

# Living Resources





■ Great cormorants (*Phalacrocorax carbo*) in the Amu Darya tugai forest. Inset: Sunset over Lake Sultankeldi in Korgalzhyn Nature Reserve.



**M**aintaining our living resources, the countless types of plants and animals that exist on earth, is vitally important for our own survival. We depend on this biological diversity, or biodiversity, not only for food but also as sources of enzymes, genes, chemicals, resins, and fibers that we can exploit to cure disease, provide substances, and create economic wealth—not to mention the essential ecological services that plants especially provide, such as keeping enough oxygen in the air and absorbing carbon dioxide that would otherwise quickly poison us. To maintain biodiversity, we must also conserve the areas where plants and animals live, their habitats.

Central Asia is amazingly diverse in its habitats, from inland seas and deserts below sea level to fertile valleys to snow-covered mountains that are among the tallest in the world. Its wide biodiversity reflects this variety of habitats. Some parts of the region can be considered “crossroads” for Asian and Mediterranean species; other areas are unique centers of endemic species, those that occur naturally nowhere else in the world.

The region’s fauna include over 900 vertebrate species—172 of them mammals, 540 birds, 106 reptiles, 14 amphibians, and about 150 fishes. More than 20,000 types of invertebrates have been documented, and this is believed to be only a portion of the total fauna present. Some well-known animals in the region are the snow leopard, Tien Shan (Himalayan brown) bear, Marco Polo sheep, and Przewalski’s horse.

Central Asia is home to about 7,000 higher plant (angiosperm) species. Best known are the region’s fruits and nuts. Many fruits and nuts now farmed worldwide have their origin in wild varieties of Central Asia—think of almonds, cherries, pears, plums, and walnuts, to name only a few.

## Ecosystems and Ecoregions

The habitats that underpin the survival of the world’s biodiversity can be grouped into

### Biodiversity

**B**iological diversity, or biodiversity, simply means the variability among living organisms wherever they are found. It is usually measured as numbers of species in a locality, but it also means the variability within species, known as genetic diversity. Biodiversity also applies to habitat diversity—the variety of places where life exists.

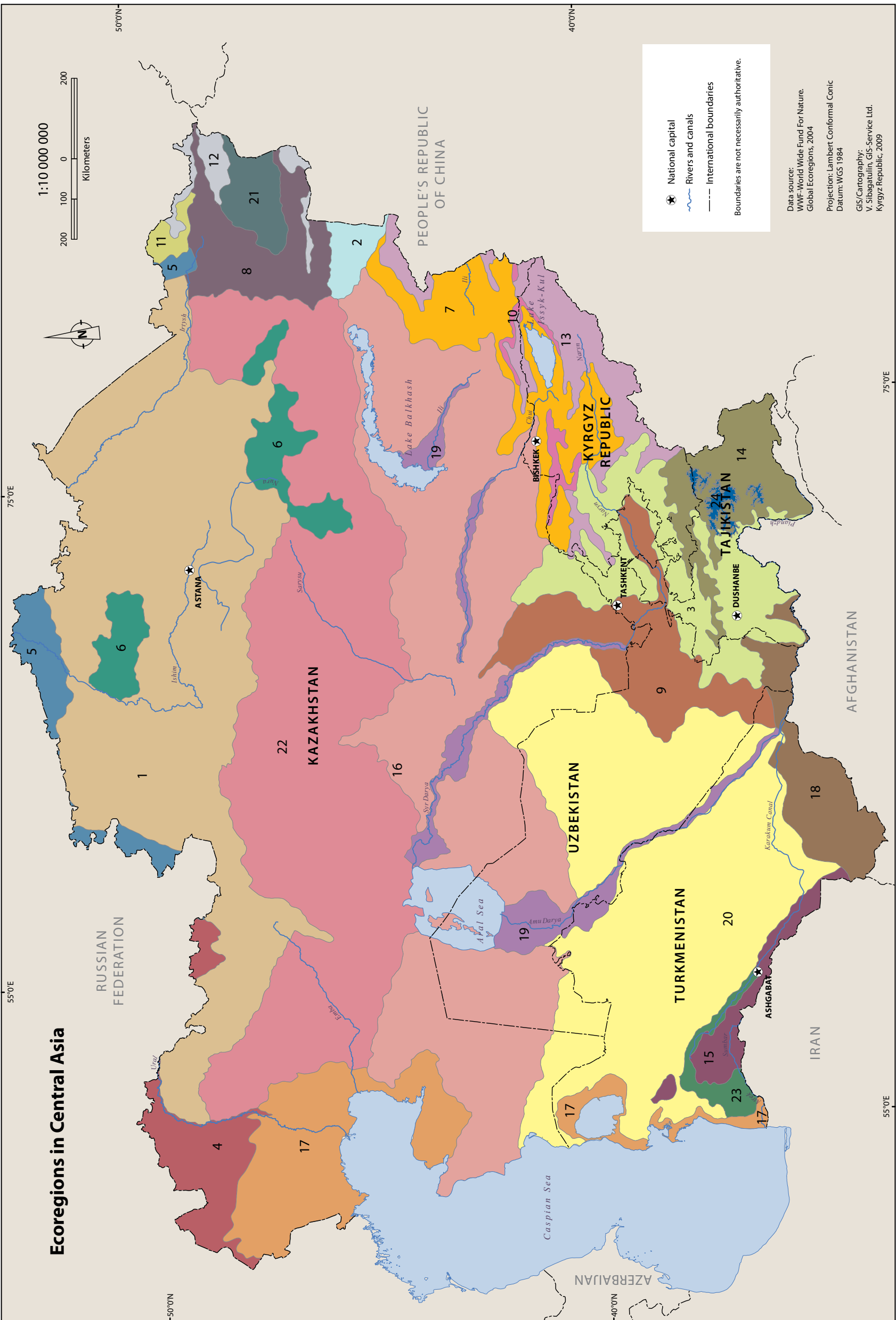
ecosystems: areas where the interactions between the different residents—animals and plants—are much stronger than their interactions with nonresidents that is, residents of neighboring ecosystems. Central Asia contains a wide range of aquatic, wetland, desert, and montane ecosystems.

At a higher level are ecoregions, groups of interacting ecosystems in which there are shared species and similar ecological processes and environmental conditions. To represent the original distribution of plants and animals on earth, the World Wildlife Fund (WWF) divided the entire planet into 867 terrestrial ecoregions. In Central Asia, 112 ecoregions were identified: 30 in mountainous and hilly areas in desert zones, 5 in mountainous areas in steppes, 29 in desert plains, 39 in steppe plains, and 7 in river valleys.

Worldwide, WWF selected 200 ecoregions—the Global 200—deemed the most outstanding for their biodiversity and other attributes. WWF Global 200 ecoregions that are within, or fall partially, in Central Asia are

- Middle Asian montane steppe and woodlands, Global 200 No. 111, which includes the terrestrial ecoregions Gissaro-Alai open woodlands (PA0808), Pamir alpine desert and tundra (PA1014), Tien Shan montane conifer forests (PA0521) Alai-Western Tien Shan steppe (PA0801), Tien Shan montane steppe and meadows (PA1019), and Tien Shan foothill arid steppe (PA0818)
- Central Asian deserts, Global 200 No. 134, which include the terrestrial ecoregions Central Asian riparian woodlands (PA1311), Central Asian northern desert (PA1310), and Central Asian southern desert (PA1312)

# Ecoregions in Central Asia



## Ecoregions

### Temperate Grasslands, Savannas, and Shrublands

1	Kazakh steppe (PA0810)
2	Emin Valley steppe (PA0806)
3	Gissaro-Alai open woodlands (PA0808)
4	Pontic steppe (PA0814)
5	Kazakh forest steppe (PA0809)
6	Kazakh upland (PA0811)
7	Tien Shan foothill arid steppe (PA0818)
8	Altai steppe and semidesert (PA0802)
9	Alai-Western Tien Shan steppe (PA0801)

### Temperate Conifer Forests

10	Tien Shan montane conifer forests (PA0521)
11	Altai montane forest and forest steppe (PA0502)

### Montane Grasslands and Shrublands

12	Altai alpine meadow and tundra (PA1001)
13	Tien Shan montane steppe and meadows (PA1019)
14	Pamir alpine desert and tundra (PA1014)
15	Kopet-Dag woodlands and forest steppe (PA1008)

## Deserts and Xeric Shrublands

16	Central Asian northern desert (PA1310)
17	Caspian lowland desert (PA1308)
18	Badkhyz and Karabil semidesert (PA1306)
19	Central Asian riparian woodlands (PA1311)
20	Central Asian southern desert (PA1312)
21	Junggar Basin semidesert (PA1317)
22	Kazakh semidesert (PA1318)
23	Kopet Dag semidesert (PA1319)

## Rock, Ice

24	Rock and ice
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- Volga River Delta, Global 200 No. 157, a freshwater ecoregion (in the Russian Federation and partially in Kazakhstan)
- Tibetan Plateau Steppe (Global 200 No. 110), which includes Central Asia, north of the Himalayas: Afghanistan, the People's Republic of China, India, Pakistan, and Tajikistan

Agricultural development has drastically altered the region's landscape since the second half of the 20th century; many habitats have been destroyed. The dissolution of the Soviet Union in 1991 led to dramatic changes in the sociopolitical and economic life of the region, that have had further enormous consequences for biodiversity conservation.

These anthropogenic pressures have put much of the wild flora and fauna of Central Asia under threat, with many already rare and endangered. The famed Caspian tiger (*Panthera tigris virgata*) was declared extinct within the last century and the Asian cheetah (*Acinonyx jubatus*) may have recently vanished in Central Asia.

## The Global 200

The Global 200 ecoregions were chosen from outstanding examples of each terrestrial, freshwater, and marine major habitat type. Ecoregions that represent the most distinctive examples of biodiversity for a given major habitat type were chosen, based on the following parameters:

- species richness;
- endemism;
- higher taxonomic uniqueness (e.g., unique genera or families, relict species or communities, primitive lineages);
- extraordinary ecological or evolutionary phenomena (e.g., extraordinary adaptive radiations, intact large vertebrate assemblages, migrations of large vertebrates); and
- global rarity of the major habitat type.

Only the biodiversity values of ecoregions sharing the same major habitat type were compared because the relative magnitude of parameters, such as richness and endemism, varies widely among them.



