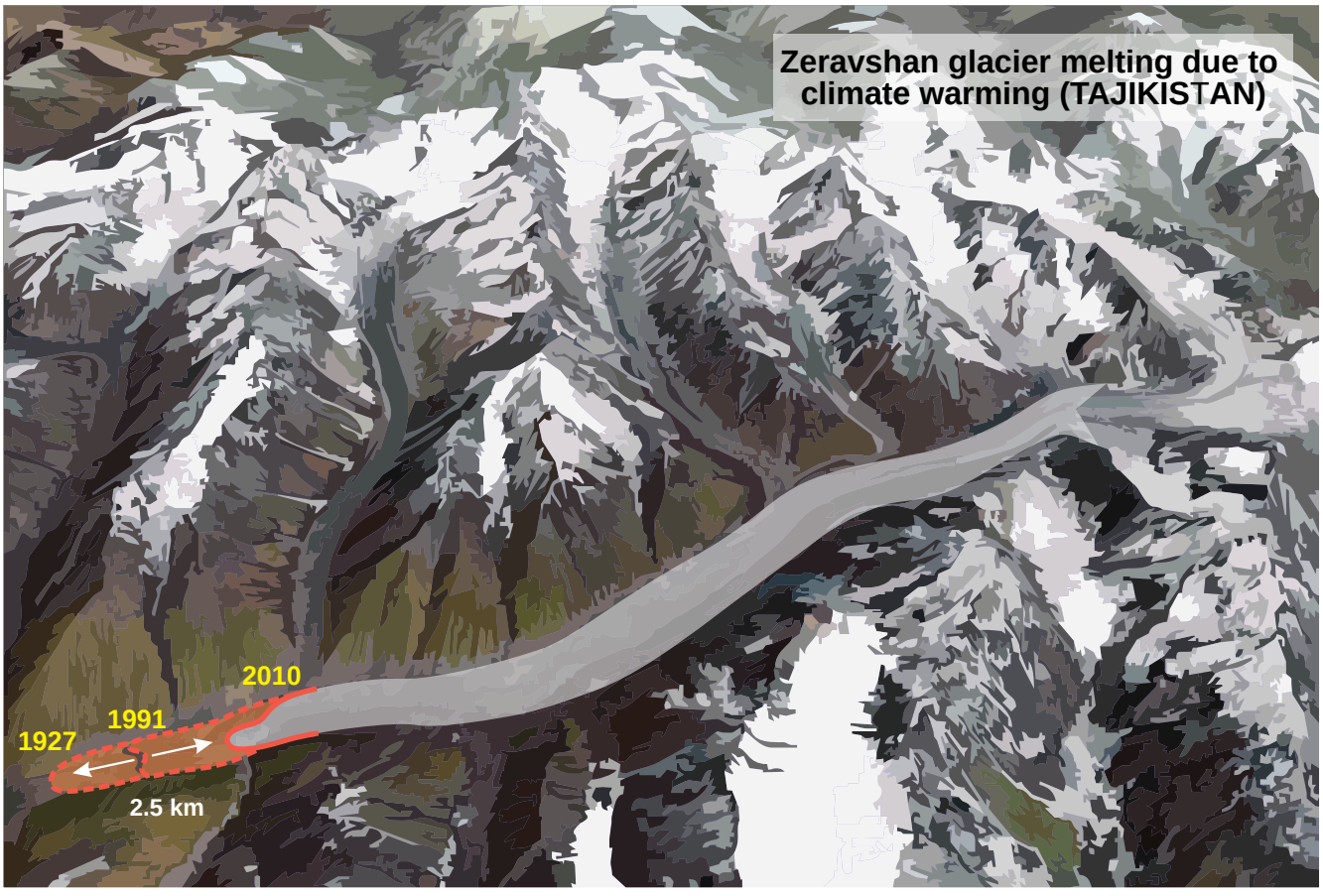
The mountains of Central Asia provide an astonishing array of essential ecosystem goods and services that serve not only the mountain inhabitants but also those in the lowlands and people around the globe. These goods and services, which fall into three broad categories – provisioning, regulating and 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 (2008), the governments officially acknowledge the role of mountains as "water towers" and storehouses of biodiversity.

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, with the largest population in the region, is 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 their country borders, Uzbekistan and Turkmenistan, are highly vulnerable to water shortages, especially the downstream communities.



Zeravshan Glacier, Tajikistan



Source: Tajikhydromet

Background image is based on the digital elevation model adapted from Google Earth

Global warming is slowly decimating mountain glaciers, affecting snow reserves and at the same time increasing the water requirements of basic agricultural crops. A 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 between 1927 and 2010. A projected reduction in the Amu Darya river runoff – the expected effect of climate change in the Pamirs 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. 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. The region is famous for harbouring genetic resources of the wild species of several domesticated plants and animals such as wheat, apples, almonds, walnuts and 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 on 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 medicinal 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 may 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.

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.

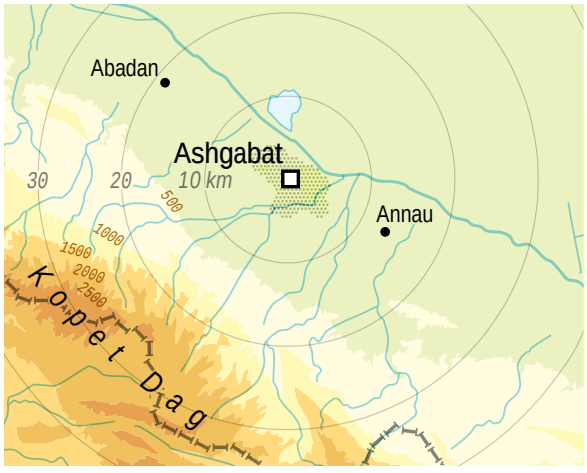
The rich and diverse cultures of Central Asia and the strong sense of place in the mountains attract visitors from around the world, and tourism offers an additional income source for mountain communities.

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.

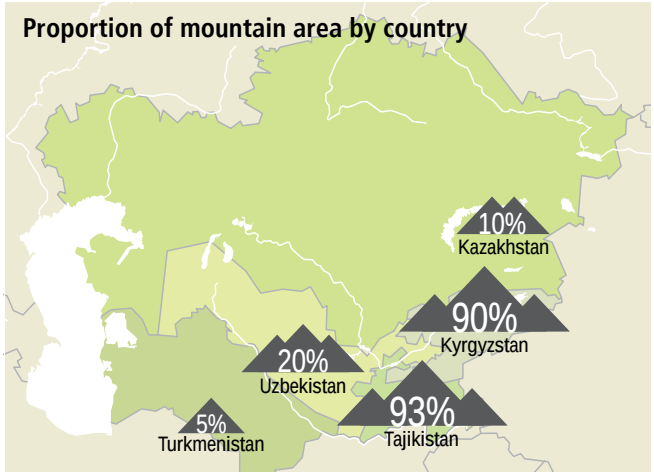
The main drivers of change in the extent and quality of Central Asian mountain ecosystems and their services since the 1950s have been population growth (and associated increasing consumption of natural resources and energy); agricultural developments; changes in land use; industrialization (and associated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

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-water streams are among the most popular weekend destinations for urban residents. In addition to picnics, hiking or skiing in beautiful unspoiled highlands, the key mountain attractions include geothermal sources and spas, kumis horse milk therapy and the sampling of diverse mountain honeys, local herbal teas and traditional products.

Main cities and mountains



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 label their mountain territories as the Alps or the Switzerland of Central Asia.

Mountain ecosystems also cover parts of Eastern Kazakhstan (Kazakh uplands, Djungar Alatoo, Tarbagatai and Altai), south-east Uzbekistan (Western Tien Shan and Gissar) and Turkmenistan (Kopet-Dag and Kugitang), 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 5 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 Alatoo Mountains, together with the Tien Shan, form a 400 kilometre-long natural border with China.

The 300 kilometre-long and 170 kilometre-wide Ferghana Valley separates the Tien Shan from the Pamir Mountains, and extends into Uzbekistan, Kyrgyzstan and Tajikistan. It is the most densely populated and ethnically diverse region of Central Asia, with an average population density of 350 persons per square kilometre. Some districts exceed 1 000 persons per square kilometre, and in 2010 the total population in the valley and nearby mountains exceeded 12 million.

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, spectacular gorges and traditional settlements nestled on alluvial fans. Eighteen distinct ethnic groups are known to occupy this culturally diverse region, and the 200 000 people living there depend largely on subsistence farming and international aid.

Mountain village, Tajikistan

Yurts at sunset, Kyrgyzstan

Glaciers cover 4 per cent of Kyrgyzstan and 6 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 about 20 000 square kilometres if the glaciers within China's territory are included. The glaciers contain frozen water reserves of about 1 000 cubic kilometres – the equivalent of 10 years of water flowing down the Amu Darya and Syr Darya Rivers. 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 and compensate for low precipitation.

The Tien Shan and the Pamirs feature contrasting climates from harsh and dry in the interior and in the eastern corners (below zero annual surface temperatures; 150–300 millimetres average annual precipitation, mainly in summer) to more humid and temperate in the western parts (1 000–1 500

millimetres average annual precipitation, mainly in winter and spring). Many high mountains consist of barren ground, glaciers and other environments inhospitable to humans, but home to wild animals such as the Marco Polo sheep and the snow leopard. Mountains with more favorable climatic conditions possess fine grasslands and forests.

The Nuratau, Chatkal and Gissar-Turkestan mountain ranges of Uzbekistan are covered by protected areas, feature well-preserved juniper forests and are important sources of water for downstream cities and oases.

Kazakh uplands stretch for more than 1 000 kilometres from west to east and feature numerous hills and mountains up to 1 500 metres above sea level. Several rivers of central Kazakhstan, including the Ishim, Nura, Sarysu, Silety and others, originate here. Numerous salty and freshwater lakes dot the uplands.

The Kopet-Dag, also known as the Turkmen-Khorasan Mountain Range, run along the border of Turkmenistan and the Islamic Republic of 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 and dinosaur footprints.

Arable lands occupy less than 0.5 per cent of the total area in the Tajik Pamirs, and pastures another 12.0 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 7 and 5 per cent of their land areas, respectively. Other lands are considered not suitable for agriculture due to harsh climate, poor soils, the 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 extensive livestock grazing on a wide range of pastures. Tourism, mining and trade form important economic sectors that have been gathering momentum in the mountain regions over the past 20 years. Infrastructure development has likewise experienced growth. All of these activities contribute to the revival of the ancient Silk Road in the modern age of globalization.

Population density

Inhabitants per km²

5 50

Populated areas above 2000 metres

Populated areas above 600 metres

Populated areas below 600 metres

Major densely populated areas nearby mountains

Source: LandScan Global Population Database 2007, Oak Ridge, TN, Oak Ridge National Laboratory (→ www.ornl.gov/sci/landscan)

Girls dancing in Tajikistan

Somoni Peak, 7 495 m, Tajikistan

Gissar Mountains, Tajikistan and Uzbekistan

Konortchek Canyon, Kyrgyzstan

Forest in the Pamirs - Hindu Kush Mountains

Lake Sarez, Tajikistan

Lake Kuli-Kalon, Fann Mountains, Tajikistan

Lake Sarychalek, Kyrgyzstan

Surkhob Valley and Jirgital

Savnob village in the Pamirs

Trends in the Central Asia mountain regions over the past 20 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 labour 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. The effects of the trends are both positive and negative, sometimes both at the same time, and progress in the mountains can be characterized as a series of forward and backward steps. 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 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

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 unified 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.

The withdrawal of Soviet support hit remote mountain communities in Tajikistan and Kyrgyzstan particularly hard, and a downward development spiral 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 by almost 50 per cent, 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, but the countries' total external debt has increased. By end of 2011, the external public debt exceeded US$ 2.7 billion in Kyrgyzstan and US$ 2.2 billion in Tajikistan. The peak of the public debt servicing is forecast for 2015–2020 when in addition to the interest on loans the countries will have to repay the principle.

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. Reducing dependency on the state, catalysing initiative and promoting an entrepreneurial spirit entailed a major change in the mentality for both people and institutions .

A period of regional and global cooperation followed the post-Soviet era with Central Asian governments demonstrating a general

1990/1991

The end of the Soviet era

1991/1992

The beginning of the independence era

2012

Increasing fragmentation and border barriers

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 supported the Bishkek Global Mountain Summit in 2002, and through the initiative of Tajikistan, the International Year of Freshwater in 2003.

Uzbekistan, of all the Central Asian States, has retained a system of central planning and management most like the Soviet style. 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.

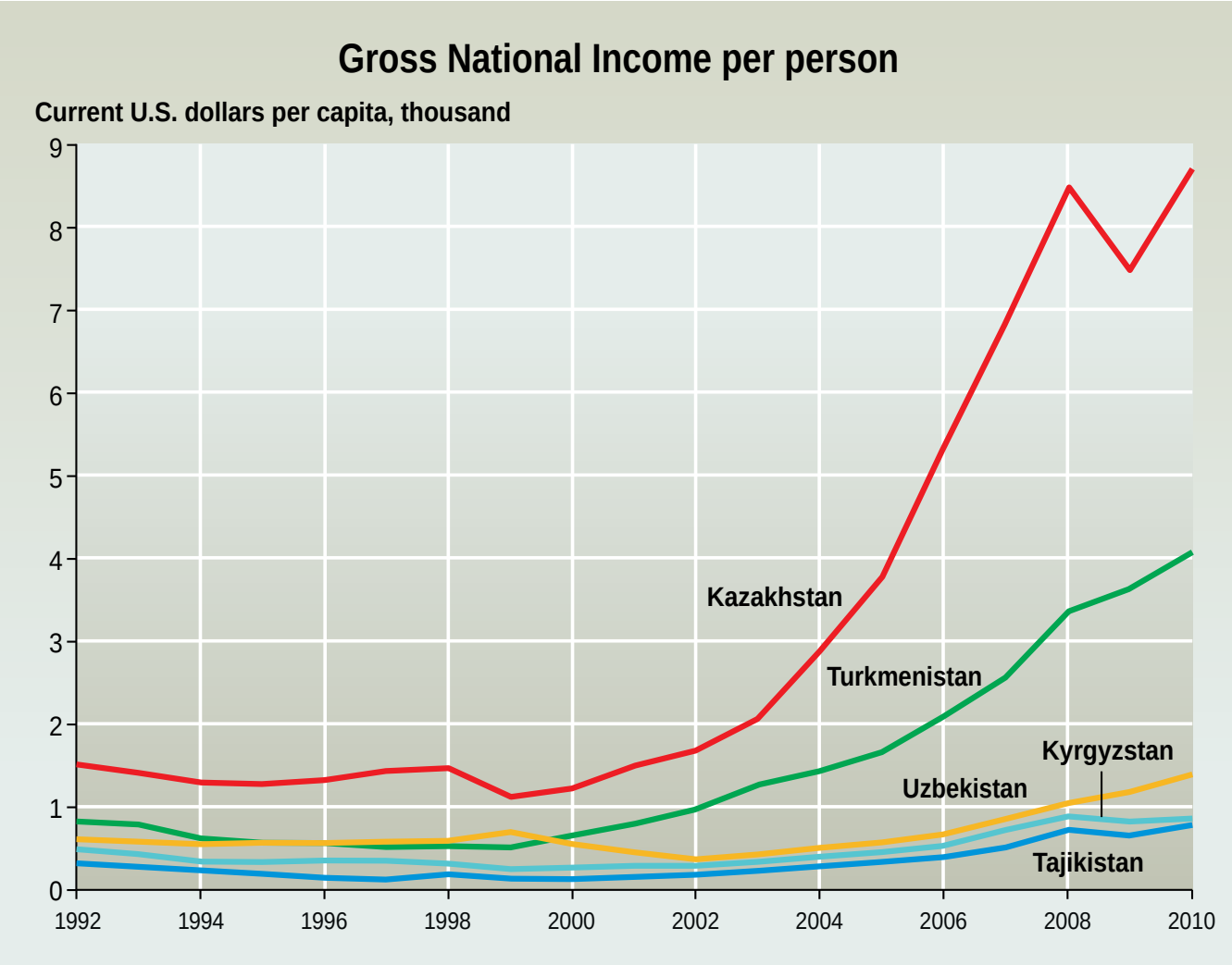
Kazakhstan has similar aspirations. A country rich in oil, gas and mineral reserves, Kazakhstan has experienced an influx of foreign investment leading to a rapid rise in wealth that has brought both challenges and new opportunities. As the bridge between Europe and Asia, Kazakhstan is also working hard 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. Kazakhstan has recently put forward a "Green Bridge" environmental initiative which will be featured at the Rio Summit in 2012. In addition, the ambitious strategic development plan, "Kazakhstan 2020", sets major economic and social targets for the country.

Turkmenistan's abundant hydrocarbon resources are fuelling the country's rapid economic growth and the modernization of its economy, particularly in the textile, food and construction industries. The state controls strategic farming sectors such as cotton and wheat production, but private farmers grow most of the fruits and vegetables, and manage the livestock. The government provides free electricity, natural gas, water and subsidies for many services and consumer products, but political and media freedoms and civil society participation in decision-making in Turkmenistan are tightly regulated.

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 revolution" 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 fuelled the uprising. The benefits of political reform in Kyrgyzstan have come at a cost – dozens of lives were lost, and in the absence of political stability, mountain initiatives languished and investors looked 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 own 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



Source: World Development Indicators (data.worldbank.org/indicator)

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 approach to governing. Government and legislation are less transparent and less inclusive, with limited practical mechanisms 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.

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 and Tajikistan have given up parts of their mountain territories to China to settle border disputes, much to the consternation of the affected communities. As a result, some mountain dwellers have had to relocate – some to lowland areas – and settle in new conditions that do not meet their previous standards. Negotiations continue over some areas still in dispute including unmarked borders from the Soviet era.

