

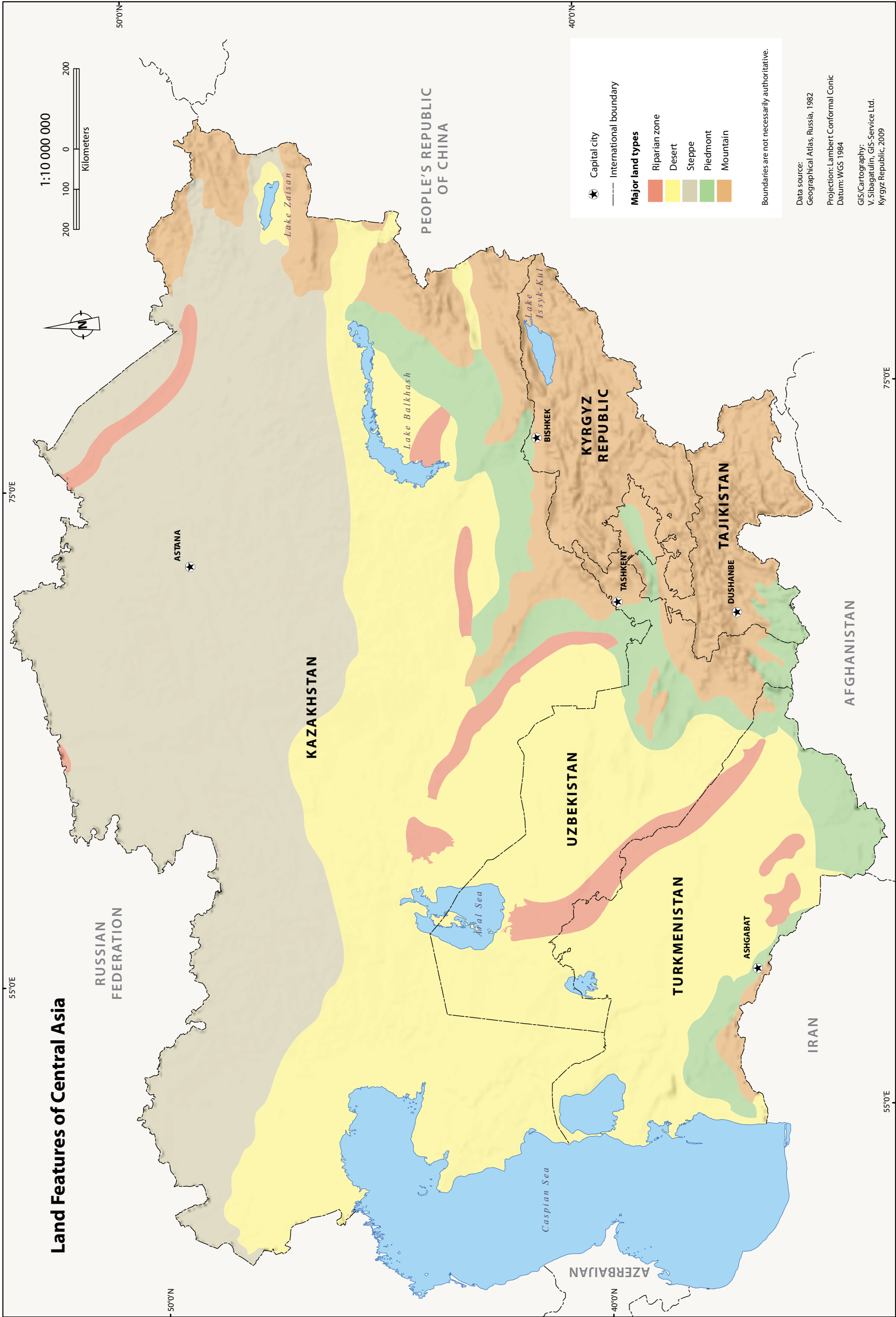
# Amid Deserts, Steppes, and Mountains



■ The glacial landscapes of the Tien Shan mountains in eastern Kyrgyz Republic near its borders with the People's Republic of China and Kazakhstan.



# Land Features of Central Asia





## A Bowl of Sand in a Rocky Cradle

A glance at a map of Central Asia—Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan—reveals a vast bowl of mainly sandy deserts, broadly capped in the north by green plains of the Central Asian steppe and cradled in the south and east by soaring mountain ranges that form Central Asia's borders with Iran, Afghanistan, and the People's Republic of China. Despite having two inland seas, one the biggest in the world, it is mainly an arid and uncompromising region stretching some 4,000 kilometers from east to west, with an area the size of Europe. And come winter, much of the region, deserts and all, is covered in a white blanket.

Deserts occupy much of Kazakhstan and almost all of Uzbekistan and Turkmenistan. The two major deserts, the Northern and Southern, are marked by temperature extremes, seasonal drought, snowy winters, and winds that move dunes, erode agricultural land, and stir up blinding dust storms.