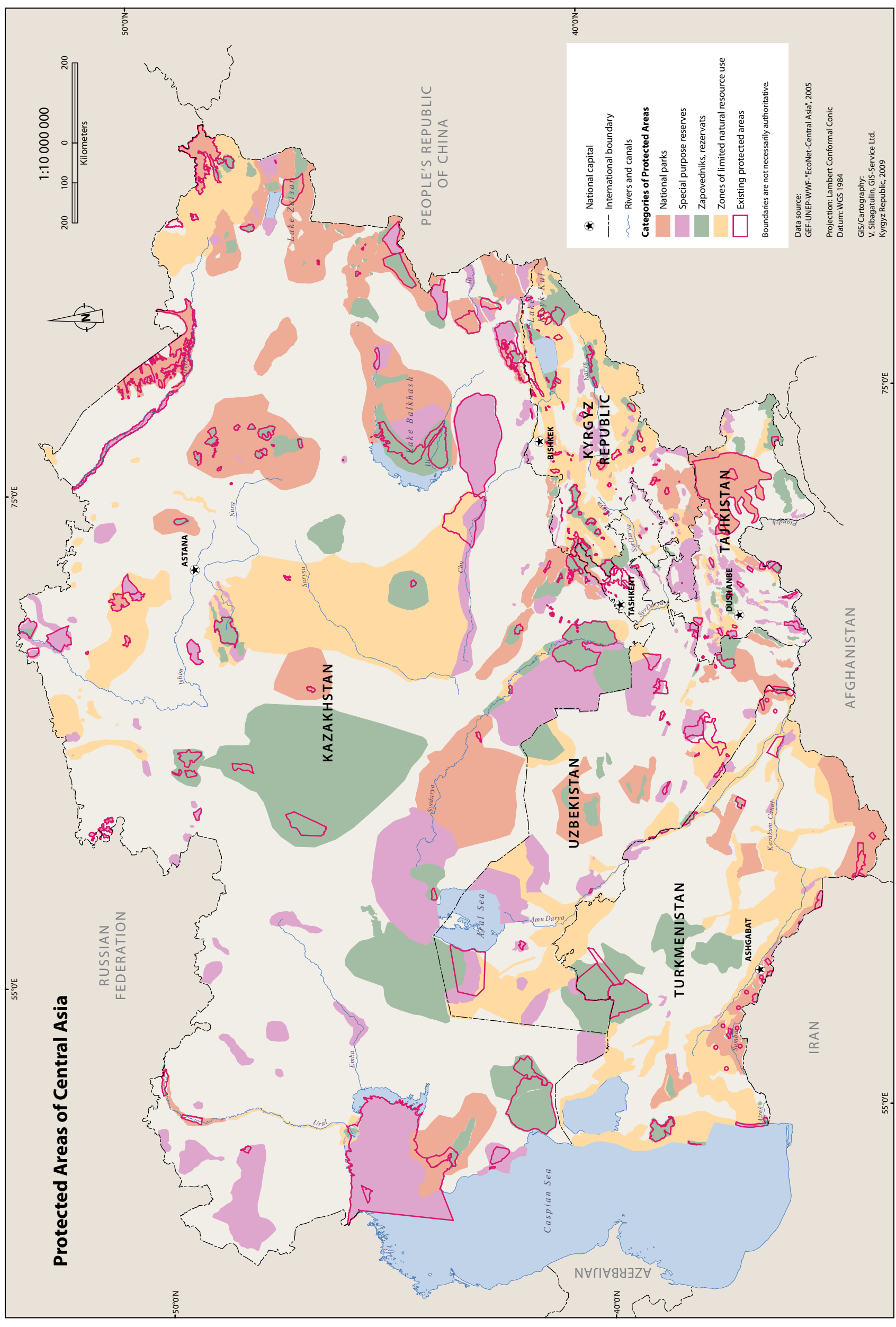
■ **Upper:** A flock of greater flamingos (*Phoenicopterus roseus*) about to take off. The Kurgalzhino Nature Reserve in Kazakhstan is an important breeding ground for this migratory species. **Lower:** A Caspian tiger killed in Northern Iran, early 1940s.

# Protected Areas of Central Asia

RUSSIAN  
FEDERATION



1:10 000 000



★ National capital  
--- International boundary  
~ Rivers and canals

**Categories of Protected Areas**

- National parks
- Special purpose reserves
- Zapovedniks, rezervats
- Zones of limited natural resource use
- Existing protected areas

Boundaries are not necessarily authoritative.

Data source:  
GEF-UNEP-WWF-“EcoNet-Central Asia”, 2005

Projection: Lambert Conformal Conic  
Datum: WGS 1984

GIS/ Cartography:  
V. Sibagatulin, GIS-Service Ltd.  
Kyrgyz Republic, 2009

## Protected Areas in Central Asia

	Existing System of Protected Areas (% of the territory of the country)				Planned Econet—PA Categories (% of the territory of the country)					Planned Econet—Ecological Network Categories (% of the territory of the country)			
	Zapovedniks	National Parks	Other PAs	Total	Zapovedniks	National Parks	Other PAs	Areas of Sustainable Development	Total	Core Areas	Ecological Corridors	Buffer Zones	Total
Kazakhstan	0.39	0.55	6.3	7.2	11.3	11.9	7.5	9.6	4.3	9.9	18.9	11.5	40.3
Kyrgyz Republic	1.8	1.5	1.8	5.1	14.1	11.6	4.6	52.8	83.3	16.0	29.5	37.8	83.3
Tajikistan	0.7	16.4	1.9	19.1	4.5	19.8	14.2	7.7	46.2	18.2	24.1	3.9	46.2
Turkmenistan	2.4	0.0	2.3	4.7	9.9	6.9	1.8	30.8	49.5	19.5	23.3	6.7	49.5
Uzbekistan	0.4	1.1	3.7	5.2	10.9	7.5	9.3	15.0	42.7	9.8	13.3	19.6	42.7
										12.1	18.9	12.8	44.0

PA = protected area.

Source: ECONET. *Web for Life*. Central Asia. Moscow, March 2006. p. 50.



## Protected Areas

Ecoregions follow natural boundaries, not political ones. Protecting the unique nature and special biodiversity of ecoregions, especially those in the Global 200, needs cooperation among countries to establish mutually agreed protection mechanisms. The Econet, or ecological network, approach has been adopted in Central Asia as a way of conserving vital natural areas while allowing sustainable use of parts of them.

An Econet has three parts. Central is a large, specially protected “core” area of an ecoregion capable of supporting ecological balance and preserving a natural level of biological and landscape diversity. The core area contains animal habitats and landscapes of high importance to nature conservation. Linking core areas are transit areas, or ecological corridors, that allow migration of animals or interaction between core area populations. Buffer zones surround these core areas and corridors to protect them, while allowing compatible, sustainable land use in nearby areas. In general, the approach is designed to provide the ecological conditions for sustainable human social and economic development.

The approach is based on a proposal by World Wildlife Fund (WWF) in the 1998 document “Biodiversity Conservation in Central Asia—An Analysis of Biodiversity and Current Threats and Initial Investment Portfolio,” which was approved by environmental authorities in all countries and integrated into the Framework Convention on Environmental Protection for Sustainable Development in Central Asia. In 2007, an agreement was signed between the Interstate Sustainable Development Commission and WWF on transboundary Econet implementation. Already, model projects by WWF are under way in Kazakhstan and Tajikistan and more are planned.

When fully implemented, Econet will have increased coverage in the region of specially protected areas from 5% to 31%. Including the buffer zones, this provides some environmental protection for 44% of the region.

Following are some outstanding Central Asian ecoregions with unique biodiversity.

**Biosphere Reserve:** An international conservation designation given by the United Nations Educational, Scientific and Cultural Organization (UNESCO) under its program on Man and the Biosphere. Biosphere reserves innovate and demonstrate approaches to conservation and sustainable development. They are under national sovereign jurisdiction, yet share their experience and ideas nationally, regionally, and internationally within the World Network of Biosphere Reserves. There are 531 sites worldwide in 105 countries.

**World Heritage Site:** An area or object inscribed on the UNESCO World Heritage List. The sites are designated as having “outstanding universal value”—cultural or physical significance—under the Convention Concerning the Protection of the World Cultural and Natural Heritage. This convention, which the UNESCO adopted in 1972, provides a framework for international cooperation in preserving and protecting cultural treasures and natural areas throughout the world. Each site is the property of the state on whose territory the site is located, but preserving each site is considered in the interest of the international community.

■ Wetlands besides Lake Tengiz in the Korgalzhyn State Nature Reserve.



## Selected Regions of Unique Biodiversity

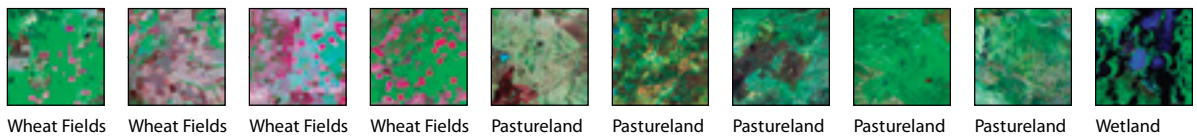
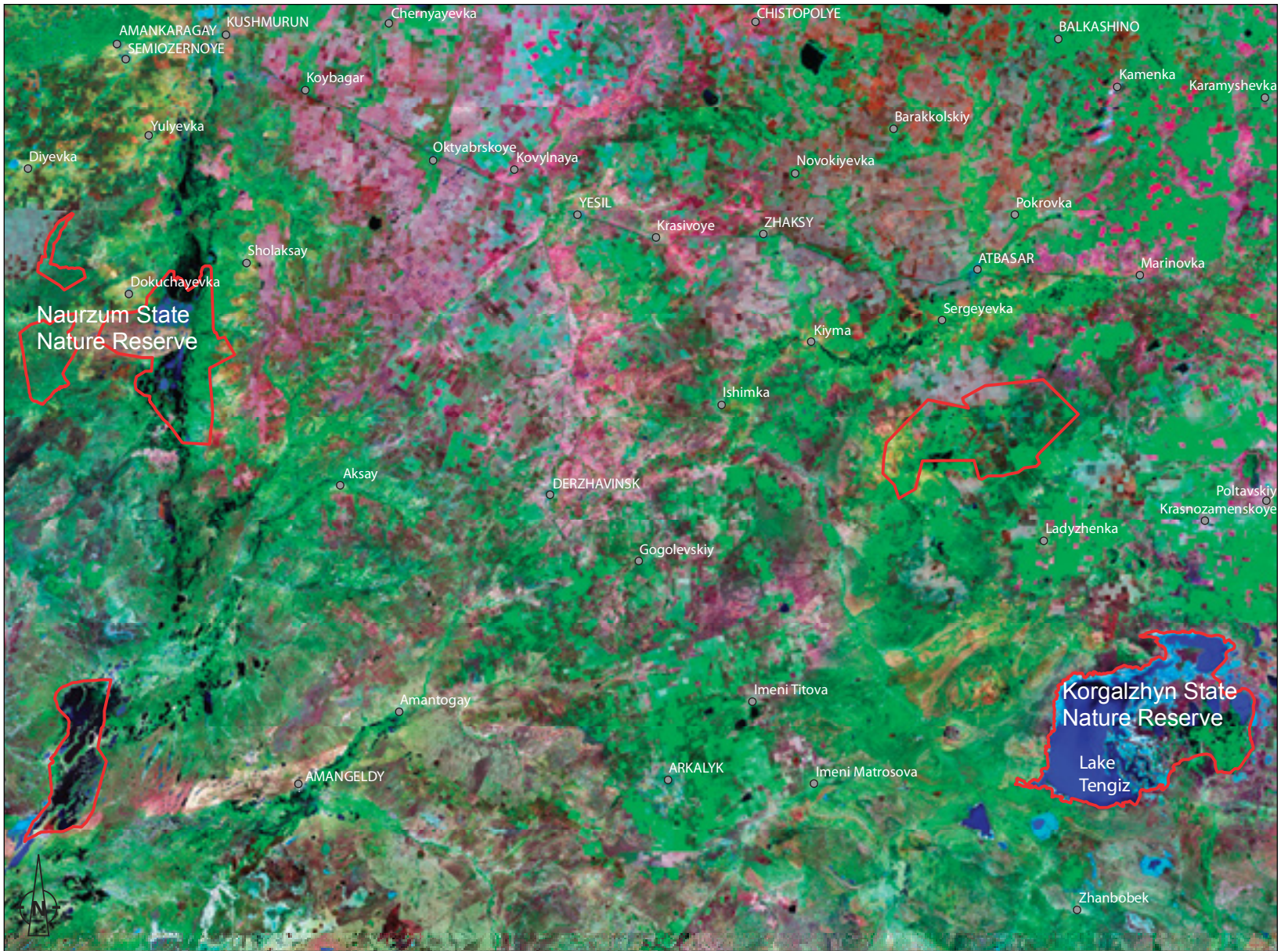
### STEPPE