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 traded broadly across borders. With the new restrictions, opportunities for local trade and labour markets have significantly declined, while at the same time corruption has flourished due to a growing shadow economy and illegal trade. Additionally, episodes of shelling of civilians by the border guards caused a 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 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 Collective Security Treaty 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 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 the 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.

Fenced border between the former Soviet Union and China in the Pamirs

Political and economic influences

The transition to independence entailed the shift from one player – the Soviet Union – to a multitude of players, among them: five new states; numerous NGOs and advocacy groups; bilateral and multilateral aid institutions; community groups; and vastly expanding numbers of businesses and farms. The participation of all these new players altered the dynamics of development.

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 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.

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, 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.

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 page 120 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 provided initial 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.

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 Global Environment Facility (GEF), 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 and regional sustainable mountain development strategies and a regional environmental action plan in the early 2000s.

The regional organizations that deal with environmental issues in Central Asia – the International Foundation for Saving the Aral Sea, for example – form the basis for continuing regional cooperation on sustainable development. (Institutions and governance in the region are discussed on pages 92-93, and Part 2 includes numerous case studies involving the new players in the region.)

Global Environmental Changes, Globalization and Technology

The effects of climate change

Weather records confirm that the surface temperatures in Central Asia are rising. In the mountains of Kyrgyzstan and Tajikistan, temperatures have increased by 0.3°C–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, the central parts of the Tien Shan and the Eastern Pamir have experienced decreases in precipitation.

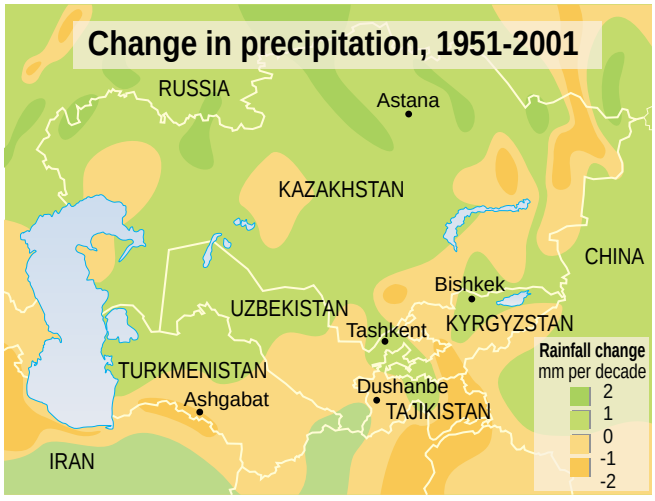
Under likely climate change scenarios for Central Asia, average temperatures are expected to increase by 1°C–3°C by 2050, and, if the global greenhouse gas emissions are unmitigated, could rise by 3°C–6°C by the end of the century. Scientists also project that climate change will reduce precipitation in the southern parts of Central Asia. The precise local impact these weather changes may have, especially in the mountains, is unknown.

The health effects of climate change can be serious. Climate warming and heat stress contribute to cardiovascular disease, increased risk of malaria outbreaks and intestinal infections (typhoid, salmonellosis, dysentery, helminthiasis) due to heavy rainfall combined with inappropriate communal water supply and sanitation.

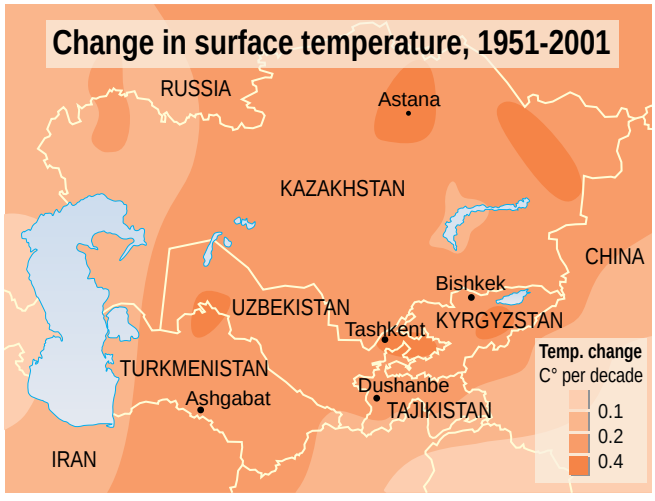
As independence altered the political landscape, global warming is changing the physical landscape, and the points of reference that define some borders in mountain regions are on the move. In the Alps, for example, retreating glaciers, melting permafrost and the resulting landslides are changing the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

Central Asian mountain dwellers and hikers have already reported visible changes in frequently visited glaciers. Many mountain paths that 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 low-altitude glaciers smaller than 0.5 square kilometres have totally melted. Today's rate of glacier loss in Central Asia is 0.5–1.0 per cent per year, and in the last 50–60 years, between 15 per cent and 35 per cent of the Tien Shan and Pamir glaciers have melted, depending on location, size and elevation. This trend is comparable to ice reduction in the European Alps, the Caucasus and the Himalayas, and these trends are confirmed by the professional glaciological and meteorological monitoring.

The degradation of the large Fedchenko glacier in central Tajikistan provides more vivid evidence of climate warming. The glacier, which exceeds 70 kilometres in length and two kilometres in width, shrank by one kilometre in length during



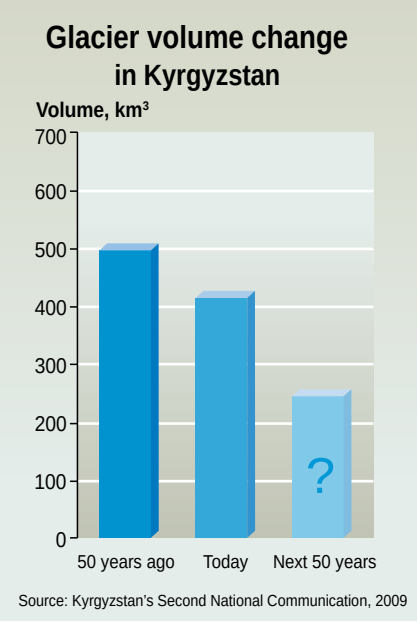
Sources: U.K. Climate Research Unit (data synthesis is available at: www.climatewizard.org), compilation of information from the Second (and First) National Communications



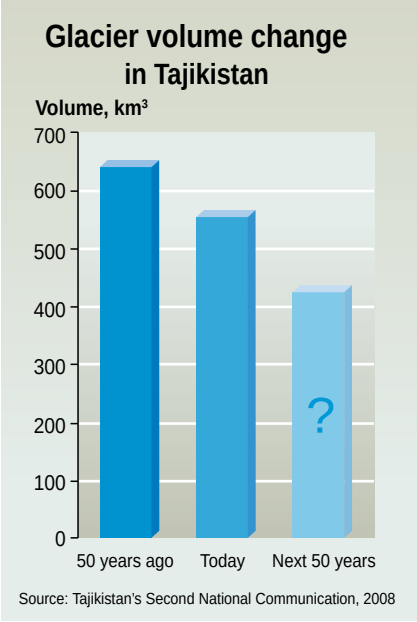
Sources: U.K. Climate Research Unit (data synthesis is available at: www.climatewizard.org), compilation of information from the Second (and the First) National Communications

Fedchenko Glacier, Tajikistan

Petrov Glacier and Lake, Central Tien Shan, Kyrgyzstan



Source: Kyrgyzstan's Second National Communication, 2009



Source: Tajikistan's Second National Communication, 2008

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 ranking is based on current climate variability and the potential impacts on natural disasters (droughts, floods) that exacerbate sustainable development challenges in the areas of poverty and food security, infrastructure, energy and agriculture. Moreover, the high level of male labour migration 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 Program for Climate Resilience. (See page 113 for details.)

the twentieth century, and substantially thinned. In Kazakhstan, the surface and the ice volume of the Tyuyksu glacier, which is the only remaining reference site in Central Asia reporting to the World Glacial Monitoring Service, 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.

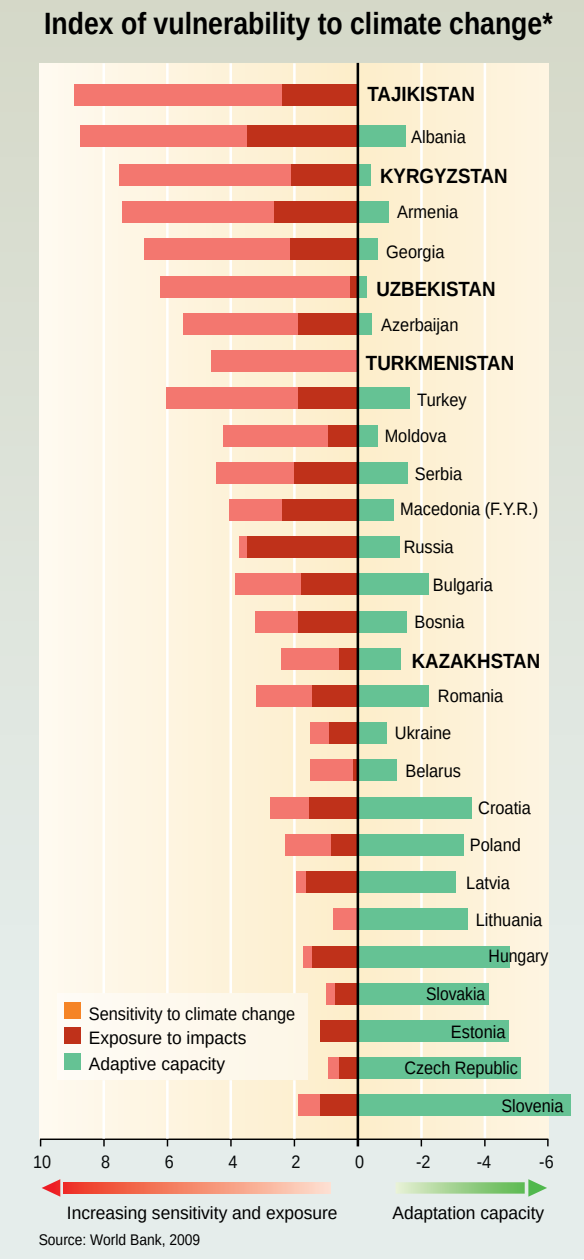
Petrov Glacier in the north Akshirak massif of central Kyrgyzstan, where the country's main gold mine, Kumtor, is located, shrank by almost two kilometres in the past 50 years. A large glacial lake with a surface area of four square kilometres and water volume of 60 million cubic metres has formed on top of its terminal moraine and is spreading steadily. Glacial dam stability, lake levels and permafrost thawing all increase the risk of flooding and its impacts on downstream infrastructure in the upper Naryn.

The mountain snow cover that plays a critical role in the water cycle and in the existence of glaciers is also slowly disappearing. Over the past 20 years, the seasonal snow-covered area of the Tien Shan has decreased by as much as 15 per cent. In summer, rain instead of snow appears more often in the mountains, even at high elevations. Since snow melt and rainfall are the two main sources of water runoff from the mountains of Central Asia, these climate change effects will largely determine the availability of water.

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 a key resource for both agricultural production and electricity generation in the region, and competition for the control of this vital resource is likely to increase as river flows 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 in the Amu Darya and Zeravshan may be reduced by 10–15 per cent and in the Syr Darya by 5 per cent.

The good news is that in spite of reductions in glacier size and volume, the flows of Central Asia rivers have not yet changed significantly. In selected river basins, the intensified glacier and permafrost melting has even increased the discharge of some rivers, while runoff from glacier-free river basins has dropped slightly. Some experts suggest that rock

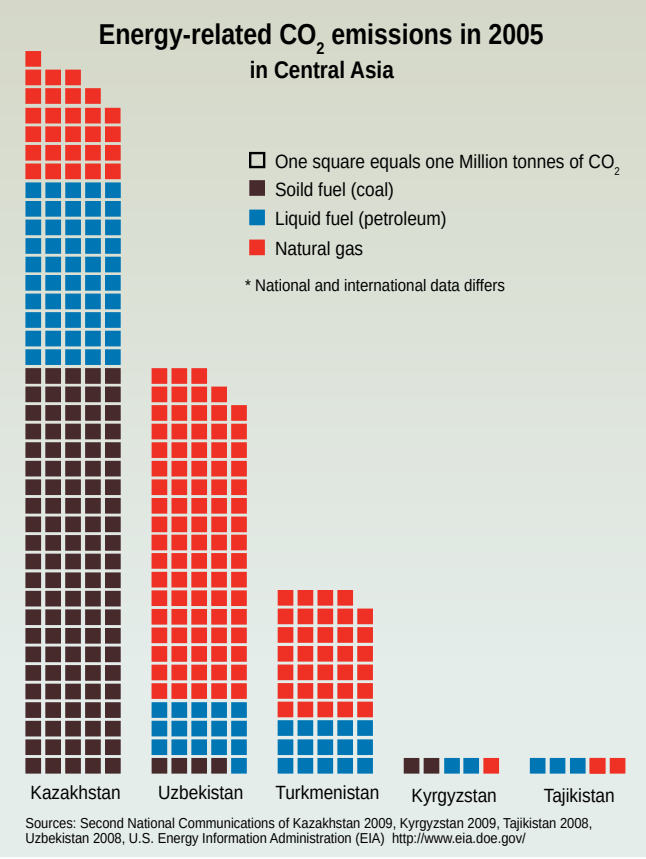


** Vulnerability to climate change is a combination of: i) exposure to hazards, measuring the strength of future climate change relative to today's climate, ii) sensitivity, indicating which economic sectors and ecosystem services are likely to be affected in view of climate change, e.g. renewable water resources, agriculture and hydropower production, and iii) adaptive capacity to climate change, e.g. social, economic, and institutional settings to respond to weather shocks and variability.*

glaciers and high-altitude permafrost contain amounts of frozen water comparable to the ice in mountain glaciers and therefore can compensate for the adverse effects of climate change. 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 Central Asia may provide a glimpse of 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 far from the mountains, especially Karakalpakstan in Uzbekistan. In 2008, hydrological drought and extreme cold in Tajikistan and Kyrgyzstan, combined with the vulnerability of the energy sector, rising food prices and lower access to remittances, created a serious food and energy crisis. Damages amounted to about US$ 250 million in Tajikistan alone. In the context of changing climate and drought impacts, mountain countries are pursuing expansion of large and small water storage facilities.

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 all 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. Climate change has amplified the risks of forest fires and the spread of forest diseases, and scientists warn that the mountain forests of Kazakhstan will be exposed to significant fire risks in dry years due to the impacts of heatwaves. The past 15 years featured particularly high numbers of, and large mountain areas affected by, forest fires.

Tajikistan and Kyrgyzstan have the lowest greenhouse gas emissions in Central Asia (1–2 tonnes of CO_2 per person per year), 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 collectively absorb more than 1.5 million tonnes of CO_2 annually, about 10–15 per cent of the country's total CO_2 emissions. The capital cities and densely populated valleys contribute most of the emissions in these countries. In contrast, energy-rich Kazakhstan, Uzbekistan and Turkmenistan have reasonably high greenhouse emissions per capita (12–14 tonnes of CO_2 per person per year), high total emissions and a lower carbon absorption share.



Natural disasters

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 the melting of glaciers, 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 Lake Issyk-Kul and the densely populated Ferghana Valley, and in the narrow Pamir-Alai valleys. Experts suggest that climate change is likely to increase this number. There have already been deadly floods in the past 15 years, including in the Shahimardan (Uzbekistan and Kyrgyzstan, 1998), Dasht (Tajikistan, 2002) and Issyk-Kul (2008) valleys.

Some large mountain lakes, such as Tajikistan's Lake Sarez, 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.

In Tajikistan and Kyrgyzstan, average annual economic losses from natural disasters reach 1.0–1.5 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.

The mountains of Kyrgyzstan and Tajikistan around the Ferghana Valley served the Soviet Union as important 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.

The next decade or two offer a window of opportunity to ensure that mountain development become more resilient and less vulnerable to climate change. This effort will require improvements in water resource management and land use, as well as in biodiversity protection, and will benefit from improvements in addressing environmental pollution, and a strengthening of interstate cooperation on disaster forecasting and mitigation. Most climate change and natural disaster effects have transboundary dimensions, and regional cooperation among the responsible state agencies, the civil and scientific community and international humanitarian organizations is essential to the development of an effective response. Disasters pose a serious obstacle for sustainable development and could tighten the existing social and economic constraints. The reduction of vulnerability is a key element of the sustainable development process.

Natural hazards

Seismic risk

- high
- moderate
- low

- Epicentres of main earthquakes
- Landslide risk
- Risk of flooding and mudflows
- Risk of major avalanches
- Glacial lakes and lake outburst flood risk areas

Usoi Dam and Lake Sarez, Tajikistan

Dwindling biodiversity

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 forested areas, especially in Kazakhstan.

Many grasslands have been affected by the overgrazing of 20 years ago. During the economic transition, the number of livestock initially declined, and herding practices centred around settlements. This development led to overuse of so-called winter and autumn pastures in the low mountains near populated areas as the regular fodder supply was no longer available or affordable to most households. At the same time, the conditions of summer pastures in the high mountains improved, but the growth of unpalatable grasses and shrubs increased. Currently, throughout the region animal stock is increasing. But the new pasture legislation and regulations developed in Kyrgyzstan that combine a 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.

A notable exception to the general decline in livestock populations was the dramatic increase in the numbers of goats, and the extensive grazing of goats added significantly to the grazing pressures already spreading to mountain forests. In combination with the other unsustainable forest uses – illegal cutting for fuel or sale and forest clearing in floodplains by mining projects – these pressures resulted in the near extinction of medicinal and rare plants and animals important both locally and globally. The development of sustainable forestry practices over the last decade has turned the tide, and the collection of medicinal plants and non-timber forest products is now better organized. Tajikistan and Kyrgyzstan protect most of their mountain forests and prohibit timber felling, and Kyrgyzstan gives communities responsibilities and incentives to take care of fruit and nut forests.