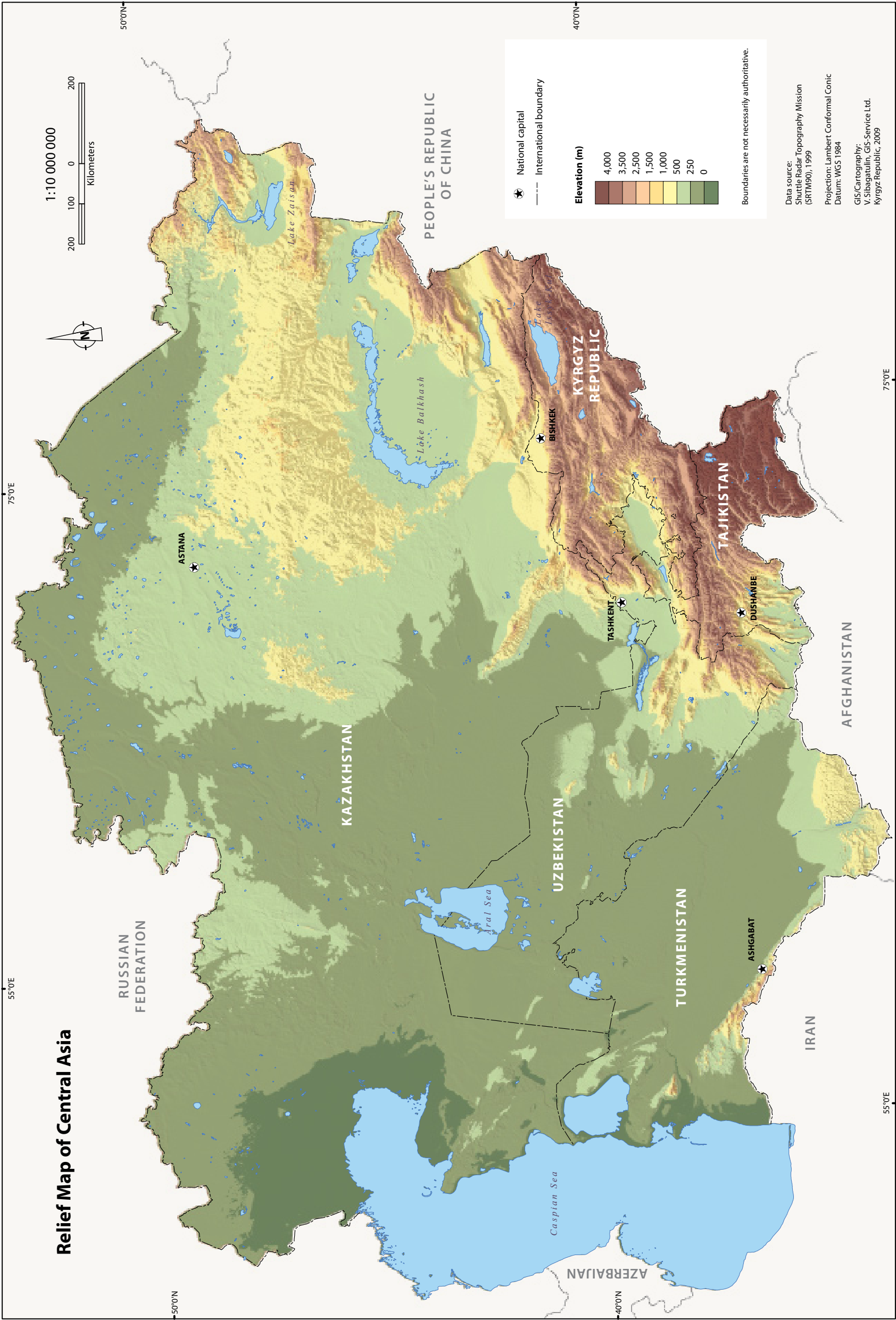
Framing the deserts to the north is a broad transition zone, the Kazakh semidesert area, a mixture of grassy plains and desert shrubland stretching across central Kazakhstan. Capping the semidesert is a vast green belt of steppes, grassy plains with few or no trees. Most of the belt is the Kazakh steppe, a seemingly endless sea of rolling, open, and windy plains.

Thus, the great majority of the region is fairly flat and low, even below sea level near the Caspian Sea. Only in the southeast do elevations rise much above 1,000 meters and where they do, it is spectacular.

■ View across the desert from one of the hillside Ayaz Qala fortresses in Karakalpakstan, Uzbekistan.



# Relief Map of Central Asia







Red poppy flowers and green rolling hillsides of southern Tajikistan.

Tall mountain ranges form the southern edge of Turkmenistan, nearly all of the Kyrgyz Republic and Tajikistan, and parts of eastern Kazakhstan. The Pamir range in Tajikistan reaches about 7,500 meters in height while the Tien Shan mountains, which lie partly in the Kyrgyz Republic, have dozens of peaks above 6,000 meters high.

Between the extremes of the central deserts and the mountains in the southeast are mild fertile valleys and foothills and lush plains alongside rivers and lakes, where agriculture thrives and forests of wild fruits and nuts abound.

Water, the keystone of life, is abundant in some mountains and plateaus of Kazakhstan, the Kyrgyz Republic, and Tajikistan, but only the two major rivers of the region, the Amu Darya and Syr Darya, venture across the sprawling deserts of Turkmenistan and Uzbekistan. Both rivers end in the Aral Sea but diversion of water for agriculture has greatly lessened their flow, such that the Aral Sea has been shrinking continually since the 1960s.

In the west of the region is the Caspian Sea, largest inland water body in the world and shared with other nations that border its shores—Iran, Azerbaijan, and the Russian Federation. Moderately saline, it supports large fisheries and is home to the famous sturgeon fish.



■ Desert village with summer yurts and winter houses in Damla Oasis, Turkmenistan.