#### Saryarka–Steppe and Lakes, Northern Kazakhstan

The Saryarka ecoregion is an area of the Central Asian steppe with both freshwater and saltwater lakes in northern Kazakhstan. A World Heritage Site, it is outstanding for its wetlands that receive millions of water birds migrating between Africa, Europe, and South Asia and their breeding areas in Siberia. It has two protected areas—Naurzum State Nature Reserve and Korgalzhyn State Nature Reserve—covering 450,344 hectares. Among the birds are globally threatened species, such as the extremely rare Siberian white crane, the Dalmatian pelican, and Pallas’s fish eagle. The Korgalzhyn-Tengiz lakes provide feeding grounds for up to 15 million–16 million birds, including flocks of up to 2.5 million geese. They also support up to 350,000 nesting waterfowl, while the Naurzum lakes are home for up to 500,000 nesting

■ **Upper:** The wetlands in Naurzum State Nature Reserve, Kazakhstan.  
**Lower:** Feather-grass steppe in Naurzum.

# Saryarka World Heritage Site



Satellite Image: Landsat ETM+ (15m)  
 Image Acquisition Date: circa 2000 (+/- 3 years)  
 Projection: Transverse Mercator

Prepared by C. Y. Ji, 2009

**The Saryarka Steppe and Lake World Heritage Site consists of two separate nature reserves: Korgalzhyn State Nature Reserve and Naurzum Nature Reserve. The former is also designated as a wetland of International Importance (Ramsar).**



waterfowl. The wetlands are key stopover points on the Central Asian flyways for migratory birds, while the 200,000-hectare steppe area is a valuable refuge for over half the species of the region's steppe flora, threatened bird species, and critically endangered Saiga antelope.

The site's steppes and lakes contain almost pristine biological, ecological, and hydrological processes, whose seasonal dynamics, along with the associated diverse fauna and flora, are of global significance and scientific interest.



View of the Naurzum State Nature Reserve.





■ **Top:** Sand dunes in the Karakum Desert. **Middle:** Panorama of the Kyzylkum Desert in Karakalpakstan, Uzbekistan. **Bottom:** A camel-borne ranger patrols the dunes of the Repetek Desert Reserve Station in the Karakum Desert.

## DESERTS

The Central Asian Southern Desert is the richest desert complex, in terms of its biodiversity, in the whole Europe–Asia landmass. The climate is milder and dryer than that of the more northerly deserts. Precipitation, totaling 70–125 millimeters, is greatest during the winter and spring, with a long summer drought. Snow cover is generally confined to December–February.

The ecoregion includes several mainly sandy deserts—Caspian coastal plains, southern part of the denuded Ustyurt Plateau, Krasnovodsk Plateau, Karakum sandy deserts, and the southern part of Kyzylkum sandy desert—that stretch from the eastern shore of the Caspian Sea to the lower Syr Darya River and to the foothills of the Central Asian mountains. Also included are the low alluvial and delta-alluvial plains of Amu Darya, Tedzhen, Murgab, and Zarafshan rivers. There are some low mountains (760–920 meters high) on Paleozoic rocks in the Kyzylkum.

The large Karakum Desert deserves special mention. It occupies more than two-thirds of Turkmenistan and covers some 350,000 square kilometers. To the west is the Caspian Sea. In the north, the Karakum is separated from the Kyzylkum Desert by the Amu Darya, Central Asia’s most important river. The Karakum includes sandy, sandy-gravel, gravel, loess, and takyr soils. From the Hindu Kush mountains to the south flow the Murgab and Tejen rivers, which empty into the Karakum Desert and provide water for irrigation. Under its arid surface are rich oil, gas, and sulfur deposits that are now being fully exploited.

Among the flora of this ecoregion, white saxaul (*Haloxylon persicum*) and black saxaul (*Haloxylon aphyllum*) trees occupy large areas on the sands. Endemic plants include *Salsola richteri*, *S. subaphylla*, *Ephedra strobilacea*, and *Ferula foetida*. Sandy acacia (*Ammodendron conollyi*) grows on sandhills. There is a high diversity of other shrubs,

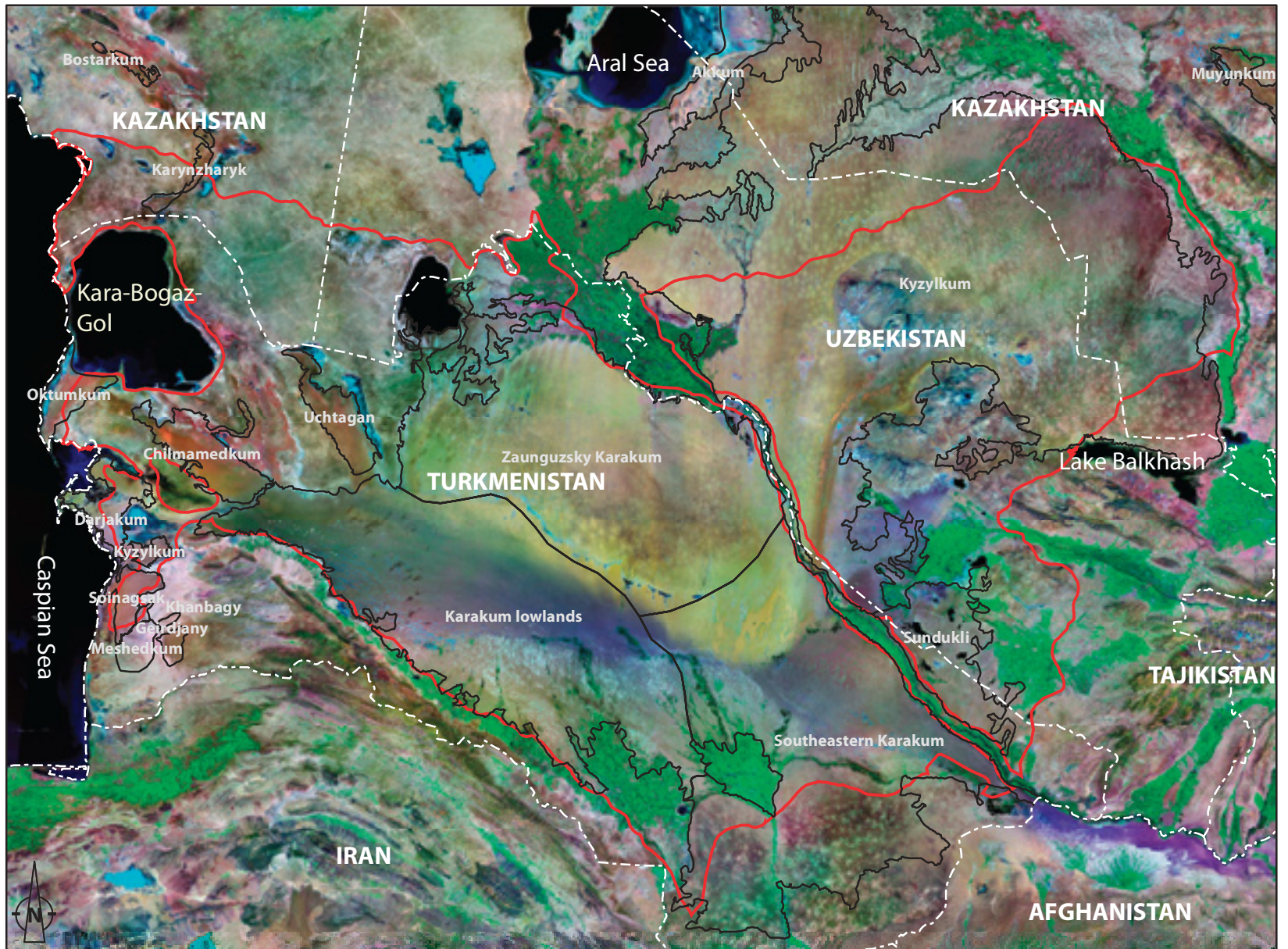
particularly types of buckwheat. On thin sandy soils and loamy sands, white salsola (*Salsola arbuscula*) and endemic sagebrush communities are widespread. Desert plants, especially the endemic legume *Astragalus vilosissimus* and shrub bindweed (*Convolvulus hammada*), are characteristic in the eastern part of the ecoregion. Perennial saltworts dominate on clay soils.

The desert fauna also include many endemic species, particularly in sandy deserts. There is a wide variety of insects, numerous reptiles (snakes and lizards), and several amphibians (toad agamas). Most common among the mammals are hedgehogs, the *tolai* hare, and rodents, such as gerbils and jerboas. Rare mammals include the honey badger, sand lynx (*Felis caracal*), sand cat (*Felis margarita*), onager (*Equus hemionus*), goitered gazelle (*Gazella subgutturosa*), and marbled polecat (*Vormela peregusna*). Prominent bird fauna include the houbara bustard, cream-colored courser, eagles, saker falcon, grouse, saxaul jay, larks, desert raven, desert shrike, desert sparrow, Egyptian vulture, desert warbler, and wheatears.

The spread of agriculture in the ecoregion, especially irrigated cotton farming, is the main threat to the desert’s biodiversity. Also damaging is the unsustainable use of plants, especially from saxaul forests, for firewood and silk production. Areas of forest left bare become covered in desert moss, which has no use as fodder and prevents reestablishment of other plants. Hunting and poaching, overgrazing by livestock, and encroachment by roads also threaten the stability of the ecoregion. Capture for zoos and collectors has dramatically reduced the numbers of both common and rare reptiles.