The condition of the ecosystems of the mountain lakes in Kyrgyzstan is alarming. Lake Issyk-Kul, with a surface area of 6 236 square kilometers the region's largest mountain lake, is among those threatened by overfishing and alien species. Just four to five decades ago, Issyk-Kul was a flourishing fishing ground and 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 endangered. Issyk-Kul is on the Ramsar Convention's list of globally significant wetlands and forms the core of a biosphere reserve. The restoration of the lake's ecosystem depends in large part on the restocking of the lake with juvenile endemic fish from hatcheries and on tighter control of illegal fishing.

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 the replacement of old species with new 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 and production costs and reducing profits.

In the Kyrgyzstan stock sector, which benefited from the special attention of the Soviets, some sheep breeds have almost disappeared in the switch from wool to meat production over the last 10–20 years. On the other hand, many milk- and meat-producing cattle from the Soviet era have been replaced by local 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 reverberates 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 manage the situation or to detect the problems that may ensue. 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 participation in the Convention on Biological Diversity 10-year strategic Aichi plan for enhanced cooperation on biodiversity and benefit-sharing. The plan address itself to the underlying causes of biodiversity loss and direct human pressures, and aims to improve the status of biodiversity and enhance the benefits to all from ecosystem services.

Land degradation

Concerns over food security promoted the growth in rainfed crop cultivation in the mountain areas, especially in Tajikistan. This cultivation often increased soil erosion on steep slopes. Overgrazing near mountain villages across Kyrgyzstan and the collection of teresken bush for fuel in the Eastern Pamirs exposed these mountain territories to a high risk of desertification. Soil compaction, reduction of vegetative cover and increased erosion of mountain slopes also contribute to higher sediment formation and silt loading of the rivers with implications for the useful life and effectiveness of the reservoirs and irrigation canals and the operation of hydroelectric turbines.

Roads, rails 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, air pollution and road accidents.

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 separated into three isolated parts in the winter due to lack of year-round roads and to difficult alternative routes. Most of this new expansion is sponsored by Chinese investment or the Asian Development Bank, and managed 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 the valley's accessibility will gradually get better.

In Tajikistan, a new road from the capital, Dushanbe, to the northern province of Sogd has caused controversy. A significant part of this nationally important road is already rebuilt to international standards, and plans call for a total of 300 kilometres, but the development of the road occurred without regard to local concerns. The tolls on the road are expensive for locals, and there is no alternative route. Despite the recent change to differentiated scales for the different types of road users, dissatisfaction among the locals remains high, and further progress may be stymied.

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

Roads and trade

- Railway
- Railway constructed in the last 20 years
- Projected railway
- Major roads
- Major roads constructed in the last 20 years
- Projected road
- Tollroad
- Road inaccessible in winter
- International airport
- Regional airport
- Inactive airport
- Cross-border transport terminal
- Major bazars
- Bridges to Afghanistan
- Recently built tunnel

0 100 200 300 km

Map produced by ZOÏ Environment Network, February 2012

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-kilometre 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 resolution 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 very dynamic. 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, 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 40 000 trading outlets. The local employment generated by the market is hard to estimate, but probably exceeds 50 000 jobs, and the current total turnover surpasses 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. 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 billion per year and more.

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 the 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 (70 000 tonnes in 2010), and trade has expanded to Russia, Bulgaria, 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 the potential of its agricultural sector to supply growing markets in Russia and across the region.

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 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 has lowered the costs and increased the efficiency of labour remittances, which now pass through banks rather than being transferred through friends. The growing capacity of "electronic government" systems allows broader, faster and more efficient and decentralized state governance, as well as increased public access to key government information and services.

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 interest to certain users. More data on mountain communities and their products and services are available on Websites, and there is an increasing trend among mountain provinces to issue regular socio-economic and 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.

The mass media are expanding their environmental coverage, and are increasingly looking for topics with a local connection. This development coincides with the Central Asian Festival of Ecological Journalism, an annual event designed to raise public awareness of environmental protection and the rational use of natural resources, and to promote the development of ecological journalism in the region. The festival sponsors competitions, and publishes the entries online.

The use of geographic information systems enables the production and updating of maps regarding a range of environmental issues, but much of the excellent data compiled in the Soviet era are not yet digitized. Botanical, soil, archeology and other valuable information remains paper-based, and only the basic geologic and meteorological data are being digitized. In addition, many scientists fail to disclose their data, in spite of the availability of outlets for dissemination, and intentionally or not, provide no access or references.

New opportunities in tourism

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.

In the Soviet era, hot springs in and around mountain areas of Central Asia were popular year-round destinations for vacationers and those seeking the healing powers of the waters. Now privately managed, these resorts no longer benefit from Soviet subsidies, and many have struggled to maintain their viability. With proper development and management, the hot springs could return to their previous popularity as major mountain attractions and bring economic and social benefits to the local communities. The springs also provide an opportunity for the bottling of mineral water.

Over the past decade, mountain trekking associations, through experience exchanges with trekkers from other mountain re-

Tourism

- Cultural tourism
- Trekking and eco-tourism
- Petroglyphs
- Summer tourism
- Alpinism
- Winter sports
- Hot springs and spas
- Responsible hunting, wildlife observation
- Major road
- Ancient silk road
- Other tourism roads

gions, have helped develop mountain trails and have sponsored annual mountain cleanups. These associations also offer courses on mountain safety, and hold Alpiniads – climbing and orienteering events intended to improve the skills of trekkers and to instill respect for the mountains.

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.

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 started to change with the 2011 Asian Winter Games, recently held in Kazakhstan, and with new developments in Kyrgyzstan. Hosting Winter Games comes with a major investment in facilities and infrastructure that endures long after the games are over, and Kazakhstan now has venues and systems that can support the development of a winter tourism industry. Kok-Zhailyau, a new ski resort being built near Almaty city, for example, will be the largest winter mountain resort in Central Asia. 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.

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 resented 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 control of their own tourism. The new 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. The Chatkal, Alai and Turkestan Mountains in south-western Kyrgyzstan and the Fann and Gissar Mountains in western Tajikistan have numerous cultural and historical sites and are among the promising regions for cooperative ventures with Uzbekistan.

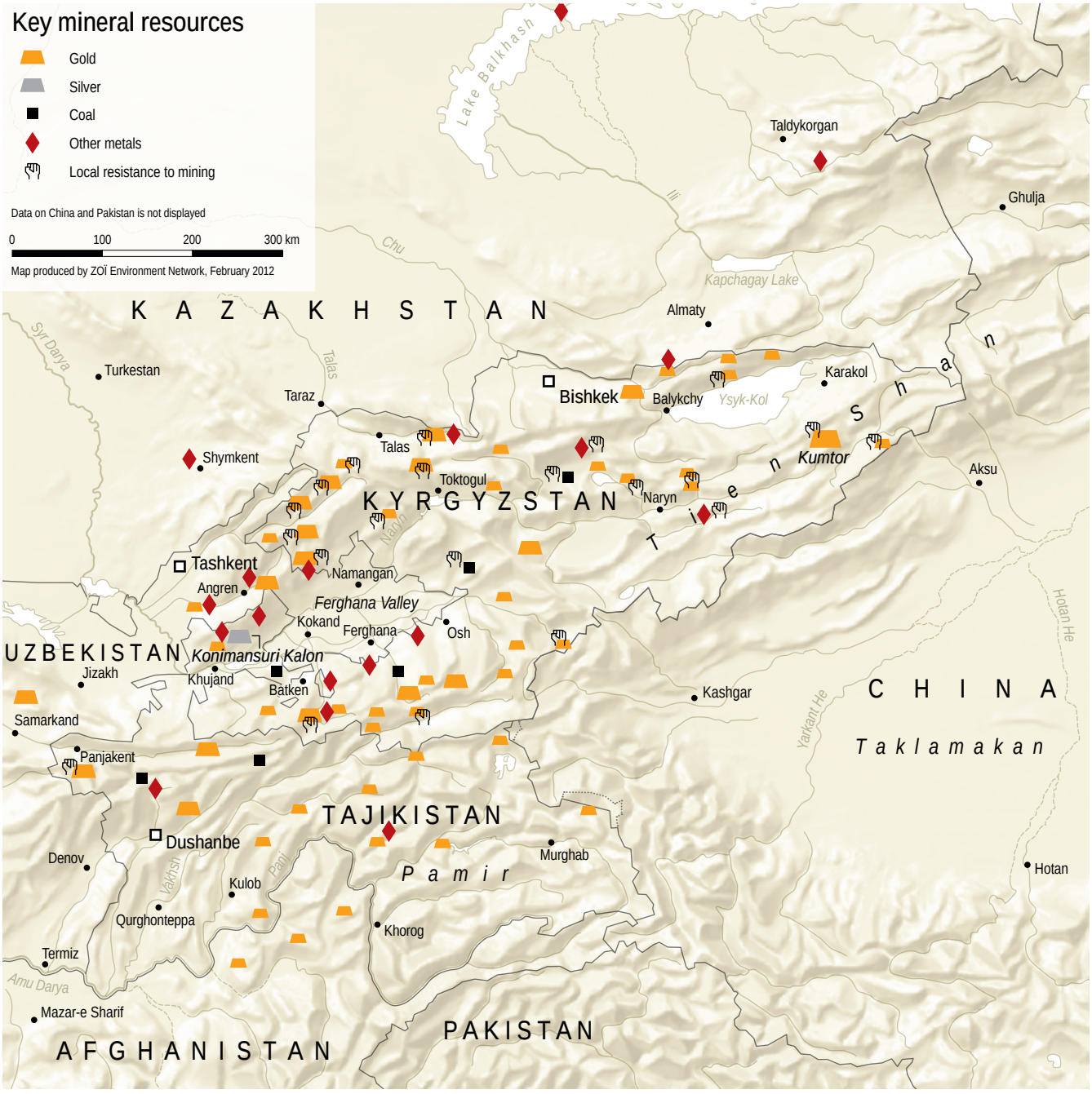
The gold rush and other mountain mining developments

Kazakhstan is the regional leader in minerals production and processing, while Uzbekistan is the world's ninth largest gold producer, but most of their mining projects are located in remote desert areas. In the mountains, the development of the mining sector has been significant over the past decade, particularly in Kyrgyzstan and Tajikistan. At the end of the Soviet era and into the 1990s, there was only marginal 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 up to 30 per cent in Kyrgyzstan (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 semi-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 eastern 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 15–18 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 stand as stark reminders of possible grim scenarios not to be repeated. Now mining operators often encounter local opposition wherever they go, and find that environmental impact statements and the necessary permissions do not easily overcome the hostility and distrust they face.

The central government's failure to understand local demands and its slow response to adjust its 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 until recently 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, and the commitments of one company may no longer be honoured by the next. Broken promises, inequalities in salaries, dubious local staff hiring procedures and potential environmental damage have hardened local opposition, and the central government continues to underestimate the discrepancies between its plan for the mining sector and the reality that has ensued. NGOs have been quick to see the problems and have initiated dialogues between operators and locals.

Regulations on mining are sometimes contradictory to environmental protection priorities: mining is allowed in river beds and sometimes even in the buffer zones of protected nature 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 products. 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, local elites have taken advantage of the situation through speculations on environmental grounds that seem whipped up with the goal of extracting a bigger share of future profits or of taking over and reselling the mining license. The tension between local environmental interests and the mining sector mirror the experience in Western countries in previous decades. The stakes are high: if political stability and consensus on social-environmental issues in the Kyrgyz mining sector are achieved, the country's gold production could double within the next few years. The Kyrgyz experience may be instructive as Tajikistan moves forward with development in the mining sector.

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. Chinese investments and technology will likely support recently announced plans of Tajikistan to develop its own alumina mining and to expand cement production capacities across the country.

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.

Kyrgyzstan still operates a mercury mine from the Soviet era, and while the operation is inefficient and mercury has a high local and global environmental impact, the mine is important 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 is looking for opportunities to help Kyrgyzstan phase out its mercury mining without damaging local communities socially or economically. The replacement of mercury mining with gold extraction or other business alternatives is considered an environmentally and socially suitable alternative to the continuation of primary mercury production.

Finally, both mountain countries have experienced a boom in small-scale mining for placer gold, particularly in Kyrgyzstan. Artisanal miners are a heterogeneous group of men aged from 16 to 60+ years, and their reasons for mining are varied. For some, mining was and still is the main source of cash income. Gold helped 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 the mountains. In any case, artisanal gold mining is beyond the control of central and local authorities and the increasing degree of labour mechanization and the use of mercury for fine gold extraction are growing threats to the mountain environment.

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 an 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 the Central Asia-South Asia Electricity Trade and Transmission (CASA-1000) or other projects. Currently, Tajikistan has about 5 000 MW of installed hydropower capacity and Kyrgyzstan has 2 700 MW, less than 10 per cent of their 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 on the Vakhsh in Tajikistan and on the Naryn in Kyrgyzstan. Additional plans and projects contemplate development on non-modified major rivers such as the Panj, Zeravshan and Obihingou in Tajikistan and the Suusamyr and Saryjaz in Kyrgyzstan.

In view of the growing national energy demand, the mountain countries of Central Asian have chosen to increase their power generation capacities using both renewable (mainly hydropower) and non-renewable energy sources such as coal, deposits of which are accessible and affordable in the mountain countries. Coal-fired plants would serve as a short-term solution to overcome energy deficits and increase energy security. The emerging trend towards increasing use of coal for power generation and in cement production and other industries is a concern, however, since this use adds to the national carbon footprint and causes local air pollution.

Frequent country-wide shortages of fossil fuels, chiefly gasoline, diesel and natural gas, which are imported from Russia, Turkmenistan, Uzbekistan and Kazakhstan, are pushing the mountain countries to seek alternatives. Moreover, fuel prices in the Central Asian mountain countries are very high and constrain local business profits. Kyrgyzstan sees biofuel plantations and home-grown fuel production as a solution. The country's biofuel strategy foresees the initiation of biofuel crops in the near future. Currently, populations in the mountains often uses dry biomass (wood and dung) to meet 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 focus on large-scale projects has left governments and the international development banks vulnerable to 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.

Finally, corruption is reducing the development potential for the largely state-owned energy sector. Illegal connections to the grid are not uncommon, and the industrial sector enjoys privileges while some communities have no service. For the past 20 years, the system has operated without transparency and without consultation of NGOs or citizens, but in July 2010, Kyrgyzstan launched an initiative on transparency in the energy sector to ensure the public participation in decision-making and the accountability of energy companies.

Actual and potential hydropower facilities

Hydropower facilities with small water storage (0.01-1 km³) and run-of-river schemes:

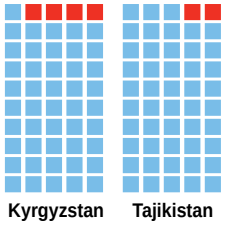
- > 500 MW
- < 500 MW
- proposed

Hydropower facilities with significant water storage capacity (> 1 km³):

- > 500 MW
- < 500 MW
- proposed

- Existing large dam
- Proposed large dam
- Transmission line
- Projected transmission line

Key sources of electricity



Kyrgyzstan Tajikistan

Fossil fuels *Hydropower*

Note: each square equals 2%

Source: Resources and Energy Atlas of Russia, 2006; Electric power sector of Tajikistan, Barki Tojik, 2011; Energy map of Kyrgyzstan, Kyrgyz Ministry of Energy 2011

Kurpasai hydropower plant, Kyrgyzstan

Security and Tensions

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 deaths 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.

Kyrgyzstan witnessed violent Kyrgyz–Uzbek inter-ethnic clashes in its southern Osh province as early as 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 the 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 hideouts for fighters thus making combat more challenging.

Warfare in mountainous countries has had not only 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 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 between Kyrgyzstan and Tajikistan for over 30 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 international 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 (also known as Tigrovaya Balka) strict nature reserve.

Drug trafficking and the ongoing conflict in Afghanistan also raise continuing security concerns. 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 weakened the mountain countries of Central Asia. Unity, rule of law, justice and a national consensus on how to proceed would strengthen these nations and substantially contribute to sustainable mountain development.

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 relations between the Central Asian countries and China. Xinjiang refugees seeking protection in Central Asia have prompted stricter border security.

Finally, one remarkable achievement in the past 20 years in the field of global security is Kazakhstan's decision to give up its nuclear arsenal (the world's fourth largest) left by the Soviet Union, and to close the Semipalatinsk nuclear test site permanently. The more than 450 underground, surface and airborne nuclear tests conducted here over several decades led to adverse effects on the environment and human health. Following a resolution on a nuclear-weapon-free Central Asia, Kazakhstan is now promoting a Universal Declaration of a Nuclear-Weapon-Free World at the UN.