## Extreme Environments

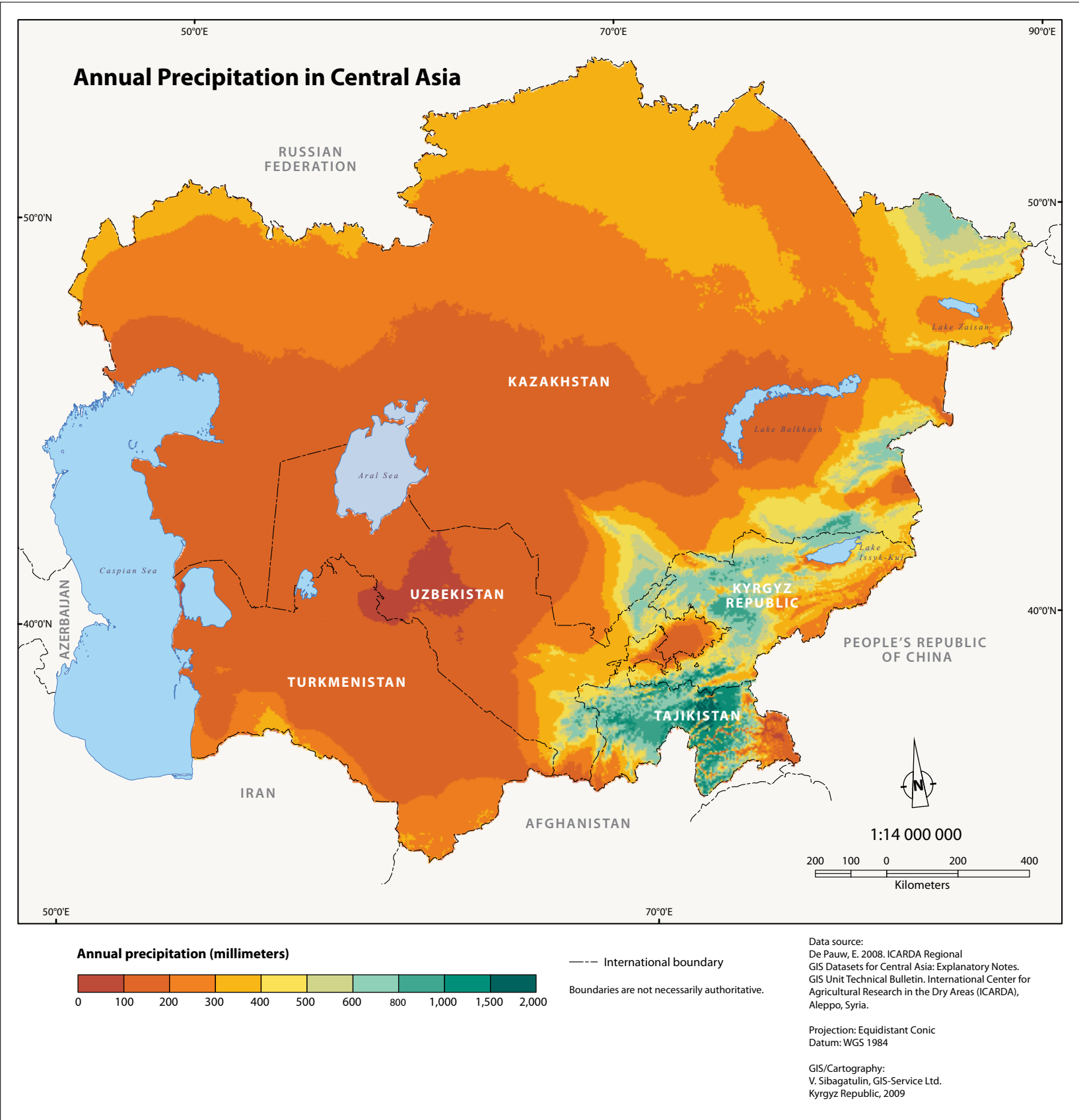
Temperatures across most of the region's steppes and deserts follow a gradient from north to south. Winters are severe in northern Kazakhstan, averaging as low as  $-20^{\circ}\text{C}$  in January, blanketing crop and pasturelands in snow for much of the winter. Further south, conditions become milder, but average midwinter temperatures do not creep above zero except in southern Turkmenistan and Uzbekistan.

Summer brings above-zero temperatures throughout the steppes and deserts, with an average of up to  $25^{\circ}\text{C}$  in midsummer in northern Kazakhstan and above  $30^{\circ}\text{C}$  in southern Turkmenistan.