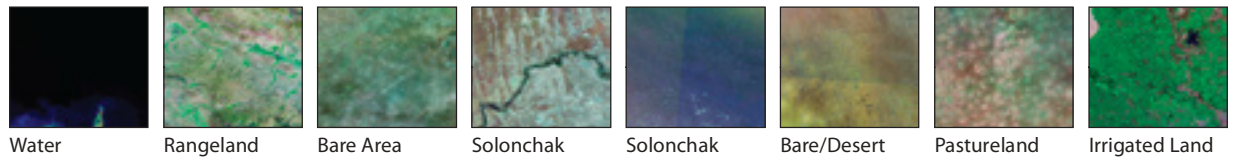
Turkmenistan, much of which is occupied by the Central Asian Southern Desert, is making efforts to rehabilitate the ecoregion, for example, through forest planting and providing gas for heating and cooking to minimize fuelwood use.

# Central Asian Southern Desert



110 55 0 110 Kilometers  
1:6,500,000

— Desert boundary  
— Central Asia Southern Desert  
- - - International boundary



Satellite Image: Landsat ETM+  
Image Acquisition Date: circa 2000 (+/- 3 years)  
Projection: Transverse Mercator

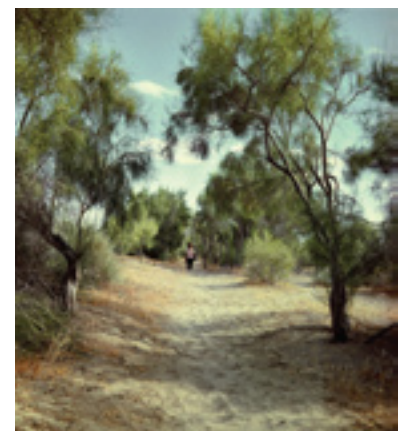
Prepared by C. Y. Ji, 2009



## Repetek Biosphere Reserve, Turkmenistan

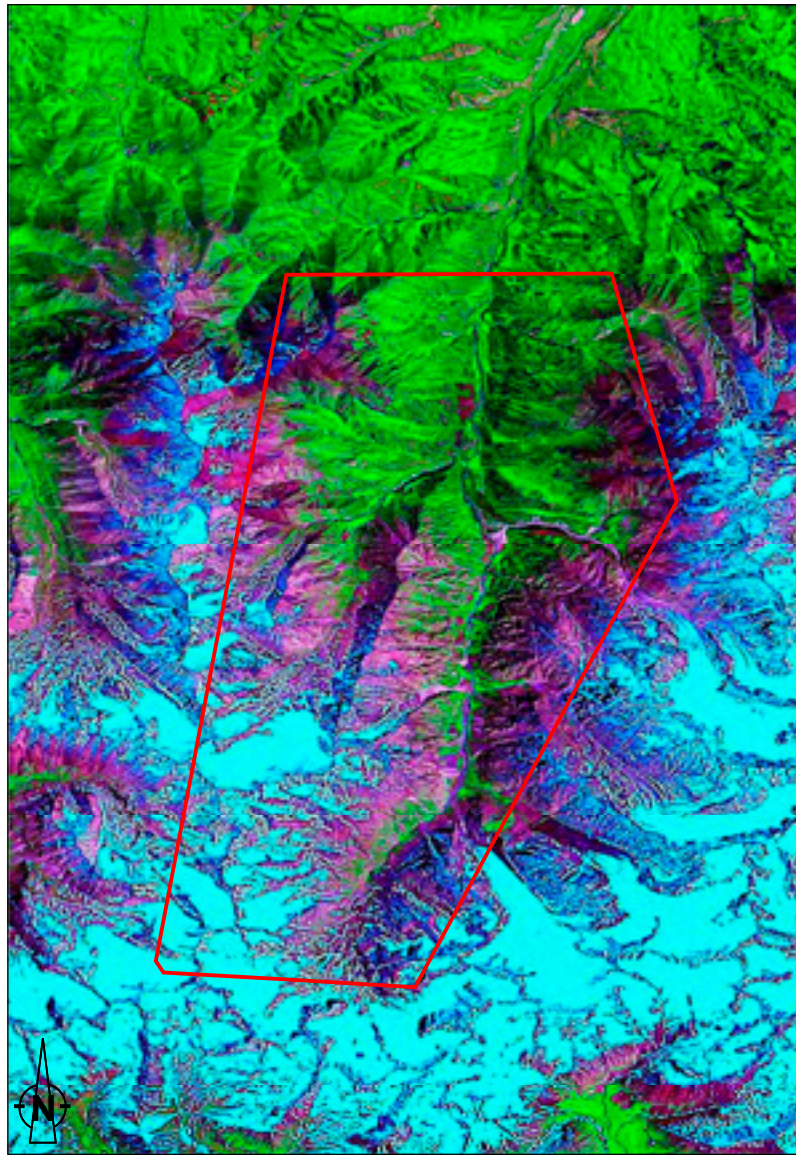
The 34,600-hectare Repetek Biosphere Reserve is classified as a cold winter desert and semidesert ecosystem in the East Karakum Desert, consisting of a sand plain with large sand ridges and valley-shaped depressions. It has traveling sand dunes (*barkhans*) with only sparse vegetation but is one of the few places in the Karakum Desert where black saxaul forest has been preserved.

The area is lightly populated (about 350 persons in 2003). Cattle breeding and fuelwood collection are the major livelihoods. Long-term studies on the dynamics of the sandy desert have led to restoration of overgrazed pastures and stopping further sand encroachment. The Government of Turkmenistan continues to monitor and protect the reserve's biodiversity.



■ A lane of saxaul trees in Repetek Reserve.

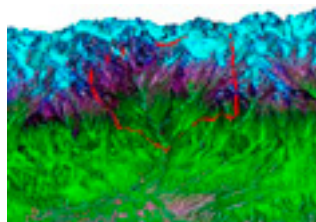
## Ala Archa National Park



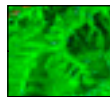
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— Boundary of National Park

Satellite Image: Landsat ETM+ (15m)  
Image Acquisition Date: circa 2000 (+/- 3 years)  
Projection: Geographic, WGS84



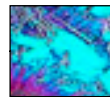
Prepared by C. Y. Ji, 2009



Mixed Forest



Bare Rock



Snow/Glacier



## MOUNTAINS

### Ala Archa National Park, Kyrgyz Republic

The Kyrgyz Republic established the 200-square-kilometer Ala Archa National Park in 1976. It was named for the juniper trees, which are held in esteem by the Kyrgyz people, who traditionally use smoke from burning wood to banish evil spirits.

The park ranges in altitude from about 1,500 meters at the entrance to 4,895 meters. More than 20 small and large glaciers and some 50 mountain peaks are within the park; two rivers, Adygene and Ak-Sai, are formed from the glaciers. The misty Adygene Gorge is a beautifully wooded valley graced by waterfalls, springs, and abundant Amu Darya trout. The very rare snow leopard lives here, as do wild goats, roe deer, and marmots.

### Pamir Alpine Desert and Tundra

Locally known as the Bam-i-dunya, or Roof of the World, Tajikistan's Pamir is a complex mountainous ecoregion that forms a plateau and covers more than 70,000 square kilometers at the crossroads of several of Asia's largest mountain ranges: the Himalayas, Karakoram, Hindu Kush, and Tien Shan. The average altitude is around 4,000 meters. The highest peak, Pik Ismoil Somoni, rises to 7,495 meters, not very far below that of Mount Everest (8,848 meters). The Western Pamir is highly glaciated and includes the Fedchenko Glacier, which, at 75 kilometers long, is one of the world's two longest glaciers outside of the polar regions. The plateau forms a biogeographic barrier between Central, middle (Mediterranean-influenced), and South Asia.

Cold, arid, and windy, it is nevertheless home for a wide variety of fauna and flora because of the convergence of several mountain ranges. Its Mediterranean-type gravelly desert in the lowest parts is dominated by salt-tolerant flora, replaced at higher elevations first by prickly cushion plants (*Acantholimon*), wormwoods (*Artemisia*), and needle grass (*Stipa*), and then by needle grass and fescue grass (*Festuca*). The highest and most extensive area is alpine sedge-meadow (*Kobresia* and *Carex* species), with many broad-leaved herbs (forbs), similar to the vegetation over most of the Tibetan Plateau and the Tien Shan. Vegetation becomes very sparse by 4,400 meters, which is near the upper limit of vegetation.

The unique nature of the Western and Eastern Pamirs is protected in the Tajik, or Pamir National Park, which occupies more than 2.6 million hectares (11% of the area of Tajikistan). The Tajik refuge includes lakes KaraKul and Sarez; the Zorkul refuge with the Zorkul lake system; the Muzkol refuge, and the Sanglyar refuge. The park contains over 400 small lakes, hundreds of small rivers, and some of the largest glaciers of Central Asia. Disturbingly, the glacier area of the Eastern Pamir



■ Ala Archa National Park.



range decreased 7.8% during the 1980s and further decreased 11.6% in the 1990s. As the glacier fronts retreat, they leave debris-covered zones and new lakes.

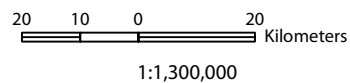
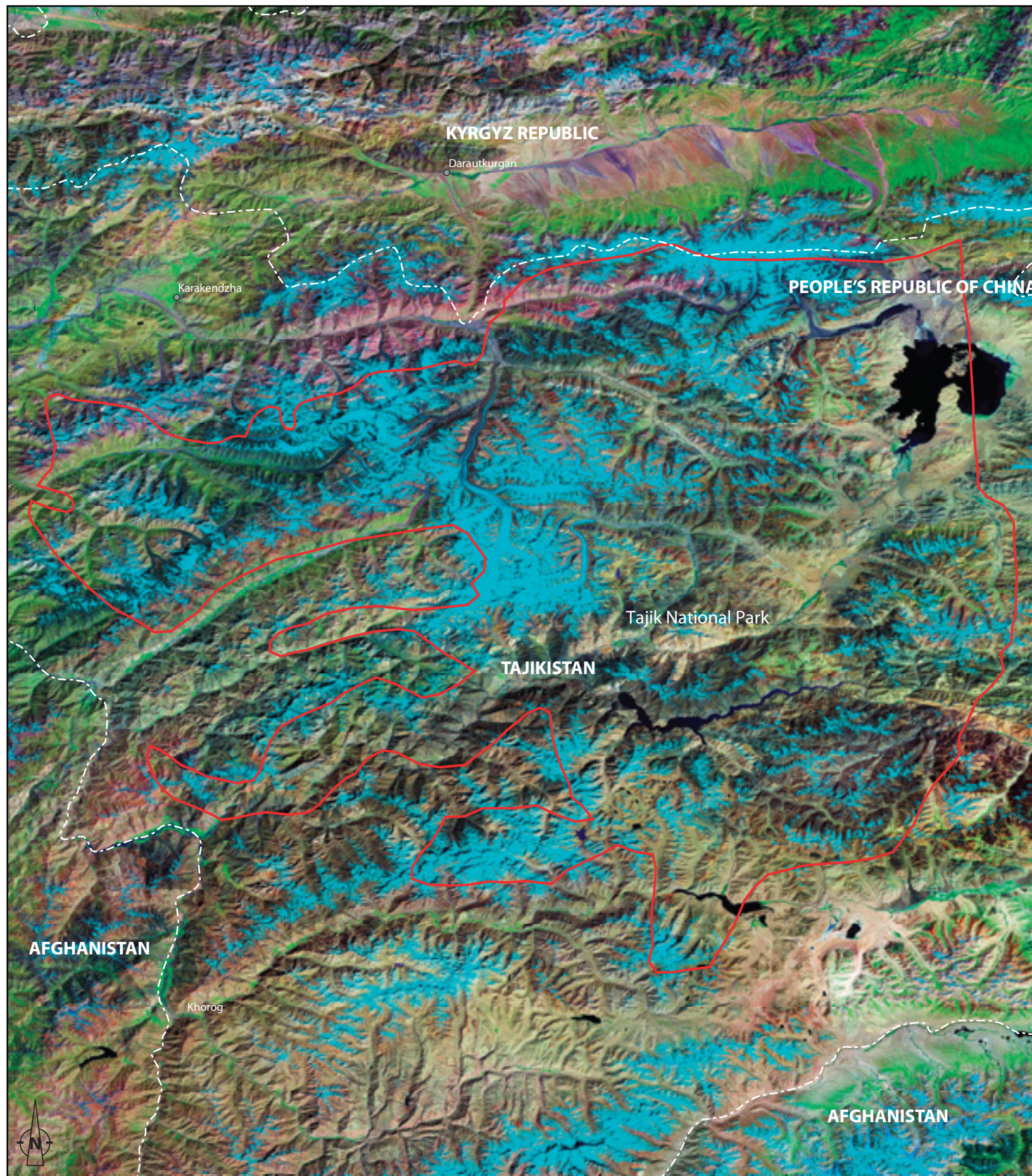
The Tajik National Park offers an insight into the breadth of biodiversity in the Pamirs. The park has more than 2,100 species of higher plants, many of which are endemic, rare, and endangered. The dominant landscapes are saxaul and wormwood deserts.