Conflict and insecurity

- Persistent insecurity
- Tajik civil war 1992-1997: humanitarian and environmental crisis
- Main routes of drug smuggling
- Flow gauging stations: limited operations due to insecurity and strict border regime
- International coalition in Afghanistan
- Local conflicts and acts of violence
- Damage to environmental observation and conservation sites resulting from conflict
- Nature resource disputes
- Russian military site
- German military site
- US military site
- French military site

Sources: Russia's Military Capabilities, Margarete Klein, 2009, German Institute for International and Security Affairs (→ www.swp-berlin.org/fileadmin/contents/products/research_papers/2009_RP12_kle_ks.pdf)

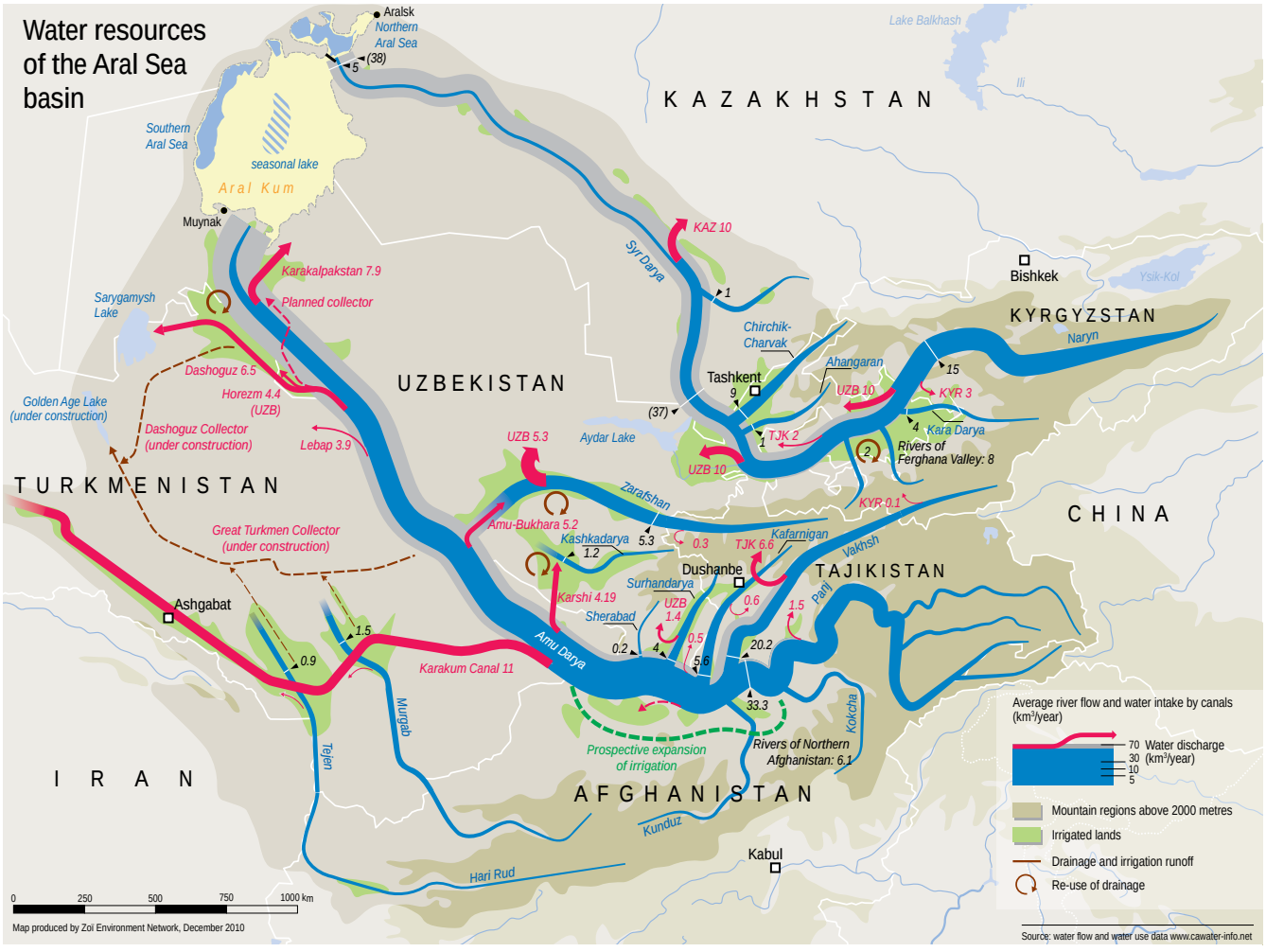
A new era in highland–lowland relations

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.

Part of the conflict relates to the timing of the release of water: lowland agriculture needs water in the summer and fall, and the mountain countries need the water for power generation primarily in the winter. The retention of water through the summer and the larger release of water in the winter have resulted in flooding on the Syr Darya River.

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 other mineral 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 and cooperation in the small river basins of the Ferghana Valley, are encouraging examples of modern cooperation. In the other mountain corner of Central Asia, ties between Afghanistan and Tajikistan on sustainable use and conservation of mountain ecosystems and watershed management in the upper Amu Darya river basin are gradually strengthening.

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, Pakistan and India as dominant regional players and major water and energy consumers 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 consider Afghanistan, whose interests in the basin have only recently begun to gain prominence.

Nurek Dam and Reservoir, Vakhsh River, Tajikistan

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 and the 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.

Herding is the main livelihood for Kyrgyz mountain dwellers. The access to Kyrgyz pastures by the herders from neighbouring Uzbekistan and Tajikistan was formerly regulated by local arrangements, but Kyrgyz legislation introduced in 2009 calls for agreement between the countries at the central level. In spite of the new opportunities, the introduction of the new pasture law has increased tensions over pasture use in near-border regions, especially around enclaves in the Batken Province of southern Kyrgyzstan.

While the demand for affordable energy has increased with population growth, the withdrawal of support from Moscow has left the region with an 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. Energy appears to be more affordable in Kyrgyzstan than in Tajikistan. Most rural families in Tajikistan, especially the mountain regions, seem to spend three quarters of their income on food and energy. Local initiatives have given rise to a number of generators (solar heat, biogas) and small-scale hydropower supply facilities, but the state generally still holds a monopoly on national power resources, and most communities do not have reliable and affordable access to energy. In Tajikistan, about one million people spend much of the winter without electricity and nearly half of all households rely on firewood and dung for winter heating. In Kyrgyzstan, households have responded to the growing energy deficit by significantly increasing coal consumption.

The sad irony is that in spite of the huge hydropower potential, the populations of both mountain countries experience – especially in winter – energy deficits and recurrent electricity cut-offs that negatively affect businesses, well-being, health and education.

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 staple goods are more expensive, and mountain populations are at risk of malnutrition and related health issues. In Tajikistan, an increase in the proportion of bread consumption corresponded with the persistence of malnutrition, and neither Tajikistan not Kyrgyzstan has yet achieved food sufficiency. The importance of the links between food security and energy security has led the United Nations and other international aid organizations to adopt a compound crisis analysis that considers food and energy as related problems that require integrated solutions.

Social Dynamics

Natural resource ownership, management approaches and property rights

As part of the transition from collective farming to a market economy, Central Asian governments launched a land redistribution process that resulted in agricultural lands passing into a quasi-private ownership or long-term private rental. This privatization turned the management of formerly collective farms over to individuals, villages or groups, and the number of farming units skyrocketed. 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 the state retains official ownership, private management systems such as long-term individual leasing are now widespread.

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 attitude regarding crop selection.

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, Tajikistan's animal husbandry (meat production, eggs, milk) and food production exceeded 1991 levels, while Kyrgyzstan's food production increased, but its animal husbandry 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 350 000 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 Shan, and a 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.

With the change in land ownership, the income gap widened between those who acquired sufficient land for stock management and domestic animals and those who did not. The disruption of state-provided agricultural services, the rise in the number of smallholder herding and the lack of self-organization limited mobility and, subsequently, led to the breakdown of the transhumance system. People without enough land and a few animals could not manage their herds, and could not replace the winter fodder provided by the Soviets. Eventually many families lost their animals. The Soviets had provided economic and agricultural management services, and with independence farmers were responsible for their own management, animal disease control, winter fodder and access to markets. After 20 years many farmers now have the necessary business skills, but the income gap persists.

The state continues to manage some mountain hunting areas, and collects license fees and taxes, but the trend is toward private ownership and management. The well-run private hunting reserves that are careful to prevent illegal hunting maintain the highest wildlife levels. The corrupt private and state hunting reserves, in contrast, pursue aggressive short-term goals with no attempt to balance hunting with the numbers of animals. As a result, these reserves enjoy a short-term financial gain at the cost of dramatically reduced animal populations.

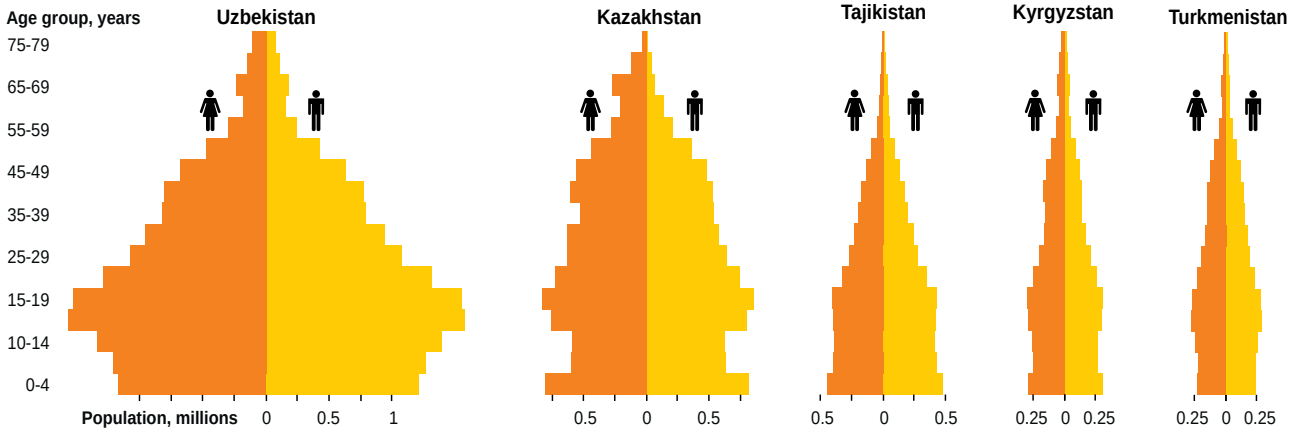
With license fees that run from US$ 10 000 to US$ 15 000, the potential for local income from international trophy hunting is significant. Tajikistan has established a revenue sharing scheme with locals, but Kyrgyzstan, which has a low regard for international hunting, has not yet done so.

The introduction of Integrated Water Resources Management (IWRM) water management associations and river commissions changed the approach to water management over the past 20 years. The previous approach relied on administrative principles and political boundaries; the new approach relies on hydrographic boundaries and local water users. The IWRM method has already enjoyed success in small basins, and in the Ferghana Valley, IWRM demonstrates how to manage resources more effectively with fewer disputes.

Demographics, poverty and labour migration

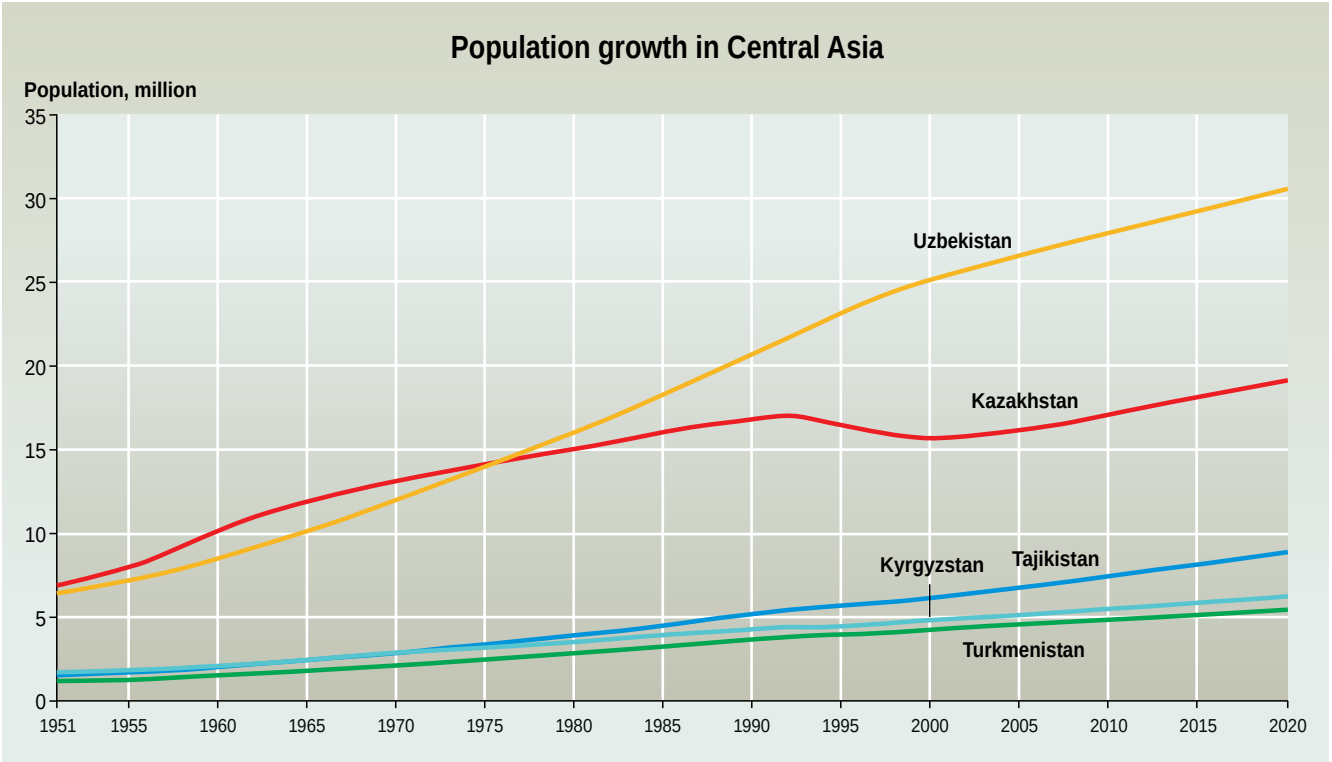
Over the past 50 to 60 years, population growth and an increase in life expectancy have led to dramatic demographic changes in the mountain regions of Central Asia. The population in Tajikistan, for example, increased from 2.1 million in 1960 to 7.5 million by 2011 (including 1.6 million since 1990). 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. In Tajikistan the average age is 22 years; in Kyrgyzstan, 27 years; and in Kazakhstan, 30 years.

Population pyramids: Central Asian nations in 2010

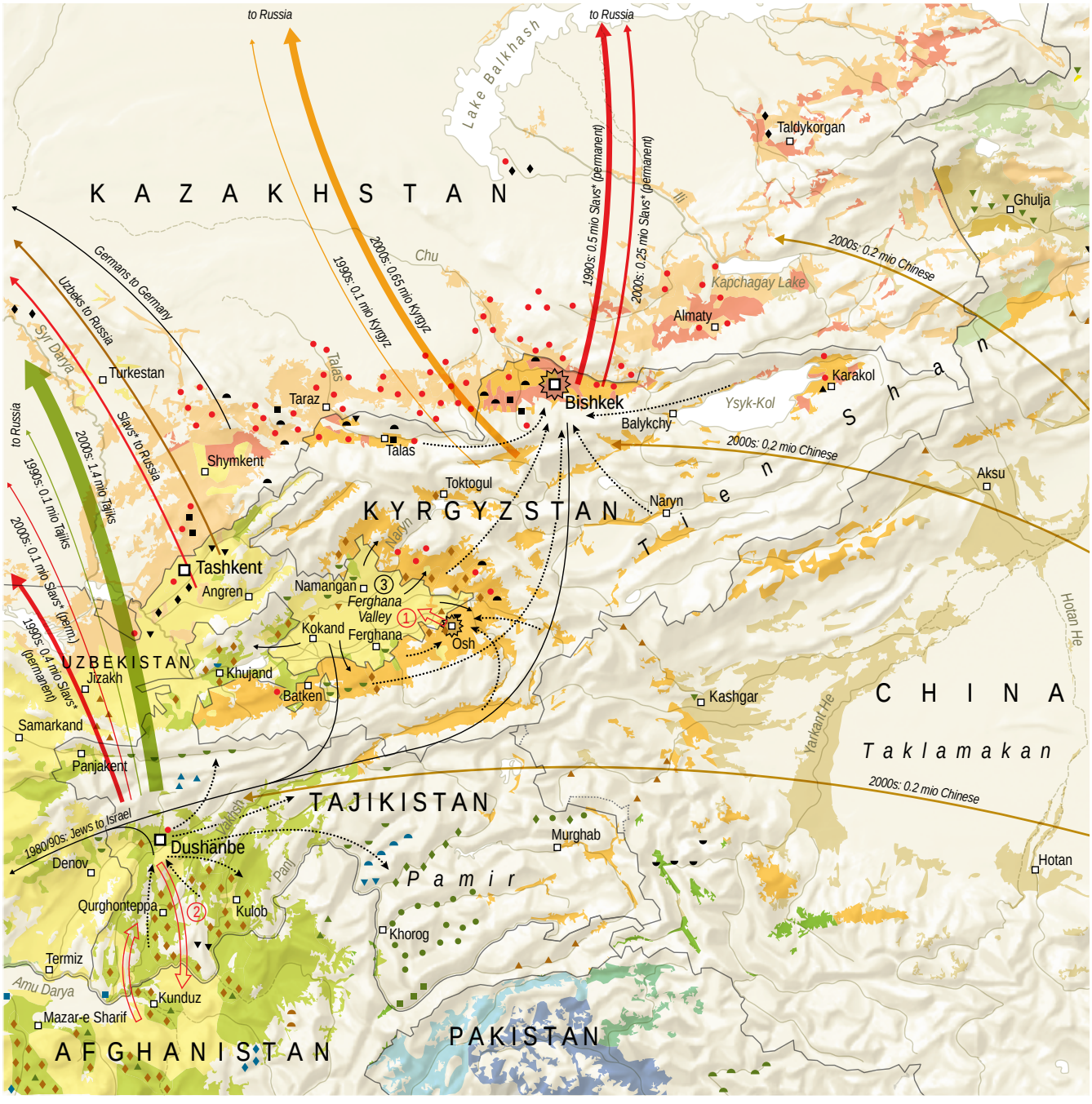


Source: U.S. Census Bureau (www.census.gov/population/international/data/idb/), data for 2010

Population growth in Central Asia



Source: U.S. Census Bureau (www.census.gov/population/international/data/idb/), data for 2010



Languages and migration

- Uzbek
- Kyrgyz
- Tajik
- Kazakh
- Russian
- Uighur
- Burushaski
- Sarikoli
- Kho
- Shina
- Mongol
- Xibe
- Karalpak
- Balochi
- Ukrainian
- Korean
- German
- Dungan (Hui)
- Tatar
- Yaghnobi
- Arab
- Hazaragi
- Yazgulyam
- Rushani
- Bartangi
- Shugni
- Ishkashimi
- Balti
- Chinese (Han)
- Afghan (Pashtun, Pathan)

Informal settlements growth

* Slavs: mostly Russians, but also Ukrainians and Belarussians

Internal migration

① Uzbek refugees from Southern Kyrgyzstan

② Refugees of the civil wars in Tajikistan and Afghanistan (1990s)

③ Labour migration in the Ferghana Valley region

100 200 300 km

Map produced by ZOÏ Environment Network, February 2012

Source: Weidmann, Nils B., Jan Ketil Rød and Lars-Erik Cederman (2010). "Representing Ethnic Groups in Space: A New Dataset". (→ http://www.icr.ethz.ch/research/greg)
All figures on migration are estimates

As small, mountain, poor, geographically isolated and landlocked countries with predominantly agricultural economies and rural populations, Tajikistan and Kyrgyzstan are 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.