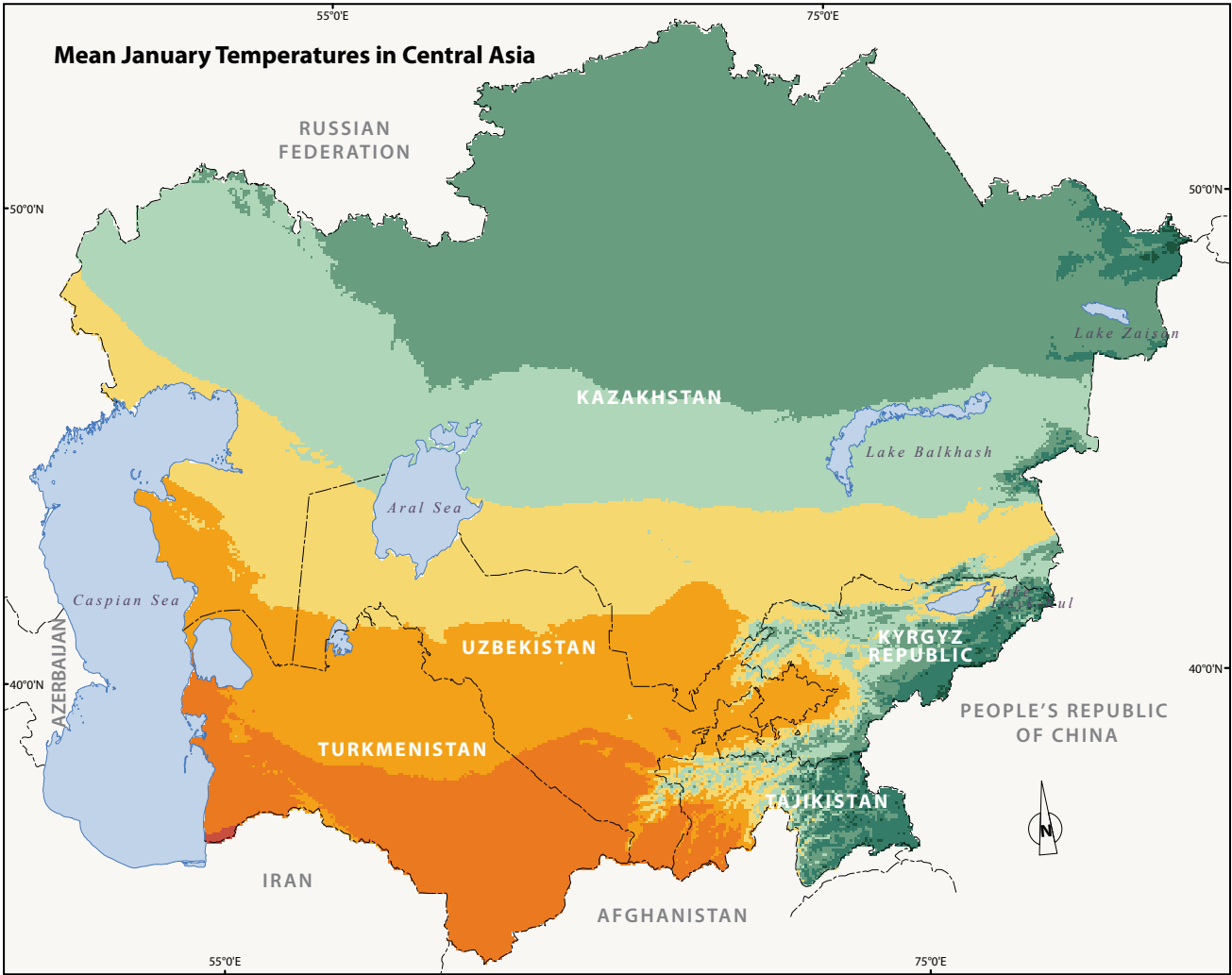
But in the mountains in the east and southeast, temperatures drop fast with altitude. Winters are bitter, averaging lower than  $-25^{\circ}\text{C}$  in the highest plateaus, which remain snow-covered year round. Even the lower slopes of the mountainous areas average  $10^{\circ}\text{C}$  or less in midsummer.

Annual precipitation (rain, sleet, and snow) patterns explain the region's generally arid environments. There is a dearth of precipitation across the great deserts of Kazakhstan, Uzbekistan, and Turkmenistan, averaging less than 100 millimeters a year. Precipitation gradually increases around the deserts on the steppes and plateaus to the north, south, and east. The eastern and southeastern mountains receive the majority of precipitation, averaging 1,000 millimeters or more. From these mountains flow the mighty rivers that provide power to the Kyrgyz Republic and Tajikistan and irrigation to southern Kazakhstan, Turkmenistan, and Uzbekistan.











■ Chimgan, a mountainous and resort area about 130 kilometers from Tashkent, Uzbekistan, whose peaks reach 3,300 meters





■ Woman making mud bricks, used for constructing winter houses in the desert.







## Deserts: Land That Makes Demands

More than 40% of Central Asia is desert. These deserts are not simply large, empty expanses of sand. Although they exhibit extremes of temperature from day to night and from winter to summer and receive little rain—and what rain they receive evaporates quickly—they contain a world of uncommon biodiversity, where plants and animals have learned to make the most with less. In no other ecoregion is biological success as dependent on subtle changes as in the desert environment. Climate, water, and soil play equal roles in determining the composition and distribution of life. Plants and animals engage in a delicate balancing act, with survival dependent on ability to adapt to extreme conditions.