The fauna of Tajik National Park include 162 species of birds. Common species are the Pamir

casarca, Mongolian falcon, golden eagle, snow griffin, short beak plover, chough, Alpine daw, red and pearl reel, larks, and snow sparrow. Colonies of mountain goose, redheaded seagull, Tibetan river tern, and masses of migrating waterfowl and wading birds frequent Lake Karakul. Mammals include tolai, big eared, and red pika hares; rodents, like the red marmot, grey hamster, silvery and pamir field voles; Pamu argali and Siberian ibex; and predators, such as the river otter, fox, grey wolf, red wolf, snow leopard, and a white-clawed subspecies of brown bear. Many of these birds and mammals are rare or endangered.

■ From forests and lakes to alpine desert and glaciers, the Pamirs provide a wide variety of habitats that host equally diverse and unique fauna and flora.

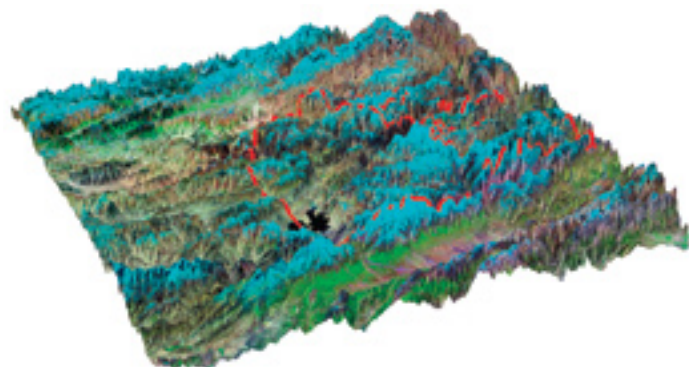
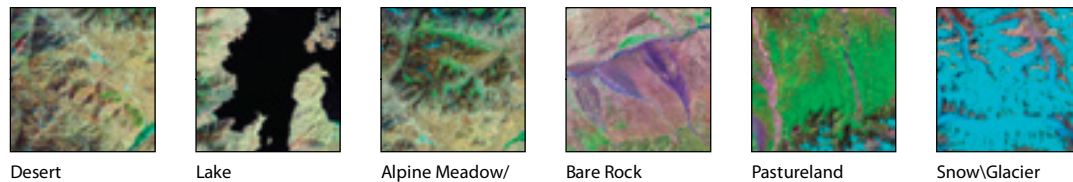
# Pamir Alpine Desert and Tundra



- City
- Boundary of National Park
- - - International boundary

Satellite Image: Landsat ETM+ (15m)  
 Image Acquisition Date: circa 2000 (+/- 3 years)  
 Projection: Geographic, WGS84

Prepared by C. Y. Ji, 2009



## WETLANDS

### Issyk-Kul Biosphere Reserve, Kyrgyz Republic

Issyk-Kul Biosphere Reserve in the Kyrgyz Republic is 4.3 million hectares of land and water at altitudes of 1,600–7,500 meters, surrounded by the Tien-Shan mountain range. The biosphere reserve, designated in 2001, has many types of ecosystems, from deserts to lakes to alpine tundra. Its name derives from the massive Lake Issyk-Kul, which occupies more than a tenth of the reserve and is a Ramsar Wetland site (see below). There is a core area of 145,000 hectares, a buffer zone of 3.5 million hectares, and a transition area of approximately 665,000 hectares. Among the reserve's flora and fauna are many endangered species in its unpopulated areas, including Marco Polo sheep, Siberian ibex, and snow leopard.

The ecosystem types are semideserts and deserts in the foothills (1,600–2,400 meters); foothill steppe ecosystems—meadows and juniper and spruce forests (2,000–3,000 meters); high mountain tundra (2,700–3,500 meters); aquatic ecosystems (Lake Issyk-Kul and mountain rivers); and areas of forestry, pastureland, mining, agriculture, and settlements.

Many Kyrgyz families move to the mountain meadows in summer to raise their cattle and nearly half a million people live in the biosphere reserve. Tourism in the north part of the reserve is economically important; the major gold mining company is active here also.

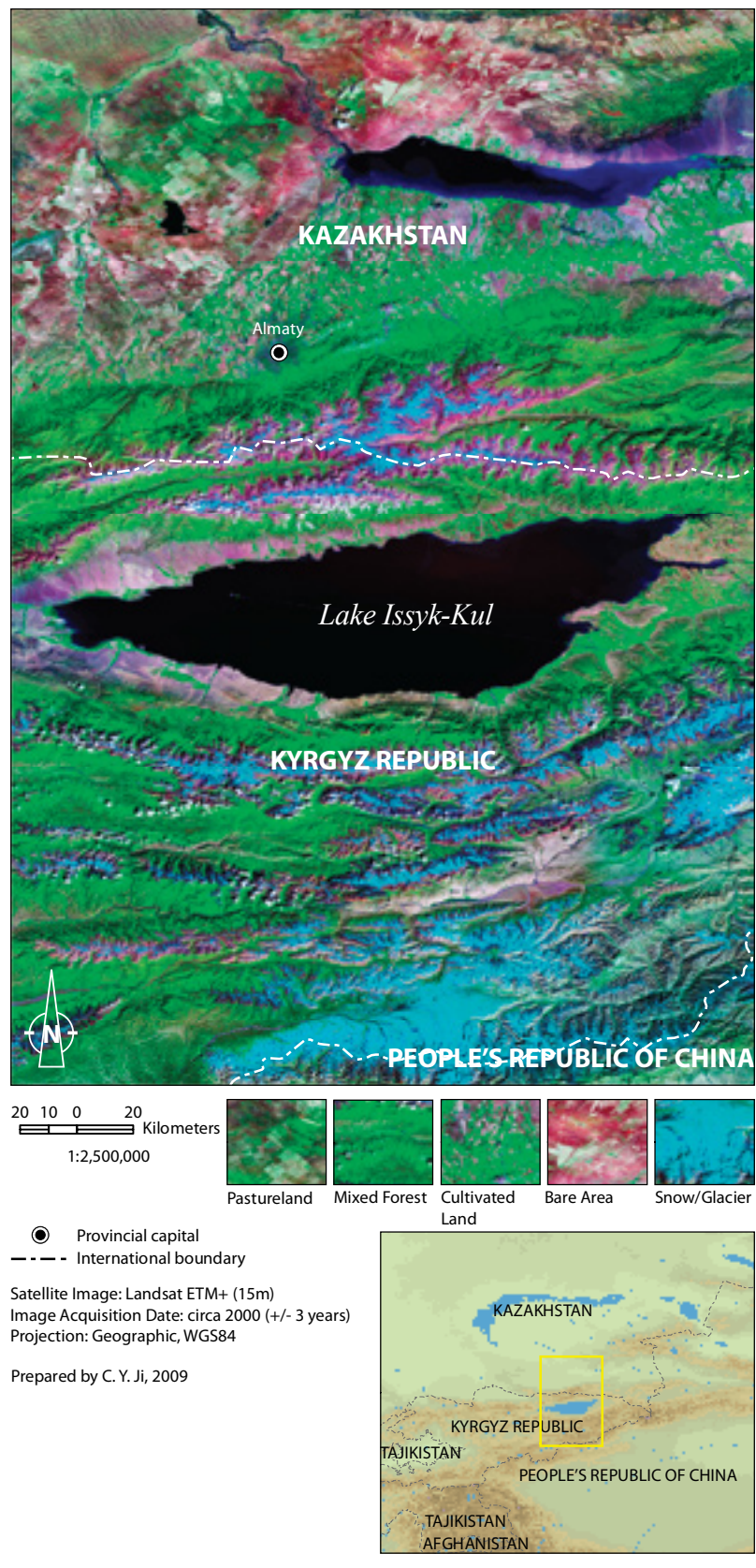
The government has set up an information center and projects on sustainable agriculture, particularly on managing livestock grazing and preventing soil erosion. Germany has been an active supporter in all phases of the biosphere program.

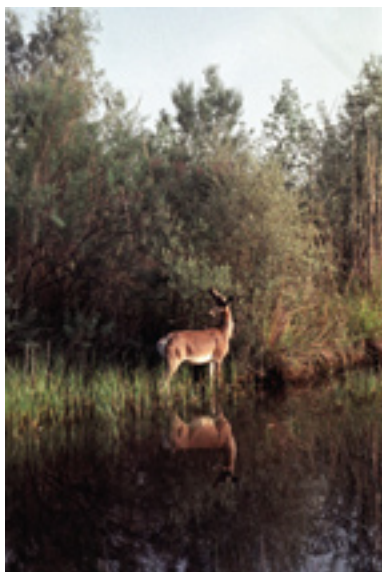
### Issyk-Kul State Reserve with the Lake Issyk-Kul Ramsar Site

Issyk-Kul Lake covers an area of 623,600 hectares, the second largest high-altitude lake in the world. Issyk-kul means “hot lake” because, although it is at a high altitude (1,609 meters), it does not freeze over; its average temperature is 22°C and popular hot springs can be found at Aksu. Lake Issyk-Kul Ramsar Site was first designated in 1976. It is a wintering site for up to 50,000 migratory waterbirds, including the whooper swan, mute swan, and common pochard, as well as small colonies of nesting storks. The lake also yields commercial fish harvests.

■ Issyk-Kul as seen from the southern shore looking north toward the Alatau mountains and Kazakhstan.

