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Ecosystems of the High Mountains

High mountain alpine and subalpine meadows ecosystem includes communities which are highly variable in their geographic range and floristic structure. They are unified by their altitudinal position above the forest belt; and by the predominance of herbaceous-grass communities. For the high grass meadows the dominant plants are perennial mesophytes (i.e., plants preferring moist environments) which include more than 100 species, including many endemics. In the subalpine meadows the number of species is 60 to 75; the herbaceous layer is from 20 to 40 cm high. The alpine meadows are characterized by the dominance of small (2-10 cm) plants with the «alpine rosette», a specific adaptation to the harsh climatic conditions of these mountains. The total number of higher plants in the alpine meadow communities is more than 50 species.

High mountain meadows possess rich insect communities, represented by a variety of orders as Dermoptera, Thysanoptera and a number of dominant families (*Elateridae*, *Largiidae*, *Pentatomidae*, *Tenebrionidae*, *Nitidulidae*). The characteristic mammals here are voles (*Microtus*), marmots (*Marmota*), the Siberian mountain goat (*Capra sibirica*), ermine (*Mustela erminea*), wolf (*Canis lupus*), bear (*Ursus arctos*), and marten (*Martes foina*). Among birds, the common species are the pipits (*Anthus spinoletta*, *A. trivialis*), finches (*Leucosticte nemoricola*, *L. brandti*, *Pyrrhospiza punicea*), accentors (*Prunella fulvescens*, *P. alpina*, *P. himalayana*), crimson-winged finch (*Rhodopechus sanguinea*), Calliope pectoralis, warbler (*Phylloscopus griseolus*), buntings (*Emberizacia*, *E. buchanani*), wagtails (*Motacilla citreola*), mountain swallow (*Riparia rupestris*), swift (*Apus opus*), keklik partridge (*Alectoris chukar*), chough (*Pyrrhocorax pyrrhocorax*, *P. gracilis*), vultures (*Gyps fulvus*, *G. himalayensis*), Egyptian vulture (*Neophron percnopterus*), black vulture (*Aegypius monachus*), raven (*Corvus corax*) etc.; among reptiles, the Alai skink (*Asymblepharus alaicus*), agamas (*Stellio chernovi*, and *S. himalayanus*; found on rocks), Nikolsky's lizard (*Eremias nikolskii*), colubrid snakes (*Elaphe dione*, *Coluber ravergieri*), and cotton-mouth (*Agkistrodon halys*).

With increasing altitude, additional ecosystems are found in the mountains of Central Asia. For example, the high mountain cryophyte steppes are found at the 2,000-3,000 m of altitude and above, the high mountain deserts are located at altitudes from 1,800-3,800 m, the snowline (nival) ecosystems are located above 4,000 m. In these ecosystems, the dominant species here are perennial turf grasses. The herbaceous layer is sparse and low and floristic composition is poor. This is the upper limit of distribution of all vertebrates and majority of invertebrates. The landscape consists of bare rocks with lichens and few patches of higher plants interspersed among snowfields and glaciers.

The complex of vertebrate animals of the high mountain steppes and deserts includes, among mammals: the tolai hare (*Lepus tolai*), pikas (*Ochotona macrotis*, *O. rutila*), marmots (*Marmota caudata*, *M. baibacina*, *M. menzbieri*), wolf (*Canis lupus*), and mountain voles (*Alticola*, *Microtus*); among birds: the homed lark (*Eremophila alpestris*), finches (*Leucosticte nemoricola*, *L. brandti*), keklik partridge (*Alectoris chukar*), snowcocks (*Tetraogallus tibetanus*, *T. altaicus*), wheatear (*Oenanthe oenanthe*), buntings (*Emberiza cia*, *E. buchanani*), warbler (*Sylvia communis*), rock sparrow (*Petronia petronia*), wallcreeper (*Tichodroma muraria*), and kestrel (*Cerchueis tinnunculus*).

Most vertebrate animals visit the nival belt only in summer; only pikas (*Ochotona*) and mountain voles (*Alticola*) live here permanently. Among species commonly found here are the wild goat (*Capra sibirica*), wild sheep (*Ovis ammon*), snow leopard (*Uncia uncia*), snowcocks (*Tetraogallus*), choughs (*Pyrrhocorax graculus*, *P. pyrrhocorax*), Alpine accentor (*Prunella collaris*), red finch (*Pyrrhospiza punicea*), and red-winged wallcreeper (*Tichodroma muraria*).