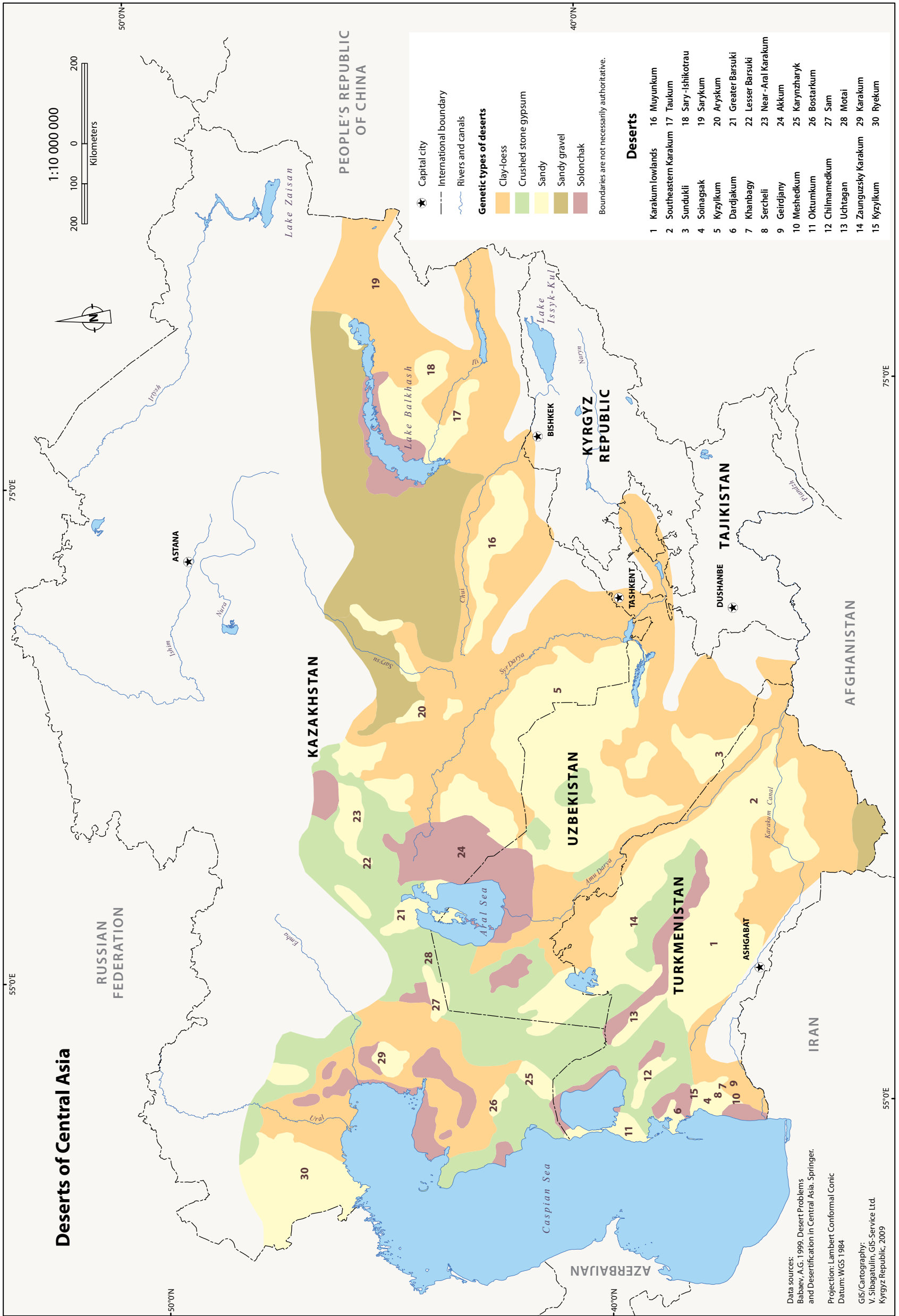
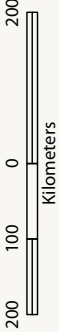
Of all the Eurasian deserts, those in Central Asia—particularly the sandy Northern Desert in central Kazakhstan and Southern Desert that embraces Turkmenistan, Uzbekistan, and southern Kazakhstan—support the greatest species diversity. Black saxaul and white saxaul are the most common tree shrub vegetation. The deserts are also home to small numbers of rare, endangered animals, such as Asian wild asses and Bactrian camels. The Southern Desert is described in detail as an ecoregion of unique diversity in the Living Resources chapter.

The desert climate is characterized by long, dry summers and high temperatures. In the Southern Desert, precipitation totals 70 millimeters or less each year and is seasonal, with more than half falling in spring, the remainder in late fall and winter. This creates two seasons: a mid-May through mid-October dry season, and a humid season the rest of the year. Winters are generally mild, with January temperatures between  $-1^{\circ}\text{C}$  and  $+5^{\circ}\text{C}$  and most plant growth stops for a short period only. Conditions are more severe in the equally large Northern Desert, where January temperatures are  $-10^{\circ}\text{C}$  to  $-15^{\circ}\text{C}$  and climb to  $24^{\circ}\text{C}$ – $26^{\circ}\text{C}$  in July. Precipitation (rain or snow) may fall any time of year, averaging up to 150 millimeters annually.