## Issyk-Kul Biosphere Reserve





■ **Upper:** A great egret (*Casmerodius albus*), grey heron (*Ardea cinerea*), and several mallard ducks (*Anas platyrhynchos*) flying over *tugai*.  
**Lower:** A Bukhara deer in the Badai Tugai Nature Reserve, Uzbekistan.

### **Tugai Forest of the Amu Darya Delta**

*Tugai* or riparian forests are those growing along river floodplains. The largest remaining *tugai* forest is the 30,000-hectare Badai Tugai in the Amu Darya delta joining the southern Aral Sea. The present forest is only about a tenth of the original *tugai* forest in the delta and is heavily fragmented. Smaller patches can be seen in the image on p. 107 along the right bank of the river and along the edges of the northeastern part of the delta.

The breadth of diversity of Amu Darya *tugai* flora is impressive. Reed communities line the shores; on land are dense forests dominated by poplars and willows; and beyond the forests are shrubs and trees characteristic of the surrounding deserts: tamarisk shrubs, and saxaul trees. Many plant species are endangered.

Equally outstanding are the fauna of these *tugai* forests: 28 mammal, 58 reptile, 91 bird, and 26 fish species. Among the mammals are the highly endangered Bukhara deer, of which fewer than 400 remain in the wild; and the endangered goitered gazelle, or djeiran. Other mammals are the grey wolf and golden jackal, red and corsac foxes, several wildcats, the Eurasian badger, Indian porcupine, and numerous rodents.

The wetlands of the *tugai* ecosystem, with their flowing waters, reed communities, and sand and mud banks, host nesting birds, such as the rare Khiva pheasant, and flocks of many migratory birds, such as the Dalmatian pelican, whiteheaded duck, marbled teal, and ferruginous duck.

Many fish and reptiles are endemic. Of global conservation value are the gray monitor lizard, Central Asian tortoise, snake (*Rhynococephalus rossikovi*), shovel-nosed sturgeons—which are critically endangered—and several kinds of carp. Some fishes that disappeared from the Aral Sea as its salinity rose, such as pike-perch, bream, barbel, and a roach subspecies, now survive only in the Amu Darya and Syr Darya deltas.

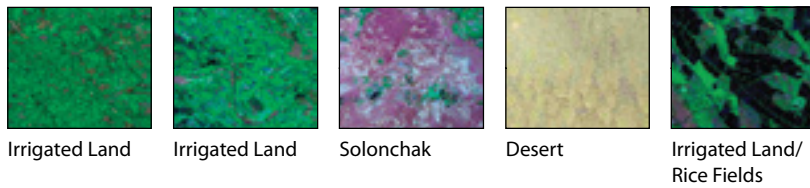
The Amu Darya delta has been an area of extensive irrigated agriculture for millennia but the retreat of the Aral Sea and its environmental consequences have made life difficult for the population, now under the Republic of Karakalpakstan, an autonomous entity that covers western Uzbekistan. A large project is under way to conserve and restore these *tugai* ecosystems in view of their great social, economic, and ecological importance. A national park is being created that will include protected areas and buffer zones to ensure sustainable use of the delta's natural resources.

# Tugai Forests, Amu Darya Delta



10 5 0 10 Kilometers  
1:1,000,000

- City/Town
- Boundary of *tugai* forest
- Boundary of protected area
- - - International boundary



Satellite Image: Landsat ETM+  
Image Acquisition Date: circa 2000 (+/- 3 years)  
Projection: Geographic, WGS84  
Prepared by C. Y. Ji, 2009



■ One of the last *tugai* forests in the Tajik Pamirs, Shakhdara Valley, Gorno Badakhshan Autonomous Oblast, Tajikistan.





■ Spruce forest surrounding KolSay Lake, Alatau Range, Almaty region, Kazakhstan.

## Forest Resources

### PLAYING A VITAL ROLE

Forests are essential to the well-being of our planet. They offer refuge to more than half of the world's plants and animals. They play a primary role in the fight against climate change by storing carbon. And they provide sources for human sustenance—economic, cultural, and spiritual. For millennia, they have served as backdrop to countless myths and legends. They enrich everything they touch. So while Central Asia is one of the least forested regions in the world, the benefits its forests provide far outweigh the scant 3.1% of the land they occupy.

Central Asian mountain forests bear wild fruit and are genetic centers of origin for varieties of cultivated apple and pear eaten around the world. Saxaul scrub forests of desert lands are important for fuelwood and provide shade for animal grazing. The walnut forests of the Kyrgyz Republic, pistachio forests of Turkmenistan, and wood plantations of Kazakhstan provide substantial cash crops. Forests safeguard the environment as well, protecting watersheds, providing sand control, ensuring water quality, stabilizing vegetation, and putting a brake on human-caused and natural hazards, such as soil erosion, desertification, landslides, and floods. And they offer marvelous venues for recreation.

### FOREST TRENDS

In 2007, about 12 million hectares of the region were classified as forestland, the proportion varying from country to country. Kazakhstan has the lowest proportion of forestland (1.2%); however, its more than 3.3 million hectares place it second in the region only to Turkmenistan whose forest cover is 8.8% and 4.1 million hectares.

According to the Food and Agriculture Organization of the United Nations, between 1990 and 2005 forestland increased by 1.6% across the region, showing little or no change in the Kyrgyz Republic, Tajikistan, and Turkmenistan, falling 3.5% in Kazakhstan, but increasing 8.2% in Uzbekistan.

While these numbers represent official figures, discrepancies as to what classifies a forest must be weighed. Increases in Uzbekistan's forest cover fall into the category of classification changes. Turkmenistan lists saxaul (*Haloxylon spp.*) as its dominant forest species, which suggests some areas designated as forest may really be "other wooded land." Were other wooded land to be included in Kazakhstan's assessment, its forest cover would jump to roughly 7% of its land area.

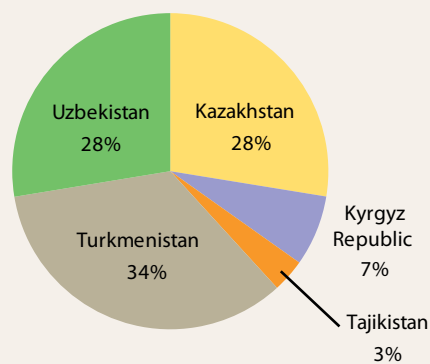
In assessing the state of the region's forestland, the Food and Agriculture Organization's inclusion of areas "temporarily unstocked" (areas that normally form part of the forest but are at least



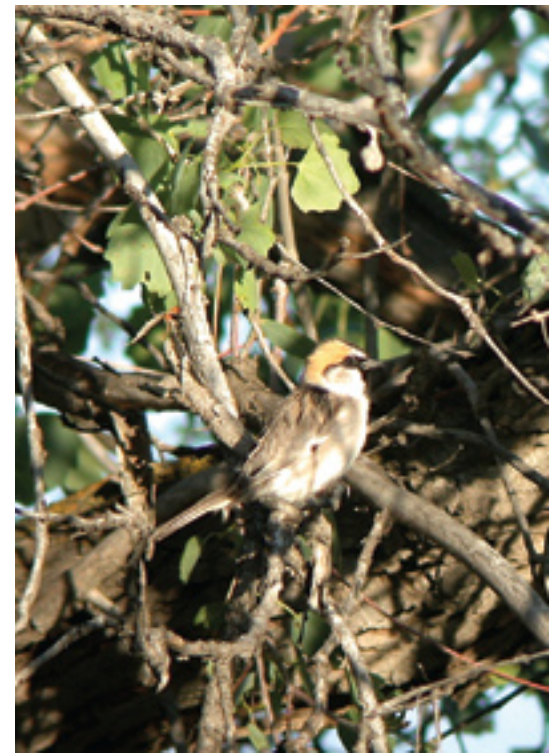
partially denuded as a result of human intervention or natural causes but are expected to revert to forest) should also be considered. There are reports that illegal felling of trees exceeds reforestation. In Uzbekistan alone, felling may have meant the loss of more than 1 million hectares of forestland since 1996. In the Kyrgyz Republic, it may have resulted in a decrease of 50% of wooded areas in the western Tien Shan area over the last half century.

In fact, although limited felling is authorized for sanitary reasons and prohibited for economic reasons, felling exceeds authorized limits in all countries. Also on the negative side is the region's 10.6% decline in forest plantations between 2000 and 2005, which suggests an increased use of wood products, without replacement of resources.

**Shares of Each Country in Total Forestland in Central Asia, 2007**



Source: FAOSTAT. <http://faostat.fao.org> (updated April 2009).



■ **Upper:** Villagers are cutting down precious *tugai* forests for fuel in gasless areas, Karakalpakstan. **Lower:** The *tugai* sparrow also needs *tugai* trees for its habitat.

#### Extent of Forest in Central Asia

Country	Forest		Total land area
	'000 hectare	% of land area	'000 hectare
Kazakhstan	3,325.8	1.2	269,970
Kyrgyz Republic	873.7	4.6	19,180
Tajikistan	410.0	2.9	13,996
Turkmenistan	4,127.0	8.8	46,993
Uzbekistan	3,328.2	7.8	42,540
Total Region	12,064.7	3.1	392,679
Total World*	3,937,326.3	30.3	13,009,115

\*May include official, semi-official or estimated data.  
Source: FAOSTAT. <http://faostat.fao.org> (updated April 2009).

#### NEED FOR BALANCED DEVELOPMENT

There are, however, bright spots. Uzbekistan has implemented a national program for growing poplars around villages and farms to increase the supply of construction timber; this has become an important source of wood supply. Kazakhstan's growing stock of 109 cubic meters per hectare is quite high. And if "other wooded land" is considered, then Kazakhstan should be commended for afforestation that has resulted in increases of more than 800,000 hectares between 2000 and 2005. In addition, Kazakhstan and Turkmenistan are greening their capitals.



■ **Upper left:** Kazakhstan forest in winter. **Upper right:** Autumn colors in a forest near Bishkek, Kyrgyz Republic. **Lower:** Birch trees in the fall, near Almaty, Kazakhstan.

These examples illustrate the need for balanced development, with equal emphasis given to production, protection, afforestation, and social and cultural benefits of forests.

## MAJOR FOREST TYPES

Central Asia has relatively few broad-leafed tree species. In Kazakhstan, Turkmenistan, and Uzbekistan, saxaul trees are common in desert and semidesert areas. Aspens, birch, and firs grow in the mountainous areas of Kazakhstan and Kyrgyz Republic's Tien Shan, as do walnut-fruit forests. Flood plain *tugai* forests follow major rivers in dryland regions. Each forest area provides a hot spot for biodiversity.

### Saxaul Forests

Forests composed primarily of white and black saxaul trees are found in some arid areas of Central Asia. The biggest saxaul forests are in southern Kazakhstan where they cover 15 million hectares. Turkmenistan has some 6 million hectares and small areas of saxaul forest are in southern Tajikistan, totaling about 10,000 hectares.