Labour income and social transfers (pensions and 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 sectors in Russia and Kazakhstan are major sources of employment for labour migrants coming from Tajikistan and Kyrgyzstan.

Unemployment and subsequent urban migration have changed the social fabric of many mountain communities. The Soviet withdrawal led to a major deficit of jobs, and many 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 and placed an additional burden on women, who increasingly take the lead in households, while village elders 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, more than 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 to their home countries and often exceed the amount offered in international aid. The value of remittances to Tajikistan officially reported by banks in 2010 exceeded US$ 2.5 billion, an amount equal to one half of the national budget. In Kyrgyzstan, the value of remittances is lower than in Tajikistan, but still significant – US$ 1.0 billion.

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 stood at more than 30–40 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 over 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 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 – most of them work illegally, do not speak Russian, have no awareness of labour regulations and have low qualifications. Russia's plans for tightening immigration policies on temporary labourers could force many migrants, especially those with limited command of the Russian language and the lack of basic skills and vocational education, to return home.

Urbanization

The urban populations in the mountain countries of Kyrgyzstan and Tajikistan in the Soviet era were a small percentage of the total populations. After independence, Kyrgyzstan experienced a movement of people from poverty areas in the mountains to urban centres, but new residential construction did not keep pace with the influx of new residents, and the resulting informal settlements exacerbated the existing urban problems. Bishkek and Osh are surrounded by these informal and unregulated settlements that developed chaotically and without regard to seismic hazards, and the cities now face the questions of how to integrate the settlements safely into the city structure and how to provide infrastructure and services.

Within its borders, Tajikistan experienced a migration in the opposite direction: from lowlands and urban areas back to the mountains. During the 1950s and the 1970s, the Soviets orchestrated the 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 in the 1990s and the availability of wood for heating and land for food cultivation were additional factors encouraging people to return to the mountains.

The Tajikistan rural population has grown over the past 20 years, but some of the same problems experienced by Kyrgyzstan are present – urban construction has not kept pace with population increases, and although privatization has led to higher quality in some expensive developments, most builders opt for cheaper solutions of lower quality. Owner-built houses in both rural and urban areas are not in conformity with the formal building regulations and until recent years, most new construction failed to meet minimum standards of earthquake resistance and energy efficiency. The energy-intensive construction sector offers huge opportunities for improvements in efficiencies. Kyrgyzstan and Tajikistan have already introduced new energy-efficient requirements for lighting and are about to enforce new energy standards for the building sector. Waste management is another problem – smaller communities lack waste management systems, and larger ones, such as the capitals and main cities, may have the systems but do not have proper landfill facilities.

Urban services have dramatically changed in the past 20 years. In the 1990s, most of the urban housing stock was taken over by city residents, and semi-private services and homeowners' associations have largely replaced the Soviet-era state municipal management and maintenance companies. Urban service providers in Kyrgyzstan and Tajikistan, however, often operate below cost-recovery levels, and revenues from tariffs cannot cover the costs of upgrading the deteriorating urban infrastructure. Water losses in degraded urban pipelines are rather high, and many urban wastewater treatment facilities are not functioning properly (especially for biological treatment) and generally perform less effectively than two decades ago. Urban water consumption has generally declined mainly due to changes in the industrial and economic profiles of urban areas, and partly due to the introduction of individual water meters. (Urban drinking and industrial water systems were often connected, so a decline in industrial operations has resulted in reduced water consumption.)

Two decades ago, industrial air pollution was one of the major urban environmental issues. Nowadays, air pollution associated with road traffic density is one of the major factors undermining air quality, and traffic congestion is limiting the mobility of urban residents and commuters. This is particularly evident in Almaty city in the foothills of the Zailisky Alatoo Mountains. With a population of more than 1.4 million, Almaty is the largest urban agglomeration in Kazakhstan. Pollution from traffic is exaggerated by specific meteorological conditions such as mountain–valley winds and temperature inversions in autumn and winter. The introduction of city metro, bus priority lanes and the enforcement of better fuel standards are some of the ongoing response measures in Almaty.

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 low. The abandonment or 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 (98–99 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 when the declining quality of education becomes an obstacle for sustainable development. The numbers 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.

The competitiveness of countries in today's high-tech and globalized world is dependent on investment in human capital. Resource management skills, a sense of responsibility and knowledge of and respect for mountain ecosystems are key factors for success in pursuing a 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. Tajikistan is planning major reforms in basic education by introducing a 12-year study cycle with options for specialist courses and certified technical training. Issyk-Kul State University in Kyrgyzstan and Khorog State University in Tajikistan historically lead in mountain-focused higher education, and the International University of Kyrgyzstan has created the UNESCO Chair on sustainable mountain development. The University of Central Asia is now working to increase the focus on mountains, and organizations such as the Aga Khan Foundation are providing assistance to mountain societies to develop both traditional and modern knowledge. (See pages 118-119 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 generally falling, but in the high-mountain city of Naryn, the rate is twice that of Bishkek. The risk of malaria, tuberculoses, HIV/AIDS and other dangerous diseases remains high, and increases with poor living standards, increased migration and inadequate preventive measures and health services. Tajikistan is the only country in the 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 and anthrax) in the southern mountain areas, and domestic animals are sometimes poisoned by grazing on land polluted in the Soviet era.

Religion, culture, ethnicity and traditional knowledge

The Tien Shan nomadic communities have deep roots in Tengriism, 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. The scenic mountain oasis of Ulytau, situated among the arid grasslands in the geographic centre of Kazakhstan, and its Auliye-Tau Sacred Mountain, comprise an ancient Kazakh shrine, which is covered with beautiful legends and rock engravings. Mountain areas of Central Asia have numerous mazars, which are among the 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 that are named after saints, and that 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 live 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. Changes during the economic transition affected nutrition and led to a 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 the 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.

Sulaiman-Too Sacred Mountain in Osh, Kyrgyzstan

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 pages 120-121 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 cultures 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.

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 oppor-

tunities for food-processing, for example, and the mechanical solutions are too expensive, so some mountain communities have tried to re-establish 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. These countries' 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 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 and east–west 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. The increasing number of Chinese workers in both countries may create antipathy among residents due to labor competition, wage inequalities and cultural differences.

Russian remains the international language of Central Asia, and in Kyrgyzstan – where the links to Russian investments are historically stronger – the Russian language remains well known in both metropolitan and rural areas. Russian was common in Tajikistan 20 years ago, but now, because of the stronger national identity and legislative requirements regarding national language, Russian is fading away. But Russia is the main receiving country for Tajik migrants, and Russian is the language of regional meetings, and Russian language skills are therefore still important to many people in Tajikistan. At the same time, the Chinese language is becoming more popular among students and traders who plan to develop business connections or participate in China-linked trade, mining and energy projects in Central Asia.

Soviet environmental legacies and emerging conditions

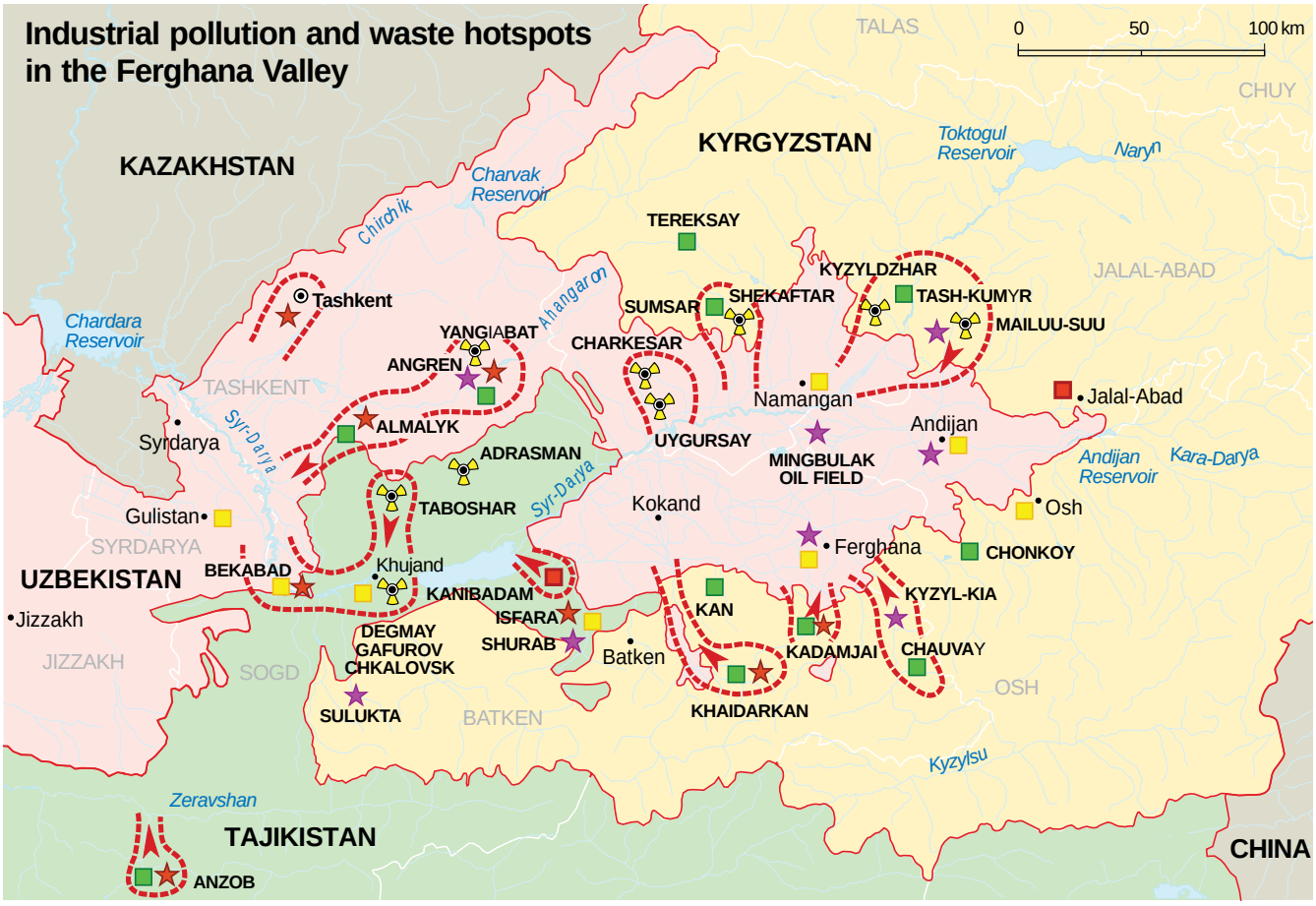
The trends discussed in the previous section all have a bearing on the environmental, economic and social conditions in Central Asia, as do the environmental legacies left by the Soviets. This section is not an exhaustive assessment of those legacies, but rather a consideration of the more visible and 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 areas 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 the region. Abandoned and active mining sites and metallurgy industries cause environmental problems in the Altai Mountains of Kazakhstan and in the Irtysh River basin, where the country's mining sector was born in the eighteenth century.

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. Russia is participating in negotiations and may commit to helping resolve the problems.

In Kyrgyzstan, abandoned uranium tailings are a national priority both politically and environmentally, but because of the scale of the problem the resources needed are overwhelming, 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.

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 in rivers are slowly recovering as a result of the changes in business operations and land use. Similarly, the water quality in Lake Issyk-Kul is improving as a result of reductions in fertilizer use because the agricultural runoff no longer carries away high levels of chemical residues. Currently, illegal fishing, overfishing and invasive species are the main threats to the Lake Issyk-Kul ecosystem.

Another positive environmental development in the independence era is the expansion of protected areas in the mountains – a doubling in the size of the total area protected in Tajikistan and Kyrgyzstan – and the application of particular types of protection, such as buffer zones and corridors, to local circumstances. Currently, all the countries of Central Asia protect their mountain ecosystems relatively well through regulations and the maintenance of protected areas. Where the Soviets maintained strict nature 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 and the Aichi targets. They are also creating reserves for special purposes such as watershed protection, forestry or regulated hunting reserves without necessarily restricting access for recreation or other compatible uses.



Over the past decade, the border mountain regions have seen the development of joint parks and other biodiversity initiatives. In the Altai Mountains, Russia and Kazakhstan cooperate on forest fire and wildlife protection and on ecotourism, and in the Western Tien Shan, Kazakhstan, Uzbekistan and Kyrgyzstan maintain a joint park that is nominated for UNESCO World Heritage designation. Afghanistan, Tajikistan, China and Pakistan are working on plans for a project in the Wakhan Corridor.

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, timber 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 diminished.

Protected areas

- Large protected areas
- Small protected areas
- Ysyk-Kol Biosphere Territory
- UNESCO World Heritage sites
- RAMSAR sites (Convention on wetlands of international importance)

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. After independence Central Asian 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 the countries of Central Asia are signatories to the three Rio Conventions: the UN Framework Convention on Climate Change, the Convention on Biological Diversity and the UN Convention on Combating Desertification. In addition, numerous multilateral and regional environmental agreements have been signed or ratified. The countries have taken different development paths, and their strategies and approaches to sustainable mountain ecosystem management have developed differently.

The key regional player in water and environmental cooperation is the International Fund for Saving the Aral Sea, an organization that deals with environmental and socio-economic challenges of the Aral Sea basin through its Aral Sea Basin Programme. Funded by international donors and by the Central Asia states, the Programme works on climate change, natural disasters in the mountains and watershed protection, among numerous other issues. Some ongoing projects in the mountains not directly linked to the Programme are contributing to its implementation.

The Interstate Commission for Sustainable Development (ICSD) was established in 1993 to assess regional environmental conditions and to coordinate the planning and implementation of environmental and sustainable development programmes. In 2008, the ICSD supported the initiative of Kyrgyzstan and Tajikistan to establish the Regional Mountain Centre of Central Asia (RMCCA) with headquarters in Bishkek. The RMCCA promotes cooperation in the Central Asia region for mountain ecosystems conservation and the sustainable use of natural resources, and works to improve the socio-economic conditions in mountain areas by providing policy support and by promoting cooperation with other mountain regions. The Regional Environmental Centre of Central Asia (RECCA) is implementing the Payment for Ecosystem Services (PES) project with Swiss support in the tourist and agricultural areas in the mountains of Issyk-Kul Province of Kyrgyzstan.

Kyrgyzstan began to attract the attention of the international community to mountain development in 1998, and successfully advocated for the UN declaration of the International Year of Mountains in 2002, which culminated with the Bishkek Global Mountain Summit. The Summit concluded with the formation of the Bishkek Mountain Platform, and reinforced the International Partnership for Sustainable Development in Mountain Regions (known as the "Mountain Partnership"). The Food and Agriculture Organization of the United Nations offer to host the Secretariat was welcomed, and since its establishment, the Mountain Partnership Secretariat has been advocating for an integrated approach to sustainable development in the world's mountain regions. In 1998, Kyrgyzstan established the National Centre for Mountain Regions Development (NCMRD), which is responsible for coordination and formulation of national policy on mountains. In 2003, the International Information and Education Centre for mountain states was established under the NCMRD. The Kyrgyz Agency for Rural Investments has played a major role in supporting rural infrastructure and business initiatives in the mountain villages across the country.

Tajikistan focused its attention on regional freshwater 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 the exchange of scientific knowledge and popular information about conditions of mountain glaciers across the region, and also established the Regional Centre for Disaster Response and Risk Reduction.

The high level of poverty together with the growing vulnerability of the ecosystems affected by the unsustainable use of natural resources by local communities demanded urgent interventions. In 2000 the Government of Switzerland launched the Central Asian Mountain Partnership (CAMP) initiative in Kyrgyzstan, Tajikistan and Kazakhstan with an aim to promote sustainable mountain development. In a shift from waiting to acting, civil society started to participate in the development process. In 2002, at the initiative of civil society and NGOs, and with support of the Swiss Agency for Development and Cooperation, the new programme was launched as an association of rural communities that would exchange information, knowledge and experience to foster participation in solving common local problems. In 2003, the Alliance of Central Asian mountain communities (AGOCA) was formally created and registered in Kyrgyzstan. The overall goal of the organization is to assist in the sustainable development of

Central Asian mountain regions and thereby contribute to the improvement of local living standards.

Mountain-focused NGOs involve various levels of stakeholders from central governments to village institutions and the general public. They often communicate "mountain voices", advocate for interactive and open processes of policy formulation and act to bridge any gaps between new legislation and strategies and the realities in mountain communities. Another category of civil society organizations – mountain associations – are working with young people and hikers to promote mountain environmental knowledge, to clean up garbage and to cultivate responsible outdoor traditions. Finally, private and public foundations such as the Aga Khan Development Network have contributed to integrated mountain development.

The Regional Environmental Action Plan (REAP) approved in 2001 by all Central Asian states treats mountain ecosystems as regional environmental priorities. The Framework Convention on Environmental Protection and Sustainable Development of Central Asia, adopted in November 2006, is aiming to strengthen regional environmental cooperation in five priority areas: air pollution, water pollution, land degradation, waste management and mountain ecosystem degradation. Kyrgyzstan, Tajikistan and Turkmenistan have signed the Convention. The Central Asian Sub-Regional Strategy for Sustainable Development, drafted In 2007–2008, is now being considered by the countries. In general, however, the progress on the implementation of all these regional agreements has been rather slow.