Deserts of Central Asia

1:10 000 000



★ Capital city

--- International boundary

~~~~ Rivers and canals

**Genetic types of deserts**

Clay-loess

Crushed stone gypsum

Sandy

Sandy gravel

Solonchak

Boundaries are not necessarily authoritative.

Deserts

- |                        |                      |
|------------------------|----------------------|
| 1 Karakum lowlands     | 16 Muyunkum          |
| 2 Southeastern Karakum | 17 Taukum            |
| 3 Sundukli             | 18 Sary-Ishikotrau   |
| 4 Soinagsak            | 19 Sarykum           |
| 5 Kyzylkum             | 20 Aryskum           |
| 6 Dardjakum            | 21 Greater Barsuki   |
| 7 Khanbagy             | 22 Lesser Barsuki    |
| 8 Sercheli             | 23 Near-Aral Karakum |
| 9 Geirdjany            | 24 Akkum             |
| 10 Meshedkum           | 25 Karynzhar'yk      |
| 11 Oktunkum            | 26 Bostarkum         |
| 12 Chilnamedkum        | 27 Sam               |
| 13 Uchtagan            | 28 Motai             |
| 14 Zaunguzsky Karakum  | 29 Karakum           |
| 15 Kyzylkum            | 30 Ryekum            |

Data sources:  
Babaev, A.G. 1999. Desert Problems  
and Desertification in Central Asia. Springer.  
Projection: Lambert Conformal Conic  
Datum: WGS 1984  
GIS/ Cartography:  
V. Sibagatulin, GIS-Service Ltd.  
Kyrgyz Republic, 2009





| Area Covered with Deserts in Central Asia (square kilometers) |                  |                          |                |
|---------------------------------------------------------------|------------------|--------------------------|----------------|
| Country                                                       | Total area       | Area Covered with Desert |                |
|                                                               |                  | All types                | Sandy Desert   |
| Uzbekistan                                                    | 449,000          | 250,000                  | 107,000        |
| Turkmenistan                                                  | 488,000          | 387,000                  | 260,000        |
| Tajikistan                                                    | 143,000          | 25,000                   | 5,000          |
| Kyrgyz Republic                                               | 198,000          | 70,000                   | 0              |
| Kazakhstan                                                    | 2,715,000        | 747,000                  | 246,000        |
| <b>Total</b>                                                  | <b>3,993,000</b> | <b>1,479,000</b>         | <b>618,000</b> |

Note: Areas are rounded numbers.  
Source: Zakirov 1980 as cited by Babaev 1999.

Drought takes a toll in the deserts, reducing harvests on rainfed lands. Desert winds are another destructive element, causing sand erosion and moving dunes. Dust storms last on average for 20–40 days a year, blanketing fields in sand and dust, and lowering crop yields. Spring and autumn frosts retard growth on irrigated land and pasture alike, and shorten growing seasons. Desert mists, which appear 10–20 days a year, create dangers for transport. The thirst for water is ever increasing, with groundwater resources under increasing pressure. And the deserts are growing due to overgrazing and poor agricultural practices.

The Kyzylkum Desert, part of the Northern Desert, offers an insight into the diversity of landforms and wealth of resources of Central Asia’s arid heart. Located southeast of the Aral Sea, between the Amu Darya and Syr Darya rivers, it covers some 300,000 square kilometers, and stretches across Kazakhstan, Uzbekistan, and Turkmenistan. The Kyzylkum includes areas of sandy, sandy-gravel,



gravel desert, crushed stone gypsum, loess, and *taky* soils. It consists of a massive plain with an altitude of up to 300 meters that slopes down toward the northwest, with a few small basins and mountains that rise to 900 meters. Crops are grown in oases and along rivers, while desert plants growing on the ridges serve primarily as pasture for camels, horses, and sheep.

The Kyzylkum is probably best known for its vast reserves of natural gas, and large deposits of aluminum, copper, gold, silver, and uranium. Measuring more than 300 meters deep and several kilometers across, the Muruntau gold mine in Uzbekistan is said to be one of the world’s largest open pit mines.

■ **Upper:** The burning deserts of Altyn Emel National Park, Kazakhstan;  
**Lower:** Young boy at play in the sands of the Karakum Desert



■ A shepherd on horseback with his flock of sheep in the poppy fields of Kazakhstan







## Steppes

### TAMING A BOUNDLESS EXPANSE

The Central Asian steppe forms the middle section of an enormous chain of plains called the Eurasian Steppe that stretches from western Hungary to Mongolia. Long an area of fascination, it conjures up images of nomadic hordes—fearless mounted archers who thundered across the land to subdue the civilizations of the now People's Republic of China, South Asia, Europe, and the Middle East. To these conquerors, the steppe was a boundless sea that provided a thoroughfare for movement, enabling them to expand traditional homelands across continents in pursuit of empire.

Steppes are the product of continental climate characterized by low and unstable precipitation. The World Wildlife Fund (WWF) categorizes steppes by ecoregions, differentiating them by flora and fauna as well as such attributes as climate, elevation, and rainfall. The Central Asian steppe is made up of a variety of steppe types—low mountain desert steppe, mid-altitude mountain steppe, mountain xerophyte steppe, mountain grassland with shrub steppe, semidesert steppe, shrub and brushwood steppe, and forest steppe. The Alai-Western Tien Shan steppe of Kazakhstan, Tajikistan, and Uzbekistan, for instance, is a foothill and low-mountain region blanketed with forbs, tall grasses, and juniper and wild pistachio forests. It contains a wide variety of fauna, including mountain sheep and wild cats.

Another steppe type is the Tien Shan foothill arid steppe of Kazakhstan and the Kyrgyz Republic, which breaks westward from the Tien Shan mountains. Moist arctic air spilling in from western Siberia enables it to support meadows and spruce forests, plus a full range of mammals, including the rare ibex and snow leopard. The steppe in eastern Kazakhstan offers still another terrain, one that includes significant wetlands and forest vegetation, such as birch, birch-aspen, and pine.