Where they occur, saxaul trees are important for protecting soil and helping prevent sand from filling channels and covering roads. They provide fuelwood and offer benefits to spring and autumn pastures by providing shade and increasing pasture productivity. Saxaul forests are home to a sparrow named saxaul sparrow (*Passer ammodendri*) after its close association with these forests.

### Tugai Forests

Forests were once widespread along the floodplains of rivers flowing through the dry steppes and deserts of Central Asia. Called *tugai* forests, they have been largely cut down for



■ Above: Walnut resin-blackened hand of a walnut grower in Jalal-Abad, Kyrgyz Republic.

their timber and only fragments remain in the basins of the rivers Atrek, Murgab, Tedgen, Tarim, Chui, Ili, Zarafshan, Syr Darya, and Amu Darya. The remainder are crucial to the biodiversity of the surrounding arid lands, and feature a dense growth of trees entwined in climbing plants, grassy clearings, and sporadic wetlands. They provide a lifeline for resident and migratory wildlife, especially wintering birds from western Siberia and Kazakhstan. And lucky observers may even gain a glimpse of rarely seen jungle cats.

### Fruit and Nut Forests

On the eastern mountain slopes of the Fergana Valley in the southern Kyrgyz Republic are found the largest areas of natural walnut-fruit forests in the world, composed mainly of walnut and other fruit tree and shrubs, including varieties of apple, pear, and plum. The forests have extremely rich

biodiversity—more than 5,000 plant species—with some 180 tree species that harbor around 150 bird and 40 mammal species.

These forests, totaling about 230,000 hectares, are important internationally because they are considered to be the place of origin of walnut—scientists have found over 300 walnut varieties alone—as well as of some other fruit trees and shrubs that are economically significant around the world.

The region also has large forests dominated by juniper trees, some 600,000 hectares, and pistachio trees, about 80,000 hectares in Tajikistan.

Apart from their valuable genetic resources, these forests have a soil-protection and water-regulating role. They are currently threatened due to cattle grazing, land cultivation, and fuelwood cutting.

Change in Extent of Forest and Wooded Land in Central Asia, 1990–2005								
Country	Area		Forest				Wooded land	
	1990 (‘000 ha)	2005 (‘000 ha)	Annual change rate		Annual change rate		1990 (‘000 ha)	2005 (‘000 ha)
			1990–2000 (‘000 ha)/ year	%	2000–2005 (‘000 ha)/ year	%		
Kazakhstan	3,422	3,337	(6)	(0.2)	(6)	(0.2)	13,049	15,622
Kyrgyz Republic	836	869	2	0.3	2	0.3	283	313
Tajikistan	408	410	n.s.	n.s.	0	0	142	142
Turkmenistan	4,127	4,127	0	0	0	0	0	0
Uzbekistan	3,045	3,295	17	0.5	17	0.5	—	904
<b>Total</b>	<b>11,838</b>	<b>12,038</b>					<b>13,474</b>	<b>16,981</b>

— = data not available, ( ) = negative number, ha = hectare, n.s. = not significant.  
Source: FAO, Global Forest Resources Assessment 2005.



■ Upper: Snow leopard. Lower: Marco Polo sheep in the Pamir mountains, Tajikistan.

## Flora and Fauna

Among Central Asia's remarkable biodiversity, some animals and plants stand out almost as icons of the region, in some cases icons of past glory only, as many of their populations are heavily depleted by habitat destruction for agriculture and infrastructure such as roads and townships. But their future may be brighter: recognition of their plight in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, the database of the Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora, and the Convention on Migratory

Species of Wild Animals offers ways to let their numbers grow once again. Here are some of the region's unique fauna and flora.

### TERRESTRIAL FAUNA

#### **Snow Leopard** (*Uncia uncia* or *Panthera uncia*)

The snow leopard, regarded as the most charismatic and symbolic animal of Asian mountain fauna, lives a solitary life in the remote mountain areas of Central Asian and neighboring countries. Adapted to the sheer precipices and jagged ridges of the mountains, it can jump more than 16 meters. Its thick, patterned gray fur allows it to blend perfectly with the rocky slopes. It stalks its prey—mainly mountain ibex and blue sheep—and is able to kill animals thrice its weight. However, it is among the most endangered animal species in the region, with perhaps only 3,500 remaining in the wild, mainly because of illegal hunting for its highly prized fur—which can be sold illegally for a small fortune—as well as the organs and bones, which are used in traditional Chinese medicine. Snow leopards are also killed by locals for preying on their livestock. Thus, the snow leopard has been listed as an endangered species since 1974 in the IUCN Red List of Threatened Species. National legislation across countries is geared toward protecting and saving these last remaining animals. It is listed in CITES, making it illegal to transport snow leopard parts across international borders. The Snow Leopard Trust works with governments and communities in

snow leopard countries to strengthen conservation policies and programs.

### **Marco Polo Sheep** (*Ovis ammon polii*)

The Marco Polo sheep roams the rolling hills of the Pamir mountains of Afghanistan, the People's Republic of China, Pakistan, and Tajikistan. This subspecies of argali or mountain sheep was first described by the explorer Marco Polo in 1273: "There are great quantities of wild sheep of huge size. Their horns grow to as much as six palms in length." Marco Polo sheep hold the record for the longest horns on any sheep at 1.85 meters, making it a coveted and almost mythical status symbol for trophy hunters. As a result of hunting and competition from domestic livestock for prime pastures, its numbers have been decreasing during the past 2 decades. It is recognized as Vulnerable on the IUCN Red List of Threatened Species. The four countries that are home to this sheep have agreed to promote a transboundary conservation area or "peace park."

### **Tien Shan Bear** (*Ursus arctos isabellinus*)

The endangered Tien Shan bear, also known as the Himalayan brown bear, is endemic to the mountains of Central Asia and is commonly found on the Uzbekistan side of the Tien Shan Mountains. This subspecies, a relative of the Kamchatka and Alaskan brown bears, is distinguished by its long white claws. It typically inhabits high mountain areas, moving to the forest line during summer to forage for fruits, berries, and bulbs. During the year it may complete long journeys from the foothills to the high mountain glaciers in search of other food, mainly marmots, pikas, and other rodents. Before the first deep snows, it builds a den in the cliffs of alpine forests and goes into hibernation through winter. Populations of the Tien Shan bear were large until the beginning of the 20th century. Due to illegal poaching and habitat destruction, it is now very rare except in nature reserves in Kazakhstan and the Kyrgyz Republic, although some 300 bears still live in the Dzhungar Alatau mountains in Kazakhstan.

### **Markhor** (*Capra falconeri*)

Distinguished by its tightly curled corkscrewed horns, somewhat reminiscent of a snake's winding body (hence the name markhor, which means "snake eater" in Persian), this rare mountain goat, one of the region's large mammals, grazes in the sparsely wooded mountainous regions of the western Himalayas at altitudes of 600–3,600 meters. In Central Asia, the subspecies *Capra falconeri heptneri* is found in the mountains of the upper Amu Darya and the Pianj rivers spanning Tajikistan and Turkmenistan. Hunting has decimated its population and fewer than 2,500 remain. It was declared Endangered in the Red List of the International Union for Conservation of Nature (IUCN) in 2008.



■ Upper: Tien Shan bears courting.  
Lower left: Markhor. Lower right: Male goitered gazelle.

### **Goitered Gazelle** (*Gazella subgutturosa subgutturosa*)

The goitered gazelle's common name came from the goiter-like swelling of the throat, distinctive of male gazelles during the rut and allowing the male to emit loud bellows during the breeding season. Also known as the *djeiran*, this subspecies is very different from all other species of the genus *Gazella*. Females are generally hornless and males are much heavier than the other species of the genus. It is also the only gazelle that can survive in a desert climate with long periods of extreme cold. It is a migratory species integral to the desert and semidesert landscapes of the region, indeed a plentiful game animal over the centuries until the 1930s. Large-scale poaching has since decimated its numbers. The remaining populations have been saved by nature reserves in most Central Asian countries. It is classified as Vulnerable in the IUCN Red List 2008 and protected under the Convention on Migratory Species.



■ **Upper left:** Saiga antelope. **Upper right:** Bukhara deer. **Lower:** Przewalski's horse.

■ **Next page. Left:** Saker falcon. **Right:** Houbara bustard.

### Saiga Antelope (*Saiga tatarica*)

As the buffalo is central to the American prairie and the wildebeest to the Serengeti, the saiga antelope is to the Central Asian steppe, migrating around areas of the Russian Federation, Central Asia, and the People's Republic of China. The saiga antelope is a living relic of the ice age, having once roamed the earth with the mammoth and saber-toothed cats. With its body like a deer and head like a camel, it is a symbol and inspiration for the nomadic people who have shared its habitat for millennia. These people valued saiga meat and hide, and the male saiga's translucent amber horns were traded for use in Chinese traditional medicine. With widespread unemployment and poverty during the breakdown of the Soviet Union, saiga poaching became an alternative source of food and income. Saiga populations fell by 95% over the past 2 decades from more than 1 million to 50,000 individuals, most of them now in Kazakhstan. Saiga were listed as Critically Endangered by IUCN in 2003. They are also listed in the Convention on International Trade in Endangered Species and in the Convention on the Conservation of Migratory Species. National legislation protecting saiga is

now in place in some countries as well as protected areas across its range.

### Bukhara Deer (*Cervus elaphus bactricanus*)

The Bukhara deer makes its home in the lush *tugai* forests of the Central Asian deserts and semideserts. These graceful animals were revered by Central Asian peoples and called "hangul" which means "the King's flower." As cows are considered holy in India, Bukhara deer were under the special protection of the feudal kings. But they are at risk because of human threats, mainly from declining natural water sources, habitat destruction, and illegal hunting and poaching. By the late 1980s, only 900 animals were left in the wild—600 animals in natural populations and 300 in artificially created populations—throughout Central Asia. As poaching increased with increased poverty after Soviet Union's collapse, the number of deer dropped to a mere 350 by the end of the 1990s. World Wildlife Fund started a Bukhara deer restoration project in 1998, which increased the deer population to 1,000 by 2007.

### Przewalski's Horse (*Equus ferus przewalskii*)

Przewalski's horse has roamed the steppes of Asia and Europe since prehistoric times, as evidenced by drawings made over 20,000 years ago in rock engravings, cave paintings, and decorated tools. Przewalski's horse is smaller than its domesticated counterparts and has a short, muscular body. It is the last surviving subspecies of wild horse. From the 1960s to 1996, it was classified as Extinct in the Wild by the International Union for the Conservation of Nature (IUCN) primarily due to a loss of genetic diversity caused by interbreeding with domesticated horses. With its successful reintroduction in several sites across Mongolia, it was reclassified in 2008 as Critically Endangered. Their total population now, however, is some 1,800, largely in zoos or reserves. Fewer than 50 mature horses survive in the wild.