National strategies, programmes and action plans on biodiversity, land management, climate change, natural disasters and the environment all mention the role of mountain regions, but often do not include adequate and realistic financial provisions. They also underestimate the implementation capacities at the local level and the cross-border importance of mountain ecosystems and services. The Global Environment Facility has recently supported national exercises on improving the linkages between finance mechanisms and regional capacity-building and the action plans associated with the Rio conventions. Mountain development would benefit from an elaboration of more specific actions, from sufficient resourcing of these actions and from synergies with development projects in tourism, trade and commerce, roads and agriculture. New opportunities in climate change and renewable energy finance, support for watershed protection, and biodiversity benefit sharing and PES are among the emerging funding prospects.

With the launch of a mountain partnership in Central Asia, Kyrgyzstan, Tajikistan and Kazakhstan prepared national sustainable mountain development strategies and a regional strategy, but the shortage of resources over the last decade 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 and national legislation were not matched by an increase in institutional capacity and financing priorities. The deterioration of management and enforcement capacities at both the central and local levels further constrained implementation. Stakeholder responses to new mining, water, forestry and pasture programmes and strategies varied from support to strong opposition.

New laws at the beginning of 2000 moved Kyrgyzstan toward a decentralized government with specific attention devoted to mountain areas. The Law of the Kyrgyz Republic on mountain territories was approved in 2002, and the Kyrgyz Government Decree on state support to the population living and working in high-altitude areas, in 2007. These laws provide salary and pension increments, as well as financial support for mountain schools, hospitals and infrastructure improvements. Kyrgyzstan leads Central Asia in developing decentralized governance, and offers new opportunities through legislation on the use of natural resources in such key sectors as pastures and forests.

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.

Arguably, much of the baseline information for current environmental research in the Pamir mountains comes from an ironic source – the search for Bigfoot. Rampant speculation in the 1960s regarding the existence of Bigfoot led scientists, under the guidance of K. Stanukovich, to advocate successfully for an expedition of discovery in the Pamirs. The ensuing research uncovered no credible evidence of the elusive Bigfoot, but it did establish a significant base of knowledge related to botany and physical geography, and considerably advanced environmental knowledge in the region.

Hydrometeorology

During the Soviet era, meteorological monitoring received extensive support from the state and was an important aspect of environmental planning across Central Asia. 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 has 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 agrometeorological stations proved extremely useful for the forecasting of summer grass growth and the conditions of pastures for 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 labour 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 distrust. This situation is changing and automatic weather stations are being integrated into daily operations. 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.

Ice, snow and permafrost

During the Soviet era, the high mountains of Central Asia were home to many 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 popular tourist attractions, putting glaciers and their protection back on the national agenda.

All of the Central Asia 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 2005, international donors have established several new glacier monitoring sites. One site – established with with Czech support near Bishkek at Adegyne glacier – is helping in early warning of potentially devastating glacial lake outbursts. In addition, German support and the participation of the Central Asian Institute for Applied Geosciences and the German Research Center for Geosciences established a site on Enylchek, the largest glacier in Kyrgyzstan, as a multi-purpose science complex equipped to measure not only glacier activity, but also weather patterns, mountain lakes, paleoclimate 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 problem, 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 a 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, 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 limited exchange of information can result in a repetition of activities and be detrimental to the development of effective measures.

In the Soviet period, snow researchers placed gauges in the mountains, and using helicopters, calculated accurate measurements of water equivalency from annual snowfall. With the withdrawal of Soviet support, these procedures proved to be too expensive to continue. Recent attempts to replace the earlier programme with satellite observations are promising, but the new approach needs more testing, and a 20-year gap in observations remains. Soviet-era meteorological stations with a focus on snow research are still in service, and continue to take manual measurements and to provide avalanche risk analysis and warnings crucial to local decision-making. Researchers have made initial efforts to automate the system of snow measurements, but the new methods are unproven.

Kazakhstan operates a special laboratory for permafrost monitoring and a research site with a dozen thermometric wells up to 300 metres deep, and advises important economic sectors of their findings. This laboratory does not have the same capacity as in the Soviet period, but it delivers useful information. It conducted permafrost research at several sites in the central regions of Kyrgyzstan and Tajikistan in the 1970s and 1980s. A renewed focus on permafrost research can assist in the development of mining and roads, rails and other infrastructure.

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 specially designated wild nature conservation sites; and through nature parks and reserves. These efforts 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 one of the highest botanical gardens in the world (at an elevation of 2 000 metres), and is 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 and reserves 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 determine how the land was used. Over the past five–ten years, governments and donors have begun to pay more attention to ensuring that land is used sustainably and to investing in systems to register lands, and to monitor soil erosion and the quality of crop production. Up-to-date soil inventories do not exist in the region, but steps to improve this system are welcome, despite the slow level of progress so far.

Since 2000, a new focus on biodiversity research employs sophisticated techniques to link species population numbers across borders. The results of this research are used to regulate

hunting and to improve biodiversity protection in the region. In addition to this effort, the World Wildlife Fund is promoting the development of maps of ecological networks and migration corridors, and is working to establish buffer zones to limit disturbances from human activity.

Finally, governments in Central Asia are looking to follow the lead of the United Kingdom and other countries in formally evaluating the monetary value of national ecosystems and their benefits. This kind of assessment will help in determining how much should be invested in nature protection initiatives and may 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.

Geological survey and seismology

State-funded geological research during the Soviet era identified deposits of various precious minerals in significant quantities across Central Asia. Under Soviet rule, however, only a small number of mining facilities, notably in Kyrgyzstan and Tajikistan, were given the green light to exploit the sites. In Kyrgyzstan the private sector is now 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 – has not yet encouraged 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 and mining 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 Central Asia. But although the equipment and technology has undergone a degree of modernization, the results of seismic research remain disconnected from practical implications for community facilities such as housing. Business development plans still need to take into account the potential consequences of seismic activity. (See pages 116-117 for recent developments in seismic research in the region.)

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 of their industrial facilities. Given that the region is at particular risk from flash flooding, earthquakes and landslides, measures to prevent accidents involving industrial facilities such as mines (and tailings), dams and power plants should be put in place.

Other mountain research

The Soviets conducted high-level research in fundamental physics and solar energy in the mountains of Central Asia. This research, which focused on high-energy particles in cosmic rays, was reduced after 1991, but Russian and other international interest in the work has given rise to the possibility of restarting the research by renewing the existing facilities and installing new equipment. The Soviets also employed high-elevation telescopes in Central Asia observatories, and these facilities are still in use for satellite tracking, and for astronomy.

The research started by the Soviets on the health effects associated with life at high elevations has expanded to include international scientists who participate with Central Asian colleagues on joint efforts, the results of which are now more widely shared in the scientific community.

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.

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.

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 Alatoo 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 exceeded 2 000, up from 150 operating in the mid-1990s. In Kyrgyzstan, the number of civil society organizations exceeds 8 000. Governments accept the role and contribution of CSOs to democratic transformation and socio-economic development.

The institutional growth for the CAMP agencies took place in parallel with the formation and growth of local institutions supported under the programme: 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

Community members discussing rural development plans

Setting up a Kyrgyz yurt at a summer pasture

been implemented in all three countries. As the CAMP agencies evolved in different specializations, some difficulties in cooperation arose. Currently, CAMP Consulting in Kazakhstan focuses on felt products, CAMP Kuhiston in Tajikistan is strong in disaster management and CAMP Alatoo in Kyrgyzstan focuses on pastures and mountain development in general.

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 - L4S" 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 L4S module is based on the approach developed by the Centre for Development and Environment of Bern University and adapted for local conditions by CAMP Alatoo and CAMP Kuhiston. This approach promotes group learning on priority topics related to sustainable development: sustainable pasture management, water resources management, integrated local risk management, energy efficiency, conflict over natural resources and others.

The programme 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 programmes and their high degree of relevance and responsiveness to local needs have been built on strong linkages with mountain communities. The annual CAMP forum networking events provide opportunities for sharing experiences and fostering dialogue between the concerned stakeholders and the general public. The 2004 CAMP forum focused on "Social mobilization and village development"; in 2005, "The role of local self-governance in sustainable development"; in 2006, "Strategies for sustainable energy use in villages"; in 2007, "Cooperation with state structures at the local community level"; in 2008, "Mountain communities and business – dialogue and cooperation"; in 2009, "Labour migration – facing challenges and opportunities"; in 2010, "Central Asian mountain communities and climate change – call to action"; and in 2011, " Mountain Green product – challenges and opportunities for mountain communities of Central Asia". About 100 participants attended each forum. These forums bring forward the voices of mountain communities to the national and regional levels and show the importance of working together for a common goal.

Villagers checking their harvest

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. Today, AGOCA is active in 40 villages.

Since 2003 AGOCA has carried out practical and theoretical workshops and training in such areas as:

- Solar cabinets for cooking
- Processing of dairy products at home
- Willow-twining
- Wool processing
- Microfinance
- Energy efficiency

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.

In 2011, AGOCA founded the Kyrgyz language newspaper *Ayil Demi* (Spirit of the Village) with a circulation of 5 000. The newspaper covers the development issues of mountain communities in Kyrgyzstan and provides a platform to express their needs, thoughts and good practices.

The Interstate Commission on Sustainable Development in Central Asia

The Interstate Commission on Sustainable Development in Central Asia (ICSD) was established in 1994 and coordinates and manages regional cooperation in environmental protection and sustainable development in Central Asia. The Commission consists of representatives from environmental ministries and agencies, and ministries of economy and science. A similar Commission dealing with water issues is composed of representatives of water ministries. The Commission allows participation of civil society organizations as observers and cooperates with the youth environmental network of Central Asia:

The Sustainable Development Commission was instrumental in developing the Regional Environmental Action Plan (2001), which targets air pollution, water resources, land degradation, mountain ecosystems and waste management. Over the last decade, the Commission produced themed reports on emerging environmental and development issues such as renewable energy, sound chemicals management, atmospheric brown cloud and stability of mountain lakes, and provided inputs to the Global Environment Outlooks 4 and 5. In 2009, the ICSD produced a draft regional strategy on adaptation to climate change. The initiative "Green Bridge", which aims to promote the partnership among Europe, Asia and the Pacific, was also facilitated and supported by the Commission.

The Commission has provided substantial inputs to the development of the "Framework Convention on Environmental Protection for Sustainable Development of Central Asia", which was endorsed in 2006. Prolonged procedures in Kazakhstan and Uzbekistan, however, have prevented this Convention from coming into effect. In 2007–2008, the Commission formulated a "Sub-Regional Strategy on Sustainable Development of Central Asia", which is pending approval. Both documents highlight the role of mountain areas as regionally important providers of ecosystem goods and services.

The ICSD supported the initiative of Kyrgyzstan and Tajikistan to establish the Regional Mountain Centre of Central Asia in Bishkek in 2007. This initiative promotes cooperation for mountain ecosystems conservation, sustainable use and improved socio-economic conditions of the mountain people. The significant continuous dependency of the Commission's activities on external funding, however, created financial vulnerability. Currently, new funding mechanisms are being discussed.

ICSD meeting, Bishkek, Kyrgyzstan, June 2007

Yapshorv and Roshkorv villages, Bartang Valley, Tajikistan

Food, biodiversity and land management

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.

Kyrgyz high-altitude 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) – independent institutions comprised of volunteers elected by the villagers and headed by a medical professionals – and works within a challenging context where villagers commonly express disbelief in the potential for vegetable cultivation in high-altitude mountain areas. 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 the Alai and Chon-Alai districts of Kyrgyzstan revealed that the vast majority of health problems suffered by women and children were related to nutrient deficiencies and malnutrition. The survey demonstrated an apparent need for improved access to nutrient-rich diets to mitigate anemia especially among mountain-dwelling mothers and children.

Setting up high-altitude kitchen gardens, Alai Valley, Kyrgyzstan

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 the Alai and Chon-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 project has established 310 kitchen gardens in 28 villages in the Alai and Chon-Alai districts, or in 35 per cent of the villages.

The 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.

The kitchen gardens were initiated with a very small pilot sampling of households – just six groups (two in the Alai, four in the Chon-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 in 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 disseminated information and played a strong organizational role in the project from the very beginning. Their main responsibilities included disseminating information on the prevention of common diseases, assisting with immunizations, monitoring of proper nutrition and adherence to standards of sanitation and hygiene through mass campaigns and public meetings. 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 more than 20 kitchen gardeners interviewed, half 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 three thousand hectares of land in the Alai and Chon-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 food security and sustainable land use of high-mountain arable lands.

Most of the kitchen gardeners 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 seasonally 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 over 9 000 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 businesses 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.

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 and pest control remains one of the main challenges for project participants. There is a need to develop small seed shops locally because many kitchen gardeners from remote areas of the Chon-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.

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 the Chon-Alai can make a wider variety of vegetables available to communities in the Kashka-Suu subdistrict, which is more than 2 800 metres above sea level, and where growing vegetables such as tomatoes and sweet peppers is difficult and arable land is limited.

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

Maturing crops in high-altitude kitchen gardens

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.

The initiative could be expanded to other villages where communities traditionally have not grown vegetables. 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.

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 training and learn to facilitate the promotion of access to high-quality inputs.

Sustainable pasture management

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 2009 Pasture Law that gave locals the right to manage and utilize pasture resources at their own discretion. 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. Learning for Sustainability (L4S) modules were developed for local community training, and field offices were set up to work with the communities of CAMP pilot villages.

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. 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 in 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 pastures and in 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

Family reviewing pasture tickets

herd, thus producing more profits and a 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, including bridges and access roads to remote pastures.

One outcome of the new Kyrgyz pasture law is that with 450 legally empowered pasture committees ("Jayet Committees") nationwide, local representatives better present and promote the long-term interests of the community, while numerous intermediary institutions and bureaucracies are eliminated. Another feature is the application of the market user fee-based mechanisms that would be fully retained at the local level and reinvested into the conservation of pastures. The size of user fees varies and is set by the local community depending on the needs for sustainable use and conservation of pastures. The financial capacity available from fees rose from nine million Kyrgyz soms (US$ 200 000) in 2008 to 33 million soms (US$ 730 000) in 2010. In pilot villages covered by CAMP Alatoo, the fee collection rates reach 80–90 per cent.

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 training 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 the 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..."

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 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 the 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.

Several trainings, seminars and round-tables on a broad range of topics covering sustainable land management, including the FAO Land Assessment in Dry Areas (LADA) methodology were conducted in Tajikistan and Kyrgyzstan. At present, this methodology is increasingly used by pasture committees.

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 of 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 a regional scale. The strategy and action plan for the entire project area (endorsed in 2011) covers four priorities:

- Improving biodiversity and forest management
- Increasing the efficiency of farming
- Improving the sustainable use of mountain pastures and increasing the productivity of livestock
- Reducing risks from natural disasters.

The strategy and action plan is supported by a memorandum of understanding signed by central environmental authorities of Kyrgyzstan and Tajikistan, and by the administrations of the Osh Province in Kyrgyzstan and the Mountain Badakhshan Autonomous Province and the Jergetal district in Tajikistan.

In parallel, research and advisory agencies are working with local communities on targeted approaches – such as introducing improved fodder cropping and improved goat husbandry; an analysis

of the value chain of local products from the Pamir Alai region; promoting community-based protection areas and wildlife protection; and the mapping of local small-scale hydropower potential and natural disaster hazards and land use risks in the area – as well as on assessing global and regional price trends and the demand for wool, berries and medicinal plants.

Local experts consider that the experience gained in the PALM project implementation is worth demonstrating in other mountain areas of Central Asia and beyond. One mechanism for knowledge exchange is the World Overview of Conservation Approaches and Technologies (WOCAT), which already features selected PALM lessons.

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 okmotu* 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, a micro-project must be one with a need identified through the community land-use planning process. To date, more than US$ 200 000 were provided as grants for co-financing of micro-projects. The projects' 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.

Teresken plants collected for fuel in the Tajik Pamirs

Community-based 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. The main participants were the State Agency for Environment and Forestry, the National Forest Institute, the State Agency for Local Self Governance, *ayil okmutu* and forest enterprises. 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 (SDC):

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.

After studying 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 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 in walnut and fruit forests, implementation of sustainable forest management is far from complete. The remaining challenges include involving local populations in the participatory management of other types of forests, particularly juniper, spruce and riverside forests. Building upon the experience gained from the KIRFOR programme, the Kyrgyz authorities, with support from donors (the Japan International Cooperation Agency and the Food and Agriculture Organization of the United Nations), are developing joint forest management models that should allow forest enterprises, *ayil okmutu* and local communities to plan and implement decisions together.

Arslanbob walnut forests, southern Kyrgyzstan

Climate change and natural disasters

Two case studies focus on the related issues of climate change and natural disasters. The first is a study on the Pilot Program for Climate Resilience (PPCR), and the second is a tree-planting project designed to stabilize mountain slopes.

Climate change: Pilot Program for Climate Resilience in Tajikistan

The Centre for Climate Change and Disaster Reduction, a local NGO in Tajikistan, addresses the issues of climate change adaptation and natural disaster risk reduction in mountain regions. Oxfam GB in Tajikistan funded and facilitated this study:

The Strategic Climate Fund provided funding for several countries participating in the Pilot Program for Climate Resilience: Bangladesh, Bolivia, Cambodia, Mozambique, Nepal, Niger, Tajikistan, Yemen, Zambia and two regions (the Caribbean and Pacific). The criteria for participation in the PPCR included the level of vulnerability to climate change hazards and risks, country preparedness to move towards climate resilient development plans and country distribution across regions and types of hazards. The participation of Tajikistan as a landlocked mountain country in the PPCR is justified by its high vulnerability and low adaptive capacity to cope with the current climate variability that will likely exacerbate existing development challenges. In Tajikistan the PPCR is coordinated by the World Bank, the Asian Development Bank and the European Bank for Reconstruction and Development.