Species of Special Interest. Ecosystems of the steppe, semidesert and desert foothills and the low mountain belt include such rare ungulate animals as goitred gazelle (*Gazella subgutturosa*), kulan (*Equus hemionus*) native to Badkhyz, rare subspecies of the wild sheep (*Ovis ammon*) such as Kyzylkum sheep (*O. a. severtzovi*) which inhabits Nuratau and Aktau; Karatau sheep (*O. a. nigrimontana*) in the Karatau range; Kazakhstan sheep (*O. a. collium*) which is relatively widely distributed in the low mountain belt of the Central Kazakhstan from Kazakh Melkosopchnik — central Kazakhstan's rolling hills — to Tarbagatai in the east; Bukhara wild sheep (*O. a. bo-charensis*) which have almost disappeared in the southern Tadjikistan and Kugitang; Turkmen wild sheep (*O. a. cycloceros*) which is found in the foothills of Kopetdagh and low mountain massifs near the Caspian Sea. A rare rodent, the five-toed dwarf jerboa (*Cardiocranius para-doxus*) inhabits the Lake Balkhash area; a rare bat, (*Tadarida teniotis*), inhabits caves and crevices. Among rare carnivores are the hyena (*Hyaena hyaena*), marble polecat (*Vormela peregusna*), and manul (*Felis manul*); among rare birds are saker falcon (*Falco cherrug*), Barbary falcon (*Falco pelegrinoides*), and short-toed eagle (*Circaetus gallicus*); among reptiles, the Turkmen eublephar (*Eublepharis turkmenicus*), spine-tailed Turkmen gekko (*Gymnodactylus turkmenicus*), chalcid skink (*Chalcides ocellatus*), gray monitor (*Varanus griseus*), snakes (*Oligodon taeniolatus*, *Lycodon stnatus*, *Coluber spinalis*), and the Central Asian cobra (*Naja oxiana*).

Of the rare ungulate species in the middle mountain belt, the bezoar goat (*Capra aegagrus*) is found in the middle mountain belt of Kopetdagh at the upper boundary of the forest communities; in Tien Shan, rare subspecies of wild sheep (*Ovis ammon*); and in Kugitang and the ranges of southern Tadjikistan, the markhor (*Capra falconeri*) is found. Of the rare carnivorous mammals, the Central Asian otter (*Lutra lutra seistanica*), lynx (*Felis lynx isabellina*), and Tien Shan bear (*Ursus arctos isabellinus*) still inhabit the mountain forests. Rare reptiles include the De Filipp's lizard (*Lacerta defilippii*). Snakes (*Eryx elegans*, *Coluber najadum*, *Telescopus rhynopoma*), and the cobra (*Naja oxiana*).

Among the rare animal species of the alpine and subalpine meadows first of all should be listed the West Tien Shan endemic, the Menzbier's marmot (*Marmota menzbien*); the markhor wild goat which still inhabits the Vakhsh range in Tadjikistan; the red wolf, or dhole (*Cyon alpinus*) which is practically extinct; the Tien Shan bear (*Ursus arctos isabellinus*), and the snow leopard (*Uncia uncia*); among birds, the white-chested dove (*Columba leuconota*), sandgrouse (*Syrhaptes tibetanus*, snowcocks (*Tetraogallus tibetanus*, *T. altaicus*) and bearded vulture (*Gypaetus barbatus*).

Main Threats to Biodiversity

The complex of ecosystems occupies the foothills, or adyrs, is characterized by intensive agricultural activity. Almost all areas suitable for field crops are ploughed, and the grazing pressure on pastures is very high. The submontane deserts expand their area due to the degradation of vegetation following the overgrazing. In the middle mountain belt the area of shrub communities, spruce and juniper forests is continuously decreasing as a result of cutting — especially within the recent transitional period of economic hardship. Today, the walnut-fruit forests are mere fragments as grazing, logging, hay harvesting, extensive collection of nuts and fruit, and illegal hunting continue to pressure this vital ecosystem. In the last 40 years, the area covered by these forests has decreased by up to ten percent of its original range. In the high mountain meadows, the primary threats are posed by extensive hay harvesting and overgrazing

which lead to a decrease in the diversity in native plants and gradual expansion of noxious and weed plant species. Throughout the mountain ecosystems, habitat destruction contributes to the extinction of many common species. Everywhere in the mountains, ungulates, predators and birds of prey are drastically decreasing in number due to poaching and badly managed «sport» hunting tourism.