**Saker Falcon** (*Falco cherrug*)

Diving for its prey of medium-sized mammals, especially rodents, and other birds at up to 300 kilometers per hour, this large, powerful, and ferocious bird hunts on open grassy landscapes, such as steppes and arid montane areas. However, it faces an alarming 70% decline in its population mainly due to illegal trade for falconry—juvenile sakers are specifically targeted for training. Of grave concern are the extreme declines in its numbers in Kazakhstan (90%), the Kyrgyz Republic (68%), and Uzbekistan. It is now listed as Endangered on the IUCN Red List in many states. Also listed in the Convention on International Trade in Endangered Species (CITES), a trade ban was imposed on the United Arab Emirates in 2002. Captive breeding programs have been developed in some countries as an alternative to wild-caught birds for falconry.

**Houbara Bustard** (*Chlamydotis undulata macqueenii*)

Don't be fooled by this unassuming turkey-like bird found in the sandy and stony semideserts. The male houbara bustard becomes a magnificent spectacle during courtship with its long black and white feathers and ornate bristles on its head and neck. Found throughout Central Asia, it migrates from Arabia through Iran and Pakistan to Turkmenistan, Uzbekistan, and Kazakhstan, with the largest population in Kazakhstan. The houbara bustard was traditionally the game bird hunted by Middle Eastern falconers. Up to now, falconers frequent Central Asia, spending large amounts of money to hunt the houbara. Habitat loss and degradation also threaten this species. As a result, and despite some captive breeding programs, its global population has shrunk by 35% in the last 20 years. It is now a protected species in most countries where it occurs, listed in CITES and the Convention on Migratory Species of Wild Animals. It is recognized by IUCN as Vulnerable.





■ **Top:** Desert monitor lizard.  
**Middle:** Central Asian tortoise.  
**Bottom:** Cliff racer snake.

## Reptiles

During the Soviet period, capturing of snakes was for the most part under government control. But with the opening of borders and a ready market for wildlife products, venomous snakes have become highly vulnerable to international traders. Venom is valued for its medicinal use (viper venom, for example, is used to develop a blood-clotting substance); it is harvested from a variety of snakes that are often “milked” dry and left to die. This has led to a marked decrease in the more common viper species (*Vipera lebetina*) as well as rare species of cobra (*Naja sp.*) and sand echis (*Echis carinatus*). Habitat destruction, particularly plowing and development of pasturelands, and outright killing by fearful people also account for decreasing snake populations.

The cliff racer (*Coluber rhodorhachis*), a whip snake, is found in the Boralday, Maly, and Karatau mountains, in the Kyrgyz Range, and in the northern part of the Aral Sea Basin. Part of its core habitat is included in the planned Karatau Reserve. It has been listed as Rare in the Kazakhstan Redbook.

### Tortoise (*Testudo horsfieldii*)

The Central Asian tortoise, also known as the Russian tortoise, inhabits the arid regions of the deserts and the steppes, at elevations of 1,500 meters or higher. It is commonly found near springs and brooks where vegetation is relatively abundant. It is among the threatened species, with a Vulnerable status in the Red List of the International Union for the Conservation of Nature

(IUCN). Decreasing numbers are due mainly to heavy exploitation for food by locals and its export by the pet trade. Being listed in Appendix II of the Convention on International Trade in Endangered Species (CITES) helps regulate the numbers that can be exported. For example, the CITES annual export quota for Uzbekistan is 22,000 live specimens and for Tajikistan 17,000 wild-taken tortoises.

### Desert Monitor (*Varanus griseus*)

Central Asia’s largest lizard, reaching 1.5 meters long and weighing up to 3 kilograms, the desert monitor (*Varanus griseus*) is classified as Vulnerable in the Red Book of IUCN and in the regional Red Data Books of the Central Asian countries. This giant lizard is the only representative of its family found in the Kyzylkum Desert. It plays an important role in the desert ecosystem, preying on gerbil colonies, nesting birds, snakes—even poisonous ones—and various invertebrates. In recent decades, development has reduced its habitat almost by half; hunting is also decreasing its numbers. To conserve the desert monitor lizard, a reserve area in the eastern Kyzylkum Desert is needed, along with captive and artificial breeding.

## AQUATIC FAUNA

Much of the region’s aquatic biodiversity resides in the Caspian Sea, a unique environment because this sea became separated from the Mediterranean in Tertiary times and its salinity gradually became lower than that of marine waters by, on average, two-thirds. This led to the evolution of many new species. Now there are more than 400 endemic



species in the Caspian. Most prominent is the Caspian seal (*Pusa caspica*), one of only two freshwater species. There are 115 fish species, some of which are anadromous, that is, they migrate into freshwater rivers to spawn. Best known of these are six sturgeon species. Illegal fishing has reduced the numbers of some of them to the point where one—the ship (*Acipenser nudiventris*)—is now in the International Union for the Conservation of Nature Red Book of threatened species in some countries, along with other threatened Caspian species: white fish (*Coregonus albula*), a roach (*Rutilus frisii kutum*), and Caspian salmon species.

The Caspian's seabed has 124 mollusk species in residence; 119 are endemic or subendemic, belonging to 2 bivalve families and 7 gastropod families. And the coasts of the Caspian Sea are seasonally lined with countless gulls, terns, and waterfowl. The northeastern coasts are on a major migration route between Europe and Asia. Tens of millions of birds pass over the area twice a year, and a large number nest there. Overwintering birds include the coot, goldeneye, long-tailed duck, mute swan, whooper swan, flamingo, grey-lag goose, mallard duck, teals, and diving ducks. Also present are the sandwich tern, great black-headed gull, and three eagle species.

The Aral Sea, deprived of most of its freshwater inflow over the past 50 years, is almost biologically dead. Its biodiversity was always low because the present-day sea was formed only about 10,000 years ago. A total of 20 fish species in 6 families, 195 species of free-living invertebrates, 12 species of higher plants, and 82 species of lower plants have been recorded in the sea. Most native species were carps and they disappeared



in the 1980s as the sea's salinity rose. They also included once-abundant populations of the famous Fringebarbel sturgeon, the Aral barbel, and the Aral trout. All endemic fishes were migratory and some species still survive in the Amu Darya and Syr Darya river basins. The Amu Darya River hosts nearly 40 native species, including 6 endangered Aral basin species. The Syr Darya's waters are also home to about 40 fish species, including 2 surviving endemics from the Aral Sea.

Lake Issyk-Kul's waters are home to a diverse group of both endemic and introduced fish species, many of which are valued commercially. In recent years, catches have declined due to overfishing, and increased pollution due to more settlements and industry around the lake, and fertilizers and pesticides used in agriculture. Looking toward making fisheries more productive, many new fish species were introduced, drastically changing the composition of Issyk-Kul's fauna and to the detriment of many endemic species. The naked osman (*Dyptichus dybowskii*) is on the verge of disappearing and the Issyk-Kul chebak (*Leuciscus schmidtii*), Issyk-Kul chebachok (*L. bergi*), and Issyk-Kul marinka (*Schizothorax pseudaksaiensis issyk-kuli*) are also threatened.

■ **Upper left:** Caspian seal.  
**Upper right:** Several sturgeon, including beluga, Russian, and stellate, caught by Kazakh fishers in the Ural River.  
**Lower left:** The spotted thicklip loach (*Triplophysa strauchi*) reaches a length of 25 centimeters; it is found in river basins in Kazakhstan as well as in the People's Republic of China and Mongolia.  
**Lower right:** The Knipfish (*Knipowitschia caucasica*) is a small (5 centimeters) goby that lives in the shallow area in fresh-, brackish-, and seawater from the Caspian to the Mediterranean.



■ **Upper:** Dried fruits and nuts at Osh bazaar in the Kyrgyz Republic. **Lower:** Families get together in the Kyrgyz Republic to harvest walnuts.

## FLORA

### Fruit and Nut Biodiversity

Central Asia has been renowned for centuries for its superior fruits and nuts. In the 7th century, the Kingdom of Samarkand in present-day Uzbekistan sent a gift of golden fruit (possibly apples) to the emperor of the Tang dynasty of China. Turkmen melons were highly valued in past centuries, adorning the feasts of kings and aristocrats and even exchanged for gold and silver. Apples, apricots, berries, cherries, grapes, nectarines,

oranges, peaches, pears, plums, and watermelons, as well as nuts like pistachios, almonds, walnuts, and hazelnuts are among the region's top agricultural produce and have an undeniable place in the food culture of the region. Many ancestors of today's domestic fruit and nut varieties grow wild in the region, making Central Asia a storehouse for wild genetic diversity, and a critical resource for plant breeding.

Receiving global attention are the highly threatened relict walnut-fruit forests that are unique to Central Asia. These ancient forests—with some walnut trees estimated at 800 years old—are found primarily on the northern slopes of the Ferghana, Chatkal and Darvaz ranges of the Tien Shan, and on the southern slopes of the Gissar range in the southeast. The forests hold almonds, cherries, maples, pears, and plums in addition to walnuts.

Almaty, Kazakhstan's largest city, translates to "place of the apples" and it is little wonder that Kazakhstan is the world's center of wild apple biodiversity. Scientists believe that the cultivated apple (*Malus domestica*) originated from the wild apple (*Malus sieversii*) in the Tien Shan mountains of Kazakhstan and the People's Republic of China. The favorable environmental conditions in the region allowed whole valleys to become forested with apple trees while varied microclimates allowed for their diversification. Travelers of the renowned Silk Road are also believed to have carried apple seeds to the Middle East and Europe where varieties then adapted to new environs. Rare genes and genotypes, as well as the continued diversification of new apple varieties in nature,



remain concentrated in the remnant wild fruit forests of Central Asia. In Turkmenistan, sweet melons or muskmelons are the reason for a national holiday and nationwide festivities on the second Sunday of August each year. The country hosts almost 400 varieties of melon.

### Tulips

Some 16 endemic species of tulips (*Tulipa* spp.) thrive in the steppes and meadows of the region. Their beautiful blooms are sought after for horticulture and decoration, which has led to the decline of many species. The largest tulip, also known as the “king of the tulips,” is the rare, brilliant orange-red Greig’s tulip (*Tulipa greigii*), found only in western Tien Shan. Another species, *T. kaufmanniana*, from the same area has beautiful white blooms suffused with orange and gold. The two species served as genetic stock for two groups of commercial tulips that are now widely cultivated and known around the world.

### Saxaul Trees

The saxaul tree or bush—it assumes the character of both—has the amazing ability to grow in the deep sands of the deserts. It grows extremely slowly above ground but has extensive root systems reaching down as deep as 10 meters to find moisture. Its slow growth results in extremely hard yet brittle wood. Saxaul trees grow up to 12 meters high and live up to 100 years.



■ **Above left:** Blossoms of the iconic saxaul tree. **Above right:** Greig’s tulip in the Aksu Jabagly Nature Reserve. **Lower left:** There are hundreds of melon varieties in the region. **Lower right:** Nuts of the pistachio tree.

Saxaul forests have contributed to making Central Asia’s harsh environments habitable. They provide a source of cheap fuelwood and charcoal. By squeezing the spongy bark, saxaul trees can be used as an emergency supply of drinking water. They are important for creating sheltered pastures and providing feed for livestock. Moreover, saxaul forests play a critical role in protecting fragile desert soils from erosion; they protect oases, channels, and roads from sand filling; and help regulate water supply.