Most impressive of all is the Kazakh steppe—the largest dry steppe region in the world. Before being targeted for massive cultivation in the 1950s, it consisted of a continuous belt stretching from the Altai foothills in the east to the Ural River in the west. The Kazakh steppe is a windy expanse that receives 250–300 millimeters of precipitation a year, and is known for hot and dry summers and cold winters with little snow accumulation. It is geologically diverse, with gentle hilly plains, plateaus, and flat low plains. Large rivers, including the Irtysh and Ural, cross the region, and it is dotted with numerous shallow lakes. The Kazakh steppe is noted for its grasslands, fescues, and wild oats.

### THE STEPPES AND HUMAN INFLUENCE

Historically, Central Asia's steppe has been used by nomadic herders for grazing and growing fodder and small grain. It has also supported hunting and fishing. But though the steppe is still used as rangeland, much began to change in the 1950s when the former Soviet Union installed its Virgin Land Scheme to develop virgin and fallow land. The scheme introduced heavy cereal cultivation putting huge areas of steppe and forest-steppe to the plow for wheat production. Between 1950 and 1960, in Kazakhstan alone, the cultivated area increased from 7.8 million to 28.5 million hectares. Enormous steppe deterioration followed, so much so that millions of hectares of land plowed for wheat were eventually abandoned. Thanks, however, to heavy seeding with grasses and perennials, such as feather grass, wheat-grass, and wild rye, some of this land has been recovered. Still, research by the Kazakh Fodder and Pasture Institute suggests it could take 30 years for these abandoned steppe lands to fully recover.

Uzbekistan's Alai-Western Tien Shan steppe region, home to a significant percentage of the country's population, has been similarly altered. Plowing has occurred in virtually every area suitable for crops. Overgrazing has affected rangeland. Agriculture poses additional threats to steppe grassland and forests, especially fires caused by the burning of straw that could be better used as animal fodder. Once started, these fires are long-lasting and can spread quickly over large areas. Extractive industries have contaminated soil and water and destroyed vegetative cover. Some natural rehabilitation has taken place. However, primarily due to a recently declining economy, some farmers have abandoned their dry steppe fields, allowing the land to rest.

### PROTECTING THE STEPPES

Protecting the steppes for future generations will take much work. Numerous efforts are now under way. Rehabilitation of the Golodnaya Steppe, or Hungry Steppe, in Uzbekistan using salt-tolerant plants for reclaiming abandoned saline soil has proven to be an effective means of bringing such soil back to production. Another approach is improving feed and livestock production technologies; promising technology includes crop rotation for production of fodder and silage. Better water management has also brought considerable benefit to the steppes. In the 1960s, a notable example was the integrated water resources management—combining the interests of all water users and water resources—of the canals of the Golodnaya Steppe and later the main canal systems of the Karshi Steppe and other irrigation zones.



## Piedmont

Piedmont, or foothills, is the land found at the base of a mountain range. In Central Asia, it includes various ecosystems at elevations of 350–1,500 meters. Piedmont desert ecosystems of the Northern Tien Shan (400–800 meters) offer good spring and autumn–winter cattle pastures, and are densely populated. Piedmont short-grass, ephemeral semi-savanna ecosystems of the Western Tien Shan (350–700 meters) offer summer–winter pastures and are also densely populated. Similarly, piedmont and low mountain short-lived tall flowering plants, and tall grass ecosystems of the Western Tien Shan and Kopet-Dag (700–1,200 meters) offer highly productive winter–spring pastures and are densely occupied. Piedmont and low mountain xerophyte open woodland ecosystems of Western Tien Shan, Kopet-Dag, and Pamir Alay (1,000–1,500 meters) are known for their pistachio woodlands and high-value, wild, and cultured walnuts. In pre-agricultural days, these open and arid woodlands covered vast areas. Genetically valuable pistachio open woodlands occur at 700–800 meters altitude in the Western Tien Shan, southern Tajikistan, and Badkhyz (Turkmenistan).

The region's famous fertile valleys are also piedmont areas. Among them in the Kyrgyz Republic are the Talas Valley, called the Land of Manas, after the Kyrgyz national hero; and the Chui Valley, site of the nation's capital Bishkek. The Fergana Valley, a breadbasket for the region, and heavily populated with settlements of three nations—the Kyrgyz Republic, Tajikistan, and Uzbekistan—is also a piedmont area.



■ Horsemen ride along piedmont near Barskoon, south of Lake Issyk-Kul, Kyrgyz Republic.







■ Pik Abi Ali ibn Sino (formerly Pik Lenina). At 7,134 meters, this is one of the highest peaks in the region and is located on the border of the Kyrgyz Republic and Tajikistan.

## Mountains

### TOWERS OF DIVERSITY

Though the Kyrgyz Republic and Tajikistan are almost completely mountainous, mountains cover little more than 10% of the total Central Asian land mass. Ranges include parts of the Kopet-Dag in Turkmenistan, Altai and Ural in Kazakhstan, and Talassikiy-Alatau in the Kyrgyz Republic. Most prominent are the Pamir Range in Tajikistan, and the Tien Shan in the Kyrgyz Republic and northern Tajikistan—two of the oldest and highest ranges in the world.

To ascend such mountains is to measure human strength and experience the arrival of many seasons in a day. Changing mountain elevations compress climate zones, making flora and fauna so diverse that mountains are home to almost half the world’s species. In Central Asia, cascading elevations and an interior continental location provide conditions for great biodiversity. They also result in a mountain region that features such rich landscapes that alpine, nival, mountain forest, steppe, meadow-steppe, desert, and semidesert can all be found.

| Mountain Ranges of Central Asia                    |                                                     |                                                                                    |
|----------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------------|
| Range                                              | Location in Central Asia                            | Prominent Peak                                                                     |