Nature Conservation Potential

The majority of Central Asia's zapovedniks and other protected territories have been established in the mountain ecosystems. The Kopetdagh mountains in the southwest region of Central Asia comprise an entirely separate mountain chain with a composition of flora and fauna distinctly different from that of the Tien Shan, Pamir, and other ranges. The Kopetdagh ecosystems are represented only by a few protected areas: Kopetdagh and Syunt-Khassardagh Zapovedniks, and several Zakazniks (Kalininsk, Meana-Chaacha, and others). These areas encompass foothill deserts, steppe grass communities, forests which harbor subtropical plants (almond, pomegranate, walnut, wild grapes), and juniper trees; rare animal species found in these territories include the Turkmen wild sheep (*Ovis ammon cycloceros*), the wild goat (*Capra aegargus*), leopard (*Panthera pardus*), hyena (*Hyaena hyaena*), marbled polecat (*Vormela peregusna*), manul cat (*Felis manul*), saker falcon (*Falco cherrug*), Barbary falcon (*Falco pelegrinoides*), short-toed eagle (*Circaetus gallicus*), cobra (*Naja oxiana*), and grey monitor (*Varanus griseus*). In the hills of the Badkhyz Plateau, the Badkhyz Zapovednik and neighboring refuges (Pulkhatum, Kizyldzhar, and Chemenibit Zakazniks) protect savannoid-type ecosystems with wild pistachio and rich animal complexes among which are prominent species such as kulan (*Equus hemionus*) and goitered gazelle (*Gazella subgutturosa*).

In the North Tien Shan, protected territories include the Almaata Reserve, the Trans-Ili National Park, and six Zakazniks (all in Kazalmtan) and the Issyk-Kul Reserve and the Ala-Archa National Park (in Kyrgyzstan) where such ecosystems are protected as the разя-herbaceous steppes in the foothills (*adyrs*), spruce (*Picea*) forests, dwarf juniper (*Juniperus*) forests, shrubs (*Rosa*, *Spiraea*, *Lonicera*, *Cotoneaster*, *Fringula*), mountain meadow-steppes communities, also widespread are subalpine and alpine meadows, and the unique combinations of rocks and glaciers on the mountain summits.

In the West Tien Shan, several reserves have been established to protect the ecosystems of the relict walnut-fruit forests. These are the Sary-Chelek (in Kyrgyzstan) and Chatkal (in Uzbekistan) Biosphere Reserves where the protected areas include the unique landscape of middle and high mountain belts, the natural complex of walnut-fruit and spruce forests, as well as mountain steppes and meadows. These territories are inhabited by a highly diverse complex of mountain animal species including, among rare mammals: the Central Asian otter (*Lutra lutra seistanica*), Turkestan lynx (*Felis lynx isabellina*), snow leopard (*Uncia uncia*), Tien Shan brown bear (*Ursus arctos isabellinus*), and wild sheep (*Ovis ammon karelini*); and among birds, the golden eagle (*Aquila chrysaetos*), Barbary falcon (*Falco pelegrinoides*), and bearded vulture (*Gypaetus barbatus*). Similar ecosystems are protected in the Nurata Reserve located on the slopes of the Nurata range where the Severtsovs wild sheep (*Ovis ammon severtsovi*) is found, and in the Ugam-Chatkal National Park (both in Uzbekistan). In the Kyrgyz part of the Chatkal Valley, the Besh-Aral Zapovednik is established where, among other species, the list of protected mammals includes the endemic Menzbiers marmot (*Marmota menzbieri*). In the Aksu-Dzhebagly Reserve (in Kazakhstan) located in the Talas Alatau range of the West Tien Shan, protected ecosystems include the arid deciduous sparse forests, shrubs, and juniper forests; here, the maral red deer (*Cervus elaphus*) and roe deer (*Capreolus capreolus*) were reintroduced. In the same region within the Kazakhstan territory, seven Zakazniks have been established.

In the mountains of the northwestern Pamirs, the well-known Ramit Zapovednik is located on

the southern slopes of the Gissar Range; here, the protected ecosystems include sparse juniper forests, groves of maple, walnut, and wild apple in combination with shrubs and subalpine and alpine meadows. Among rare protected mammal species here are: the Central Asian otter (*Lutra lutra seistanica*), Turkestan lynx (*Felis lynx isabellina*), snow leopard (*Uncia uncia*), and Tien Shan brown bear (*Ursus arctis isabellinus*). Similar ecosystems are protected in the Gissar Reserve (in Uzbekistan) and, in Tadjikistan, in the Shirkent National Park (which is known, besides its wildlife, for its records of dinosaur tracks), in the Iskanderkul refuge (with the Lake Iskanderkul), and in the Kusavlisai refuge (with the tall juniper forest). In Uzbekistan, the Zaamin Zapovednik includes protected mountain ecosystems such as the juniper forests of the Turkestan Range (here, in addition to the rare bird species listed above, the black stork (*Ciconia nigra*) occurs); and the Kitab Zapovednik includes unique paleostratigraphic objects. In the very south of Uzbekistan, in the Surkhan Reserve, are protected ecosystems of the Kugitang Range with markhor (*Capra falconeri*) and wild sheep (*Ovis ammon bocharensis*) among its rare mammals.