This study analyses the Pilot Program for Climate Resilience 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 objectives of the study were to identify lessons learned and to make recommendations for channeling climate change adaptation funds in the context of Tajikistan. The study was based on interviews and focus group discussions with a wide range of stakeholders. Participants included representatives of government institutions, international and local NGOs, academia, bilateral and multilateral donors and civil society.

The key outcomes of the PPCR are the development of the Strategic Program for Climate Resilience (SPCR) and the approval from the Climate Investment Fund of a US$ 50 million grant for a 3–5 year period. The project areas set to receive SPCR funding include:

- Capacity-building for climate resilience
- Improving weather, climate and hydrological service delivery
- Improving climate science and modelling
- Enhancing climate resilience in the energy sector
- Developing sustainable agriculture and land management
- Building climate resilience in the Panj River basin.
- With the exception of the last item, the list specifies no geographic area for any of the projects. The region would benefit from an equitable distribution of funds across both programmatic and geographic areas.
- The critical lessons learned and recommendations of the Pilot Program for Climate Resilience in Tajikistan 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
- Country-level ownership of adaptation finance is required
- 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. 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.

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 stabilization of hazardous mountain slopes through planting trees

CAMP Kuhiston took an integrated approach linking disaster risk management in mountains with the planting of appropriate fruit tree species to improve land productivity in the Nurobod district:

In the Nurobod district of central Tajikistan, numerous tributaries flowing from the high mountains have cut deep gorges into the soft loess soils, and during the spring snow melt there is a risk of floods, landslides and mudflows that threaten mountain communities. In the spring of 2010, the single local road that links the 26 villages in the area to the main road to the capital Dushanbe was blocked for 41 days due to a mudslide.

CAMP Kuhiston catalysed donor support and facilitated disaster risk management training and tree planting to stabilize hazardous mountain slopes around the villages. Initially, the local government showed limited interest, but when the practical interventions started, it became more interested and supportive. The Tajik Horticulture Institute developed a tree planting plan, selected saplings, conducted training and monitored tree development. This was complemented by soil sampling by the Tajik Soil Institute. The head of the village initiated a local community action day known as a khashar to erect a wire fence and to plant the saplings in accordance with the plan.

The project targeted about 300 community members, who increased their natural disaster management skills and who participated in local risk assessments, the formulation of mitigation measures and emergency response. A total of 2 000 fruit trees (peach, apple, quince, walnut, pear, cherry and apricot) were planted in seven communities. The trees will stabilize the soil cover, improve the soil structure and increase the nutrient content of the soil. As the trees have grown and become established, the risk of natural hazardous such as floods and mudslides has decreased. Up to 100 people received training on fruit tree planting and on soil and water conservation measures. The newly planted peach trees suffered in the heavy spring rains, and their growth was not as rapid as first hoped. But they survived and will most likely produce fruit in several years. This case study was documented in the World Overview of Conservation Approaches and Technologies database.

Over-exploitation of natural resources is one of the unsustainable activities leading to increased risk of natural disasters. Shahtuti Bolo village burns almost 12 metric tonnes of dry wood per year, and the average annual fuel bill is US$ 350 per household, both amounts typical for the Nurobod district. To supplement the planting of the fruit trees, a campaign on energy efficiency measures is under way to reduce the amount of biomass burned by households. This is achieved by improvements in outdoor cooking stoves, by introducing energy efficient indoor stoves and through better thermal insulation and the installation of solar water heaters.

Tree plantings in central Tajikistan

Community-based 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 community-based tourism, generally regarded as sustainable development activities, offer significant opportunities at the national and local levels. Community-based tourism is the practice of providing tourism services that utilize local accommodation, food, music, crafts and traditions. 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 150 participants from seven villages attended the training sessions. The training covered topics of hospitality; service orientation; language courses for local guides; food and beverage service; and environmental safeguarding practices. The communities were supported in their marketing and public outreach activities. Later, standards and classifications for guest houses were introduced. As a result, most of villages initiated ecotourism products and one of those villages is Bokonbaevo.

This initiative was launched with the aim of reviving forgotten kinds of tourism and introducing visitors to the national customs, games, horse-riding and life in traditional Kyrgyz yurts.
The social and cultural aspects of Bokonbaevo tourism activities foster preservation of traditional culture, knowledge and skills. Overall, up to one fourth of the total village population of 12 000 is involved in activities associated with tourism, including homestay, cultural sightseeing, trekking, horse-riding, ecological food products and handicrafts. In addition, the "One village-One product" project contributed to the quality improvement and competitiveness of local products in this and other villages around Lake Issyk-Kul.

The Bokonbaevo community-based tourism (CBT) association, in cooperation with local self-government bodies, organizes annual events with such themes as:

- Promotion of traditional embroidery such as *saima* and *shyrdak*
- Demonstration of Kyrgyz horses
- Southern Lake Issyk-Kul beach clean-up.

Community-based tourism differs from commercial tourism in the way income is generated and distributed: all the income remains in the villages where the CBT members decide themselves how to distribute it. By creating demand in tour products and locally produced goods and services, tourism has many positive direct and indirect economic outcomes on local livelihood and rural poverty alleviation. The jobs that were previously available only to skilled non-locals employed by commercial tourism companies based in the capital city are now filled by local residents. Guides, interpreters, cooks and chefs, drivers and managers all come from the local community. This promotes social balance, justice and inclusiveness for local communities.

Environmental considerations for minimizing the adverse impacts from tourism include programmes on waste management. As the ecosystem services and goods are exploited for profit generation, the local communities invest 5–20 per cent of the income in environmental conservation. The use of renewable energy in guest houses and other services helps to raise awareness at the household and small business levels and to reduce the carbon footprint of the local tourism sector. An energy efficiency programme run by CAMP Alatoo installed 100 energy-efficient stoves, and improved thermal insulation for 30 houses in Bokonbaevo village.

Community-based tourism services can be easily booked centrally through the Bishkek coordination office or via CBT in villages across Kyrgyzstan. The CBT Bokonbaevo earns more than US$ 10 000 per summer season, but the cold off season for tourism (lasting for 8–9 months) is problematic. In this context, the village is looking forward for cooperation with tourism service providers in the skiing sector.

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.

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.

Science station in Tien Shan, Kyrgyzstan

Science station in Tien Shan, Kyrgyzstan

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 2012. 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 collecting data about the seismic vulnerability of the building stock in the 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.

Using the existing consortium of 11 national and international partners and seismic monitoring network created during the CASCADE project, it had been followed up by the new initiatives such as the Earthquake Model of Central Asia (EMCA) which is a part of the Global Earthquake Model programme, aiming at the crossborder assessment of seismic hazard and risks in Central Asia and Tien-Shan Pamir Tibet Monitoring Project (TIPTIMON) aiming to study seismotectonics of the Tajik depression bordered by Tien Shan, Pamir and Hindu Kush mountains. The future results of the both projects will promote the development of seismic risk scenarios and early warning systems in Central Asia, and will allow identification of active seismic structures for this densely populated mountain region.

The University of Central Asia: One university, three campuses

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:

UCA aims to achieve its education and development goals 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 the Institute for Public Policy and Public Administration), 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.

UCA is located in and designed to serve the mountain regions of Central Asia. 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.

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 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.

Certain UCA programs are currently operational, while others, including the undergraduate and graduate programs, are in the planning stages. The University is currently supporting 30 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 to hold doctoral degrees earned at universities meeting international standards. At the School of Professional and Continuing Education, more than 34 000 learners have participated in internationally benchmarked non-degree programmes such as 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. In 2010, 154 trained instructors at 35 universities in the region were using the Aga Khan Humanities Program (AKHP) curriculum and were reaching 7 500 learners. The AKHP curriculum was developed to provide 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.

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 extensive 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 only one institution.

Students at the University of Central Asia

Tien Shan Mountains, Kyrgyzstan

Integrated approach to 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 – natural resource management, community development, enterprise development, engineering and policy and evaluation. The programme targets a 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). To date, MSDSP has supported over 1 150 VOs with more than 100 000 active village members, half of them women.

Since 1997, MSDSP has supported the construction or rehabilitation of 400 water and sanitation projects, 864 irrigation projects, 270 road and bridge projects, 280 health facilities, 158 schools and 28 mini hydropower projects. Alongside every project, the MSDSP 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 similar units.

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 3–10 individuals and repayment becomes a collective responsibility; each member effectively guarantees the repayment of the other members. Group loans are often offered to women, usually for small business start-up costs or small-scale agricultural production.

A core MSDSP strategic direction is to increase rural incomes and employment by strengthening the private sector through micro- and small-enterprises, business services and capital.

Agricultural processing and tourism are among strategic areas for local business development.

The Aga Khan Development Network sponsors opportunities for local market development and cultural exchange along the Tajik-Afghan border. Providing communities on both sides of the border with access to opportunity increases the potential for income generation and improved livelihoods. Cross-border activities began in 2006 at Darvaz then expanded into other areas to promote local markets and the exchange of ideas.

The Aga Khan Community Health Project works to empower community members and community-based organizations to address their own healthcare needs. Since its inception, the Project has trained over 500 community health promoters.

The Nursing Development Project aims to improve the education of nurses in Tajikistan. In partnership with the World Health Organization, the project 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, 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 per cent market share in 2010 (over two million subscribers). It has become an exemplar in the country for its corporate practices and customer service.

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 Mountain 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 220 000 residents resorted to wood fuel for their heating and cooking needs during the winter, resulting in the decimation of local forests. The AKFED, in partnership with the International Finance Corporation, formed the PamirEnergy Company in 2002 to address the situation. Over US$ 30 million has since been invested by the company to repair the electrical infrastructure of the province and to 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.

Lessons learned

Making generalizations from any case study is a risky proposition. By their nature case studies are specific to a particular time and place, and the degree to which the experience is transferrable to any other time and place is subject to the comparability of the circumstances. A project such as the Kyrgyz kitchen gardens, for example, may not work in neighbouring Tajikistan much less in Morocco or Panama. On the other hand, conditions may be sufficiently similar that a kitchen garden project would succeed in these other countries. The point to remember is that the people in the other places are in the best position to decide whether such a project would work, and whether some adjustments for local conditions might be necessary. The replication of successes is an inherent goal of pilot projects. The highest value of the cases presented here is in the potential transfer of knowledge to others in a similar situation.

The literature on sustainable mountain development is rich with advice on practices that have proven effective over time and across space. Extensive research and field experience have led to a broad agreement on the important considerations for successful sustainable development. Professionals in the field are likely to advocate for:

- A decentralized approach that provides local participants with a share in decision-making
- A capacity-building function that assists participants to acquire the tools and knowledge necessary to succeed
- The broad participation of civil society, NGOs and decision-makers at all levels
- A strong and effective process for incorporating the views of stakeholders
- The inclusion of all relevant sectors
- A process that honours traditional knowledge
- A multidisciplinary and geographically focused approach
- A balance among the three components (environmental, economic and social) of sustainable development.

Conforming to this guidance may not guarantee a project's success, but the failure to conform may increase the likelihood of failure. Where there is no tradition of local participation in civic affairs, adherence to the best sustainable development practices may be more difficult, but the experience of the Central Asian mountain projects reported here suggests that the effort to overcome the barriers to broad participation is rewarded by the success of the projects.

The capacity-building component of sustainable development can include a wide range of activities – from workshops on the

processes to be followed to training on the specific tasks necessary to implement a project to institution-building. The CASCADE earthquake risk reduction project, for example, applied a highly sophisticated analysis of seismic data to the development of an appropriate building code. The capacity-building component of the project focused on helping scientists, engineers and decision-makers understand the seismological equipment and technology used in the analysis. The project succeeded in training 200 people, a significant increase in the knowledge base needed to develop earthquake building code. In the meantime, however, rapid urbanization in Bishkek ran ahead of the seismic study, and the informal and unregulated settlements that sprang up must now be integrated into the city structure. The Bishkek experience indicates the importance of having the necessary institutions in place as part of the context for sustainable development – the success of the seismic project now depends on the development of the institutional capacity to regulate the construction of new buildings and the retrofitting of existing buildings.

Two of the networking case studies provide the kind of modest lessons learned that connect directly to the experience gained from the projects. The CAMP study found that the introduction of participatory and partnership principles to replace the centralized command system required the development of new systems; that consolidating the efforts for more coordinated and cohesive interventions required the strengthening of institutional capacity at all levels; and that institutional development required investment in human potential and local capacity-building. The AGOCA experience exchange found that neglectful and careless selection of training participants leads to a reduction in the percentage of participants who benefit from the project. This finding led to the strengthening of the selection process.
The CAMP Alatoo pasture management project also derived lessons directly from their work. In this case the findings have implications for the science, financial requirements, scale and policy considerations for pasture management. The study finds that the complexity of sustainable pasture management requires a holistic, multidisciplinary and integrated approach; that policy level interventions and practical implementation of the work needs to be supported with the allocation of sufficient financial resources; and that future sustainable pasture management interventions should be undertaken at the watershed scale to address the upstream and downstream and transboundary aspects of mountain massifs that span two or more countries. The CAMP Alatoo project concludes that raising awareness and promoting the concept of payment for ecosystem services is of the utmost importance.

The analysis of mountain development in Central Asia beyond the case studies also shows that:

- Political stability and conflict avoidance are the key factors for sustainable mountain development.
- Personal safety, food and energy security, decent jobs, health and education, and poverty alleviation are the key priorities for people in the Central Asia mountains. If these basic necessities are not addressed and balanced, sustainable mountain development and environmental protection cannot be ensured.
- Good governance, corruption prevention, transparency and participation in decision-making in the main economic and social sectors are paramount to success of development projects in the mountains.
- Communication of easily understandable, reliable information is crucial for public understanding, support and motivation to act responsibly.
- The absence of well-defined property and management rights and responsibilities puts constraints on, and adds uncertainties to, sustainable mountain development.
- Heavy reliance on subsidies (as in the Soviet period), natural resource extraction and use without benefit sharing (as in the energy and mining sectors) and continuing reliance on substantial external donor inputs may lead to unsustainable mountain development patterns that could hit hard in times of abrupt change.
- Affordable microfinance, successful demonstration projects and new knowledge often lead to self-reliance.
- The valuation of mountain ecosystem services and the provision for ecosystem carrying capacity, including the regulation and mitigation of man-made pressures, are essential to mountain development and benefit sharing.
- Legislation and programmes on mountain development are essential, and need to be supported by efficient institutions and resources.
- The lack of willingness to cooperate and the tensions between upstream and downstream countries (mainly on region's delicate and politicized water issues) impede regional cooperation.

Kyrgyz yurt on pasture, Kyrgyzstan

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.

Opportunities associated with the trends

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 20 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.

Independence and governance

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 leads 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 their 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.

Legislation and programmes that target mountain territories are already in place in Central Asia, but they need to be enriched by international practices and strengthened to support sustainable development. The consolidation of efforts and the creation of a mountain countries group under the United Nations could help to define and promote common interests and exchange good practices.

Another initiative, initially proposed by Kyrgyzstan in 2005 and being increasingly pursued by the Kyrgyz government since then, is the exchange of external debt for sustainable development. The idea behind this mechanism is that the lender would agree to convert debt repayments into support for sustainable development projects. A similar system was successful in Latin American countries, and Kyrgyzstan is hoping for replicate that success.

New borders and mobility

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.

Subnational cooperation

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 subnational 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.

The Issyk-Kul Biosphere Territory in Kyrgyzstan stands as an example of a sustainability initiative that might be duplicated in other areas. Established in 1998-2001, Issyk-Kul Biosphere Territory benefited from sound scientific planning and strong local participation in its development. The rules of the reserve ensure that all human activities from the household level to agriculture to mining are consistent with the functions of the territory, and while the reserve has not reached its full potential, it provides a good legal framework and a set of practices that can guide new developments. The Kyrgyz government has the opportunity to parlay the Issyk-Kul experience in managing a large territory into region-to-region cooperation with other parts of the country, the Central Asia region and the rest of the world – anywhere similar challenges exist.

In Tajikistan, almost half of the Pamirs and Badakhshan Province are included in Tajik National Park, the country's largest. Nominated for UNESCO World Heritage designation, Tajik National Park is similar to the Issyk-Kul Biosphere Territory, but has much less economic activity – some small-scale agriculture and tiny mountain villages.

Each of these protected areas has its own sustainable mountain development and land-use plans that were approved for specific areas as opposed to their whole countries. Local authorities want the Tajik National Park to exclude mining and some other economic activities, and to concentrate on sustainable agriculture, ecotourism and legal hunting. Assistance with branding, public relations and promotion at the national level could enhance the prospects for success in these endeavours. Governments can also acknowledge provincial distinctions and, through their support, help make regional products more competitive in local and regional markets.

Climate change

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.

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 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 energy sources and efficient stoves and increase resilience to climate change through adaptation.

Natural disasters

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.

Biodiversity management and conservation

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 promotions, 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.

Land degradation

Excess irrigation leads to land degradation in addition to water losses in the 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.

Geographic isolation, roads and trade

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 helps their economies. The international community, including the United Nations, could assist mountain countries in tackling the economic effects of geographic isolation and high shipment costs.

Information technology

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.

Tourism

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.

Mining

The resolution of the continuing controversies in the mining sector requires 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.

Energy

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.

Security

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.

Resource ownership and property rights

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.

Migration

The remittances that come from labour migrants have become a crucial source of income for families, and the Central Asia 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.

Education and health

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. Higher education institutions have an additional opportunity to focus on the preparation of the next generation of managers in tourism, mining and infrastructure, all of which demonstrate promising growth potential.

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 require more attention to the associated environmental health risks.

Traditions and modernity

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.

Towards a green economy

Given their low-carbon profile and the high proportion of hydropower in their energy use, the mountain countries of Central Asia are well positioned for a transition to a low-carbon, resource-efficient and socially inclusive green economy. Rural electrification experienced a step back in the last 20 years as energy production capacities have not been adequate to meet growing energy demands. The development of community-scale hydro, biomass, wind and solar facilities, together with the improvement of energy efficiency in the housing sector, could help improve the accessibility and reliability of energy supplies. Booming businesses – in tourism and agro-processing, for example – may also invest in small renewable energy systems to make their businesses climate friendly. Reducing the energy losses in energy infrastructure is another area that promises significant advances.