| Altai-Dzhungar Alatau, Tarbagatai, and Rudny Altai | Kazakhstan                                          | Mt. Belukha (Gora Belukha): 4,506 meters                                           |
| Tien Shan                                          | Kazakhstan, Kyrgyz Republic, Tajikistan, Uzbekistan | Victory Peak (Pik Pobeda): 7,439 meters                                            |
| Pamir Alay                                         | Kyrgyz Republic, Tajikistan                         | Pik Ismoil Somoni: 7,495 meters                                                    |
| Gissar                                             | Tajikistan, Uzbekistan                              | Peak of the 22nd Congress of the Communist Party (currently unnamed): 4,643 meters |
| Kopet-Dag                                          | Turkmenistan                                        | Highest peak in Turkmenistan: 2,940 meters                                         |
| Alatau                                             | Kyrgyz Republic                                     | Peak Korona: 4,860 meters – highest peak in Ala-Archa National Park                |







■ Water, flowing west across the region from the mountains in the southeast, is its most precious resource.







## A TROVE OF RESOURCES

Half of all humans depend on mountain resources. The proportion is even higher in Central Asia, where people rely almost exclusively on mountain water to sate their arid landscape. Mountain areas receive the highest precipitation, 500 to more than 1,000 millimeters, of any land type in the region, plus they contain a glacial water storehouse. They provide most of the region's water for hydropower and agriculture, and the only renewable source of freshwater.

Large rivers, such as the Aksu, Atrek, Amu Darya, Ili, Karatal, Lepsa, Shu, Syr Darya, Talas, and Zarafshan, find their source in the mountains. They are served by a series of dams and reservoirs used for power generation and irrigation. Underground mountain water runoff also fuels numerous small rivers that begin in the foothills and help irrigate land in the valleys.

The mountains contain the region's primary forest resources. In addition to fuel wood and timber, forests supply fruit and medicinal plants, and are a habitat for wild animals. Originating in the mountain ecosystems are numerous cultivated plants and breeds of animals. These ecosystems serve as refuges for various plants and animal species, and provide a globally important gene pool for many species, including the walnut.

Arguably, the greatest mountain range in Central Asia is the Tien Shan, with more than 30 peaks that are 6,000 meters or higher. Aptly called the "Celestial Mountains," this vast range stretches almost 3,000 kilometers from the Kyrgyz Republic to the Mongolian frontier. Lines of mountains of the Tien Shan orient east-west in the form of parallel ranges around the catchment of the Naryn River, whose outflow reaches the Syr Darya, and numerous lakes, including Lake Issyk-Kul, purported to be the world's second-largest high-altitude lake. The highest Tien Shan peak within the region is Victory Peak (7,439 meters) in the Kyrgyz Republic.

Inhabitants of the Tien Shan are primarily Kazakh and Kyrgyz pastoralists whose animals include goats, horses, sheep, and yaks. The Tien Shan is an important source of oil, gas, and hydropower for the region, and has valuable reserves of antimony, copper, gold, lead, and tungsten.





■ **Upper:** Harvesters in cotton field.  
**Lower:** Herding cows in Jalalabad,  
 Kyrgyz Republic.

## Agriculture to Uranium: Natural Resource Powerhouse

The Turks were mainly pastoralists, herding livestock. This was the main activity in most of Central Asia in past centuries and, indeed, it remains important today. Crop agriculture was confined to narrow bands around oases and along water courses with limited, though impressive, irrigation. The Soviets brought large-scale crop agriculture—cotton and wheat—to Central Asia. Vast tracts of marginal desert and steppe were plowed to make the area one of the world's leading cotton-producing centers and a breadbasket for the former Soviet Union's populations.

Cotton had its heyday in the Soviet period but production continues at a high level. Wheat production is increasing rapidly since independence of the region's countries, with the aim of food self sufficiency. Fisheries have declined dramatically since the 1980s, mainly due to the changes in river flows and pollution.

Large reservoirs were built during the Soviet period to regulate water flow for agriculture, hydropower, and storage; and more are being constructed or planned by the now-independent countries, especially on the two main rivers (Amu Darya and Syr Darya), resulting in conflict among user types and among the countries themselves. Finding a balance to suit all water users will be difficult but critical. Long-term water conservation measures are especially important because global climate





change is threatening the ecology of Central Asia; glaciers in the region are melting at an alarming rate. As they retreat, water supplies from them will gradually dwindle.

Signs of copious energy resources are clearly visible in the lowland parts of the region. Oil and gas pipelines crisscross the region, where once only camel caravans passed, especially in hydrocarbon-rich Kazakhstan, Turkmenistan, and Uzbekistan. Natural gas provides nearly all the energy needs of Turkmenistan and Uzbekistan, while Kazakhstan relies on coal power and is the biggest exporter of oil in the region. The mountainous countries, the Kyrgyz Republic and Tajikistan, derive nearly all their energy needs from water—hydropower.

Apart from hydropower, the countries offer outstanding opportunities for other forms of alternative energy, particularly by harnessing wind and solar power. Biogas and biofuel production—energy from agriculture—is also being investigated.

And all the countries have excess energy resources for export, even for nuclear energy: Kazakhstan and Uzbekistan have abundant uranium reserves.

But uranium is a minor product—albeit with major environmental implications—in the region. Scattered across the deserts and mountains are huge reserves of other important minerals and ores. Mines produce scores of minerals from aluminum to zinc, and significantly contribute to the countries’ gross domestic product.



■ **Upper:** Hydroelectric plant and Karakum reservoir in Tajikistan.  
**Lower:** Yellow cake at the North Karamurun PV-1 uranium mine in south Kazakhstan.