In southern Tadjikistan, on the southern slope of the Darvaz Range, the Dashtidzhum Zapovednik protects juniper stands, mountain forests comprised by pistachio, almonds, maple, pomegranate, and wild fig tree, combined with desert-steppe plant communities which include ephemers and ephemeroids. The largest population of markhor (*Capra falconeri*) survives here, and other rare mammals are found as well, e.g., the Central Asian otter (*Lutra lutra seistanica*). The Sarykhosor and Dashtimaidon Zakazniks are located on the slopes of the Vakhsh Range, and the Karatau refuge, on the Karatau Range of the West Tien Shan mountains.

The unique nature of the West and East Pamirs is protected in the Папи National Park (Tadjikistan) which occupies more than 1.5 million ha. The dominant ecosystem here: is the cold high mountain desert with the xerophyte cushion plants; many endemic and rare species of plants and animals are found here including snow leopard (*Uncia uncia*), Tien Shan brown bear (*Ursus arctos isabellinus*), golden eagle (*Aquila chrysaetos*), Barbary falcon (*Falco pelegrinoides lammergeier* (*Gypaetus barbatus*)), Tibet snowcock (*Tetraogallus tibetanus*), and Tibet sandgrouse (*Tchangtangia tibetana*). The network of complex natural refuges exists in the Pamirs: the Pamir refuge which includes the Lake Kara-Kul; the Zorkul refuge with the Zorkul lake system which protects not only high mountain ecosystems but also the fish resources, mountain goose (*Anser indicus*), and brown-headed gull (*Larus brunnicephalus*); the Muzkol refuge established between the Trans-Alai and Muzkol Ranges; and the Sanglyar refuge on the slopes of the Peter the First Range.

The ecosystems of the Inner Tien Shan are protected in a network of reserves in Kyrgyzstan and include the communities of sagebrush-Festuca and sagebrush-grass steppes, conifer forest and mountain belt with the subalpine and alpine vegetation, mountain tundras, and snow field and glaciers. The Naryn Zapovednik, established in the middle portion of the Naryn River valley protects a large massif of mountain spruce forest, 1336 mountain meadows, and other ecosystems. Among rare animals here are the snow leopard (*Uncia uncia*), lynx (*Felis lynx isabellina*), Tien Shan brown bear (*Ursus arctis isabellinus*), Marco Polo wild sheep (*Ovis ammon poli*), Ibisbill (*Ibidorhyncha struthersii*); also high are numbers of the Siberian red deer (*Cervus elaphus sibiricus*). The mountain spruce forests and riparian forests are well represented in the Karatal-Zhyppyryk Zapovednik, which is located near the Lake Son-Kel (in Central Kyrgyzstan). The Sarychat-Ertash Reserve is the first ever created for the protection of the high mountain plateaus and syrts of the Inner Tien Shan. Here, numerous wild sheep (*Ovis ammon karelini*) and Siberian wild goats (*Capra sibirica*) are found, as well as the Tien Shan brown bear (*Ursus arctis isabellinus*), snow leopard (*Uncia uncia*); a record of manul cat (*Felis manul*) is also confirmed.

In the Dzhungar Alatau (in Kazakhstan), the Altyn-Emel National Park has been established. Here, the protected landscapes include the peculiar Dzhungarian deserts as well as mountain steppe, shrub stands, spruce forest, and the ecosystems of the aï mountain subapline alpine meadows. Among rare mammal and bird species found here are snow leopard (*Uncia uncia*), Tien Shan brown bear (*Ursus arctis isabellinus*), golden eagle (*Aquila chrysaetos*), Barbary falcon (*Falco pelegrinoides*), bearded vulture (*Gypaetus barbatus*), and Ibisbill (*Ibidorhyncha struthersii*).