The economies and populations of the mountain countries rely on agriculture, biodiversity and forest products, and increasingly on mineral extraction, transport and trade. Green economy initiatives in these sectors can provide significant benefits.

Agriculture, water and land use

The agricultural sector employs nearly half of the total population in the Central Asian mountain countries, and a green economy offers significant opportunities to diversify the sector through the expansion of organic crops and environmentally sound grazing practices. The global and regional markets for organic food and other high-quality and environmentally friendly mountain goods (wool, fibre, wild forest products) are growing, but only a small fraction of agricultural production in Central Asia is currently certified and labeled as organic. There is a great potential to reduce pollution and to increase yields and local benefits through the introduction of biological pest controls, crop rotation and diversification, all of which will ultimately reduce soil erosion and biodiversity loss, and enhance the quality of life and food security of mountain dwellers. "One village–one product" schemes and improving market access for local producers promise broader opportunities for local agricultural products and handicrafts. Fish stocks in mountain lakes – heavily depressed by over-exploitation – need to be restored and managed sustainably.

Increasing fodder production for animal feed is an effective way to reduce pressures on pastures, and encouraging poplar and other native tree plantations to serve heating and construction needs would reduce dependence on wild forests. The expansion of mountain orchards and vineyards has several potential benefits – a boost for local income; the appropriate use of valuable local genetic resources and the rational use of mountain terrain; and

the employment of local people in a labour-intensive enterprise. This strategy also takes advantage of the natural potential of the mountains to provide long-term storage of products.

Central Asian agriculture is infamous for its inefficient use of water. Growing population and food demands increase pressure on water resources, while climate change is adding to an already difficult situation. Investing in more efficient water use and improved sanitation is not only cost-effective but also necessary to avoid conflicts and water-related diseases and epidemics. One of the responses to growing water scarcity is the building of dams. But dams require massive investments and could have negative environmental consequences. Small-scale water management solutions should be promoted. Principles for the pricing of resources and services provided by mountain areas to lowland and downstream regions, and mechanisms for the allocation of a fair share of the benefits to mountain communities, should be established, tested and introduced in practice.

New thinking, new technologies, new skills

Trade liberalization can facilitate consumer access to clean technologies at lower costs. Access to affordable renewable energy technologies and energy efficient products produced in China and better construction materials could help reduce energy consumption, for example.

The transition to a green economy requires changes in strategies and the application of new technologies and management approaches. These changes require new skills, expertise and ways of thinking often lacking in existing institutions. The successful application of new policies and technologies and the facilitation of coordinated actions require a strengthening of the capacities of local and national institutions, and the reinforcement of the role of the private sector and the civil society.

Institutions and governance

The Central Asia governments do not maintain a consistent, well advanced policy focus on mountains, and while the countries recognize the vulnerability of their mountain ecosystems, the protection of these ecosystems could benefit from a linking of the strategies for mountain development to the Rio conventions and to other, broader agreements on trade, economic development, conflict resolution and resource management. The integration of sustainable mountain development into the Rio strategies, programmes and plans would help ensure political attention for mountain concerns, and help establish financial security for the funding of mountain projects.

Following the Bishkek Global Mountain Summit, the role of civil society in sustainable mountain development expanded significantly, and numerous NGOs interested in mountain issues opened an era of regional cooperation. These organizations developed their own areas of expertise and sought their own niches, and as their specialization increased, the cooperation among groups seemed to diminish. The Mountain Societies Development Support Programme, which works throughout Central Asia, takes an integrated approach to sustainable mountain development, and provides a model that other organizations can follow to renew their regional cooperation.

Calls for action

In *The Future We Want*, a document produced in advance of the Rio+20 Earth Summit, the United Nations Conference on Sustainable Development recognizes the benefits provided by mountain ecosystems, and identifies the need to explore ways of compensating and rewarding mountain communities for their ecosystem protection services. Similarly, the Mountain Partnership argues that such compensation would assure the continuation of these benefits while enhancing livelihoods and reducing poverty. The Mountain Partnership also calls for national mountain-specific strategies and for the inclusion of mountain programmes in the Rio conventions.

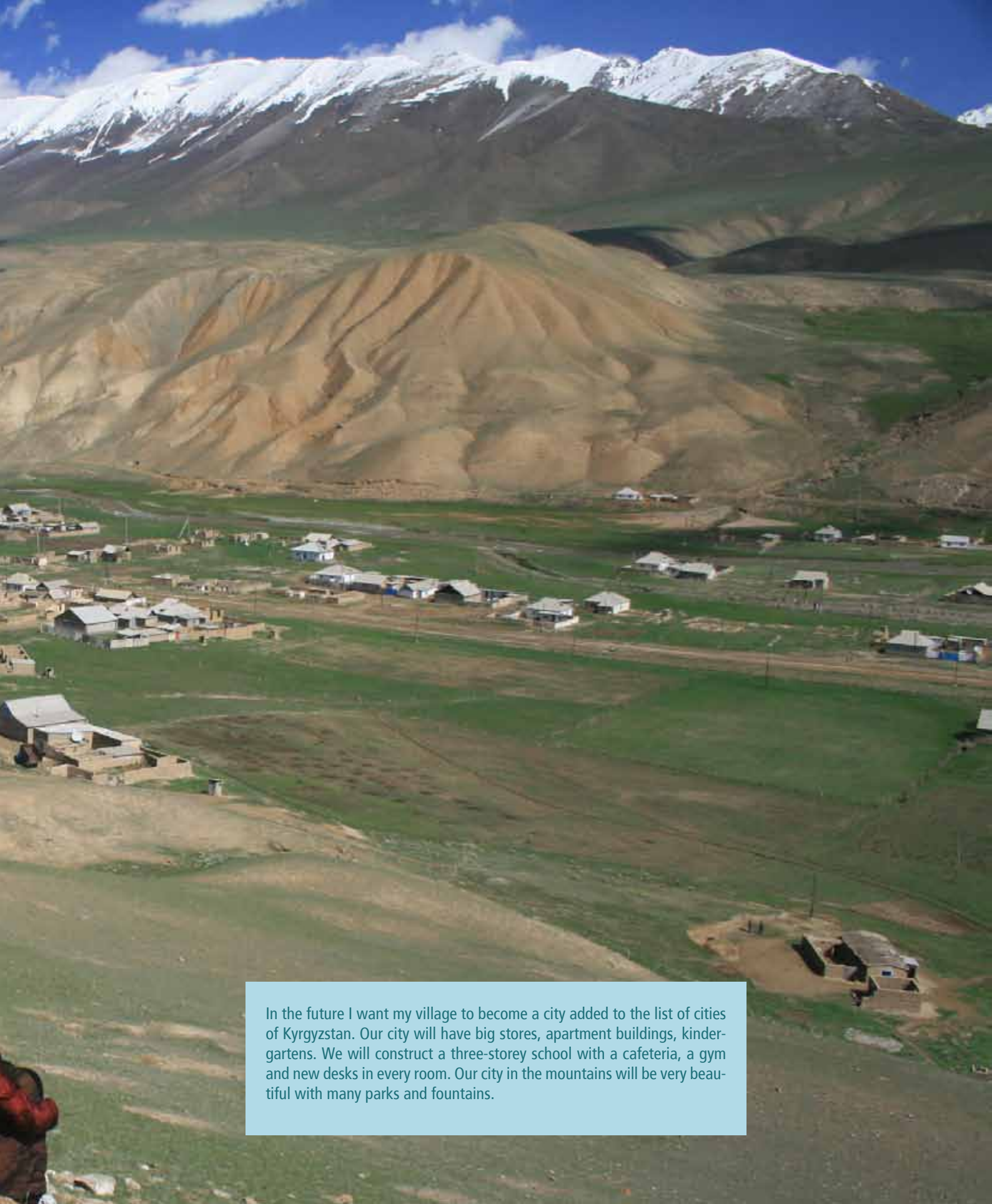
This and other regional mountain reports were conceived and developed to inform the Rio+20 Earth Summit and the Lucerne World Mountain Conference. In its own call for action, the Lucerne Conference seeks the recognition of the vulnerability of mountain ecosystems by the Rio conventions, and calls for:

- Mountain governance that accounts for the unique characteristics of mountains
- Support for mountain communities to assure fair access to resources and a fair share of benefits
- The involvement of mountain people in decision-making that concerns their livelihood, economy, environment and culture

Both the Lucerne Conference and the Mountain Partnership propose the strengthening of efforts related to transboundary cooperation and highland-lowland interactions, and support sustainable development based on the specific conditions in the mountains.

Children of the mountains

The Mountain Partnership project, "Dreams of the mountain children in Central Asia", gives voice to some 600 children from 35 villages of Kyrgyzstan, Kazakhstan and Tajikistan, telling their stories and dreams in their own words and in photos. Selected photos and essays from the project are available at: www.photo.kg/gallery/children



In the future I want my village to become a city added to the list of cities of Kyrgyzstan. Our city will have big stores, apartment buildings, kindergartens. We will construct a three-storey school with a cafeteria, a gym and new desks in every room. Our city in the mountains will be very beautiful with many parks and fountains.

My dream is that my dad stay with us and see how we grow. I think that Tajikistan will develop faster if all fathers come back to their families from working somewhere else.

My dream is to study at school and then for profession, but in our village we cannot do homework in winter because of the electricity cuts. Therefore, if I would become country leader I would provide the entire country with electricity.

I want to become a doctor, as people of this profession save people's lives. I will study in Bishkek. My parents will be proud of me. To become a doctor, you must be brave, kind and not be afraid of giving injections.

My dream is to be useful at home and be a good citizen of my country. I want to go to college and finish it with honours. My dream is to become a soldier to defend my homeland.

My biggest dream is to become Zhigit (local hero). Zhigit fights our enemies, is very strong and should have a horse and a dagger. I will live in a yurt and ride a horse in the mountains.

I dream that when I grow up I will finish school with honours and go to college to become a builder. I love this profession. My dream is to build houses. I want to build a beautiful family house with large and clean rooms and strong walls.

In the future I want to become a teacher. I have always liked this profession. I like my teachers and I want to educate children.

Old and religious people of our village go to the mosque every Friday. But some people cannot afford to go there. So I want to build a mosque in our village. Now there are many rude and dishonest people. If there will be a mosque, people would be kinder and honest.

I want to achieve great results in sport just as Chingiz Aitmatov did in literature. My strength will be as great as the power of the mountains.

Mountains are a market where you can find everything. They give us water, food, and separate us from others.

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Central Asia Environment and Sustainable Development portal: http://www.caresd.net

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Climate Wizard: Interactive web tool developed by The Nature Conservancy, The University of Washington and The University of Southern Mississippi http://www.climatewizard.org

International Centre for Integrated Mountain Development (ICIMOD): http://www.icimod.org/

Food and Agriculture Organization of the United Nations GLADIS Global Land Degradation Information System: http://lprapp11.fao.org:8080/glad_res

Food and Agriculture Organization of the United Nations Stat: http://faostat.fao.org

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GRID-Arendal: http://www.grida.no

Kazakhstan Ministry of Environmental Protection: http://www.eco.gov.kz

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Mountain Forum: http://www.mtnforum.org

Mountain Partnership:
http://www.mountainpartnership.org

Rio+20 United Nations Conference on Sustainable Development http://www.uncsd2012.org/rio20/index.html

Tajikistan Committee for Nature Protection:
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Tajikistan National Biodiversity and Biosafety Centre:
http://www.biodiv.tj

Turkmenistan Ministry of Nature Protection:
http://www.natureprotection.gov.tm

Uzbekistan State Committee for Nature Protection:
http://www.uznature.uz

United Nations Environment Programme and World Conservation Monitoring Centre. World Protected Areas Visual Database:
http://www.protectedplanet.net/#5_44.25_65.25_0

United Nations Educational, Scientific and Cultural Organization World Heritage List: http://whc.unesco.org/en/list

United Nations Millennium Development Goals Indicators:
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University of Central Asia: http://www.ucentralasia.org

World Overview of Conservation Approaches and Technologies (WOCAT): http://www.wocat.net

World Bank development indicators:
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Acronyms and abbreviations

ADB	Asian Development Bank
AGOCA	Alliance of Central Asian Mountain Communities
AKDN	Aga Khan Development Network
AKF	Aga Khan Foundation
AKFED	Aga Khan Fund for Economic Development
AKHP	Aga Khan Humanities Program
AO	Aiyl Okmutu (village government/communal executive in Kyrgyzstan)
CAIAG	Central-Asian Institute for Applied Geosciences
CAMP	Central Asian Mountain Partnership
CAREC	Central Asia Regional Economic Cooperation
CASCADE	Central Asia Cross-Border Natural Disaster Prevention
CBO	community-based organization
CHP	Community Health Promoter
CSO	civil society organization
EDU	Enterprise Development Unit
EurAsEC	Eurasian Economic Community
FAO	Food and Agriculture Organization of the United Nations
FMFB	First MicroFinanceBank of Tajikistan
GBAO	Mountain Badakhshan Autonomous Province
GDP	gross domestic product
GFZ	German Research Centre for Geosciences
GMOs	genetically modified organisms
ICSD	Interstate Commission on Sustainable Development
IFAS	International Foundation for Saving the Aral Sea
ISAF	Afghan International Security Assistance Force
KIRFOR	Kyrgyz–Swiss Forestry Support programme
MSDSP	Mountain Societies Development Support Programme
NGO	non-governmental organization
OSCE	Organization for Security and Co-operation in Europe
PALM	Pamir-Alai Land Management
PPCR	Pilot Program for Climate Resilience
RMCCA	Regional Mountain Centre of Central Asia
SCO	Shanghai Cooperation Organization
SUDVO	Social Union for the Development of Village Organizations
TES	Training and Extension System
TPS	Territorial Public Self-governance body
UCA	University of Central Asia
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
VHC	Village Health Committee
VO	Village Organization
WTO	World Trade Organization

Glossary

Ayil aimak	lowest administrative and territorial unit at which the state performs its functions
Ayil okmotu	executive body of the ayil aimak
Ayil kenesh	representative body of ayil aimak
Jamoat	rural municipality in Tajikistan
Mazar	holy place marked by a landmark such as a spring, a stone or a tree; or a burial place

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Variations in selected geographic names used in the report

Alatoo	Alatau	
Ashgabat	Ashhabad	
Dordoi	Dordoy	
Enylchek	Inylchek	
Gissar	Hissar	Hissor
Gorno-Badakhshan	Mountain Badakhshan	Kuhistoni Badakhshon
Jengish Chokusu	Jenish Choqusu	Peak Pobedy
Lucerne	Luzern	
Onarcha	On-Archa	
Zeravshan	Zarafshan	
Zhergetal	Jirgital	

Many geographic and local names are pronounced and spelled differently depending on the international or local usage, historical and modern style and other peculiarities. This report maintains a consistent spelling of names, and the table above presents some variations in selected names used in the report.

This report is an illustrated overview of the trends and challenges in sustainable mountain development in Central Asia since 1992. It highlights selected achievements and lessons learned, and identifies opportunities for further progress. The information comes from interviews with key actors, from official and scientific sources and from media accounts. While the report strives to maintain high research standards, it presents the scientific and technical material in a manner accessible to lay readers.

In 1992, at the United Nations Conference on Environment and Development – commonly referred to as 'Rio 1992' or 'the Rio Earth Summit' – mountains received unexpected high political attention. They were granted a chapter in the 'Agenda 21' as fragile ecosystems that matter for humankind.

Since then, efforts by different actors have been undertaken to promote Sustainable Mountain Development. Some of them relate to the above event, others just emerged on their own. However, in view of the UN Conference Rio+20 – United Nations Conference on Sustainable Development in 2012 it seemed relevant to assess and understand what has been achieved by whom and how. It appears equally important to learn what has worked and what has not worked, and why, in order to draw lessons for more effective interventions in future. The anticipation of possible future challenges or opportunities may further help to be better prepared for their management. This will certainly encompass the adaptation to and mitigation of global change as the mainstream concern of the last decade as well as the new, albeit disputed paradigm of a Green Economy. As in the past, major unexpected and unpredictable political, social, economic or technological innovations may overshadow such mainstreams.

The Swiss Agency for Development and Cooperation, committed to sustainable mountain development since many decades, has commissioned a number of regional reports to assess achievements and progress in major mountain regions such as in particular Central Asia, Hindu Kush-Himalaya and the South East Pacific, South and Meso America or the Middle East and North Africa. The Swiss Federal Office for Spatial Development has commissioned - in the context of the Swiss Presidency of the Alpine Convention 2011/12 – a report on the European Alps. In addition, UNEP has provided a report on Eastern Europe and one on Africa's mountains; and the Aspen International Mountain Foundation together with the Telluride Institute has prepared a report on the mountains of North America.

The insights gained through these reports in which key local, regional and global actors have been actively involved provided the inputs for a mountain section in the outcome document of Rio+20. They are also meant to feed into future global and regional processes, institutional mechanisms, and initiatives that emerge as a result of Rio+20 in support of Sustainable Mountain Development.

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

FAO FIAT PANIS

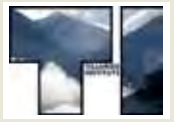
UNEP

UNESCO MaB

zoï environment

u b
b UNIVERSITÄT BERN
CDE CENTRE FOR DEVELOPMENT AND ENVIRONMENT

mri mountain research initiative



IMS International Mountain Society

ICIMOD

CONDESAN
Consorcio para el Desarrollo Sostenible de la Ecorregión Andina

UCA UNIVERSITY OF CENTRAL ASIA
Mountain Societies Research Centre

ASPEN INTERNATIONAL MOUNTAIN FOUNDATION

Mountain Partnership