In the Altai Mountains (in Kazakhstan), the ecosystems of the steppe foothills, taiga middle mountain belt, mountain meadows and tundras, and nival belt (snowline) are protected in the West Altai and the Markakol Zapovedniks, and two refuges. Among rare species recorded here are the Altai mountain sheep, or argali (*Ovis ammon ammon*), red wolf (*Cuon alpinus*), snow leopard (*Uncia uncia*), Altai snowcock (*Tetraogallus altaicus*), and black stork (*Ciconia nigra*).

2.E. PROTECTED AREAS NETWORK IN UZBEKISTAN

Name	Year of designation	Location	Area (ha.)	Protected ecosystems; species diversity; threatened species that occur in the protected area	Management authority
State Strict Nature Reserves (Zapovedniks)					
1. Zaamin	1926, 1960	Dzhizak Region, Zaamin and Bakhmal districts	26847	Mountain ecosystems and juniper stands on Turkestan range. Plants: 694 species. Birds: 130 sp. Mammals: 37 sp. <i>Ursus arctos</i> , <i>Felis lynx isabellina</i> , <i>Ciconia nigra</i> , <i>Gypaetus barbatus</i> ; <i>Astragalus sp.</i> , <i>Tulipa sp.</i>	State Forest Committee (Goskomles)
2. Chatkal Biosphere NR	1947	Tashkent Region, Bostanlyk, Parkent and Akhangaran districts	35686	Mountain forest ecosystems of the western Tien Shan. Plants: 1060 sp. Birds: 168 sp. Mammals: 32 sp. <i>Ursus arctos</i> , <i>Marmota menzbieri</i> , <i>Aquila chrysaetos</i> , <i>Gypaetus barbatus</i> ; <i>Astragalus sp.</i> , <i>Tulipa sp.</i>	State Environment Committee (Goskomprroda)
3. Badai-Tugai	1971	Karakalpakstan Republic, Berunia & Kegelia districts	6462	Tugai forests in the Lower Amy Darya area. Plants: 167. Birds: 136. Mammals: 21 sp. <i>Cervus elaphus bactrianus</i> , waterfowl; <i>Euphorbiaceae</i> , <i>Liliaceae</i> , <i>Leguminosales sp.</i>	Goskomles
4. Kyzyl-Kum	1971	Bukhara Region, Romitan district; Khorezm Region, Druzhbin district	10141	Tugai forests and adjacent sandy deserts along the middle Amy Darya. Plants: 102 sp. Bech: 197 sp. Mammals: 37 sp. <i>Cervus elaphus bactrianus</i> , <i>Anas angustirostris</i> , <i>Varanus griseus</i> ; <i>Liliaceae</i> , <i>Leguminosales</i> , <i>Caryophyllaceae</i> , <i>Gramineae sp.</i>	Goskomles
5. Zerafshan	1975	Samarkand Region, Bulungur & Dzhambai districts	2352	Tugai complexes in the middle reaches of the Zerafshan River. Plants: 308 sp. Birds: 172 sp. Mammals: 19 sp. <i>Cervus elaphus bactrianus</i> , <i>Orchidaceae</i> , <i>Liliaceae</i> , <i>Hippophae rhamnoides</i> .	Goskomles

6. Nurata	1975	Dzhizak Region, Farish district	17752	Nut forests of the Nuratau range. Plants: 664 sp. Birds: 150 sp. Mammals: 33 sp. <i>Ovis orientalis severtzovi</i> , raptors, cobras, <i>Varanus griseus</i> ; <i>Astragalus sp.</i> , <i>Liliaceae sp.</i> , <i>Compositae sp.</i>	Goskom-les
7. Kitab Geological NR	1979	Kashkadarya Region, Kitab district	5378	Palaeo-stratigraphical objects as natural monuments of Earth's geological history. 486 fossil sp. Living species: plants: 500; birds: 120; mammalia: 21. <i>Ursus arctos</i> <i>Aquila chrysaetos</i> , <i>Gypaeetus barbatus</i> , <i>Aquila pennata</i> , <i>Naja oxiana</i> , <i>Tulipa sp.</i>	Goscom-geologia
8. Gissar	1983	Kashkadarya Region, Yakkabag & Shakhrisabz distr.	81438	Mountain ecosystems and juniper stands on the Gissar range. Plants: 870 sp. Birds: 116 sp. Mammals: 30 sp. <i>Uncia uncia</i> , <i>Ursus arctos</i> , <i>Felis lynx isabelina</i> , <i>Gyps himalayensis</i> , <i>Gypaeetus barbatus</i> ; <i>Compositae</i> , <i>Liliaceae sp.</i>	Goskom-priroda