

1.2. Biological Diversity of Tajikistan

Geographical location of Tajikistan in the southern arid zone and high mountain systems among continental deserts of Eurasia, a combination of latitude zonation and vertical belts with hot deserts and subtropics permafrost natural complexes and genetically merging botanical and geographical zones conditioned rich landscape biological diversity.

The mountain landscapes of Tajikistan contain 0.66% of the world animal and 1.8% – plant diversity, including wild relatives of domestic animals and cultivated plants.

Tajikistan has rich genetic resources of species which are a potential source of raising high-productive and resistant cultivated varieties, adornment plants, and medicinal, aromatic, and industrial raw material.

The richness of biodiversity (table 1.1) is observed at the genetic, species, population, biocoenosis and ecosystem levels.

The area of contemporary Tajikistan contains more than 9 thousand species of plants and over 13 thousand of animal species.

Table 1.1. Main Components of Biodiversity

No.	Composition	Number
1.	Ecosystems	12 types
2.	Types of vegetation	20 types
3.	Flora	9 771 species
4.	Wild relatives of cultivated plants	1000 species
5.	Endemic plants	1132 species
6.	Plants, listed in the Red Data Book of Tajikistan	226 species
7.	Fauna	13531 species
8.	Endemic animals	800 species
9.	Animals, listed in the Red Data Book of Tajikistan	162 species
10.	Agricultural crops	500 varieties
11.	Domestic animals	30 breeds

Value of Biological Resources for the Population of Tajikistan

The local population traditionally uses wild nature products as raw materials in construction, utensils and dyers production, etc.

1090.7 thousand head of cattle, 2269.3 thousand sheep and goats, and 71.2 thousand horses are being raised due to the natural vegetation of pastures.

Local people gather wild berries – sea buckthorn (*Hippophae rhamnoides*), barberries (*Berberis*), currants (*Ribes*), raspberries (*Rubus odoratus*), hawthorn (*Crataegus*), etc., as well as mushrooms and dozens of medicinal plant species.

They gather nuts and stone fruits in naturally growing forests – walnut (*Juglans*), pistachio (*Pistacia*), almond (*Amygdalus*), wild apple (*Malus*), pear (*Pyrus*), plum (*Prunus*), cherry plum (*Prunus sogdiana*) etc.

Local people and specialized organizations store up medicinal plants.

Small part of the population is engaged in hunting and fishing.

The number of game mammals is estimated at 11 species, birds – 36, and fish – 20.

Fur-skins of red marmot (*Marmota caudata*), muskrat (*Ondatra zibethica*), fox (*Vulpes vulpes*), badger (*Meles meles*), wolf (*Canis lupus*), etc. are stored up.

International hunting is organized for the following animals: argali (*Ovis ammon*), Siberian ibex (*Capra sibirica*), urial (*Ovis vignei*), and Tajik markhur (*Capra falconeri*).

Game fishing in lakes and water reservoirs is inconsiderable (164 t). Most of fish and animals are caught by poachers.

1.2.1. Ecological Systems

Complicated natural climatic and mountain-formation processes, occurred in Tajikistan, promoted penetration of plant and animal species from neighboring botanical and geographical zones, hybridization, and appearance of new species. Numerous types of ecotopes, biocoenosis, and ecosystems, in contrast combination, were formed on a relatively small area.

Mountain ecosystems include: nival-glacier, high-mountain-desert, meadow-desert, forest, most of wetland, ruderal, and, sometimes, urban ecosystems. More than 80% of natural watercourses of the country are located in mountainous areas. The foothills contain a small part of meadow-steppe ecosystems, situated in the lower reaches of the Pyandj, Vakhsh, Kafirnigan, Zeravshan, and Syrdarya rivers. Relatively young ecosystems, with a small number of species, are formed in the artificial watercourses.

Geographically, the ecosystems of Tajikistan are subdivided into mountain and foothill-plain ecosystems.

Mountain ecosystems occupy the altitudes from 600 to 7000 masl. This zone contains over 90% of mountain communities. Water resources are formed in mountain ecosystems; over 80% of biodiversity are accumulated here.

Foothill-plain ecosystems located on the flat areas of mountain zones include: foothill semidesert-desert, wetland, agricultural, urban, and ruderal-degraded ecosystems.



Nival glacier ecosystems

According to their use, ecosystems are subdivided into natural and anthropogenic. The interrelation of ecosystems dependent on the areas and the number of population is shown in figures 1.6 and 1.7.

Natural Ecosystems

A considerable part of the country possesses natural ecosystems which are relatively undisturbed due to their isolation. Though some small fragments of ecosystems are observed at easily accessible places.

1. Nival glacier ecosystems occupy high-mountain landscapes and considerable part of the Eastern and Western Pamirs. They are of great importance for climate formation and ecology at the regional and global levels. The main water resources of Central Asian region are formed here. The cold glacial rocky landscapes of these ecosystems contain 16-17 species of flowering plants: ragged robin (*Melandrium apetalum*), whitlow grass (*Draba altaica*), milk vetch (*Astragalus nivalis*), *Saussurea glacialis*, etc. Argali (*Ovis ammon*), snow leopard (*Uncia uncia*), and Siberian ibex (*Capra sibirica*) are found at the lower boundaries of these ecosystems.

2. High mountain desert ecosystems occupy the vast areas of the Eastern and Western Pamirs; fragmentarily, they occur in the Zeravshan River Valley. They are used for summer pasturing, tourism, and international hunting. Vegetation consists mostly of tereskens (*Ceratoides Krascheninnikovia*), wormwoods (*Artemisia pamirica*, *A. Korshinskyi*), *Ajania tibetica*, feather-grasses (*Stipa glareosa*), *Oxytro-*

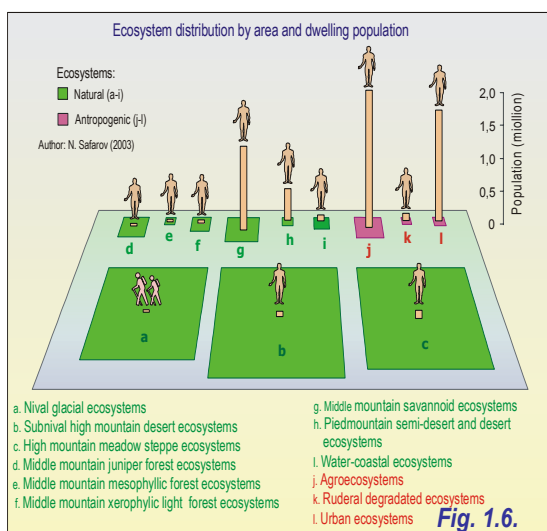


Fig. 1.6.

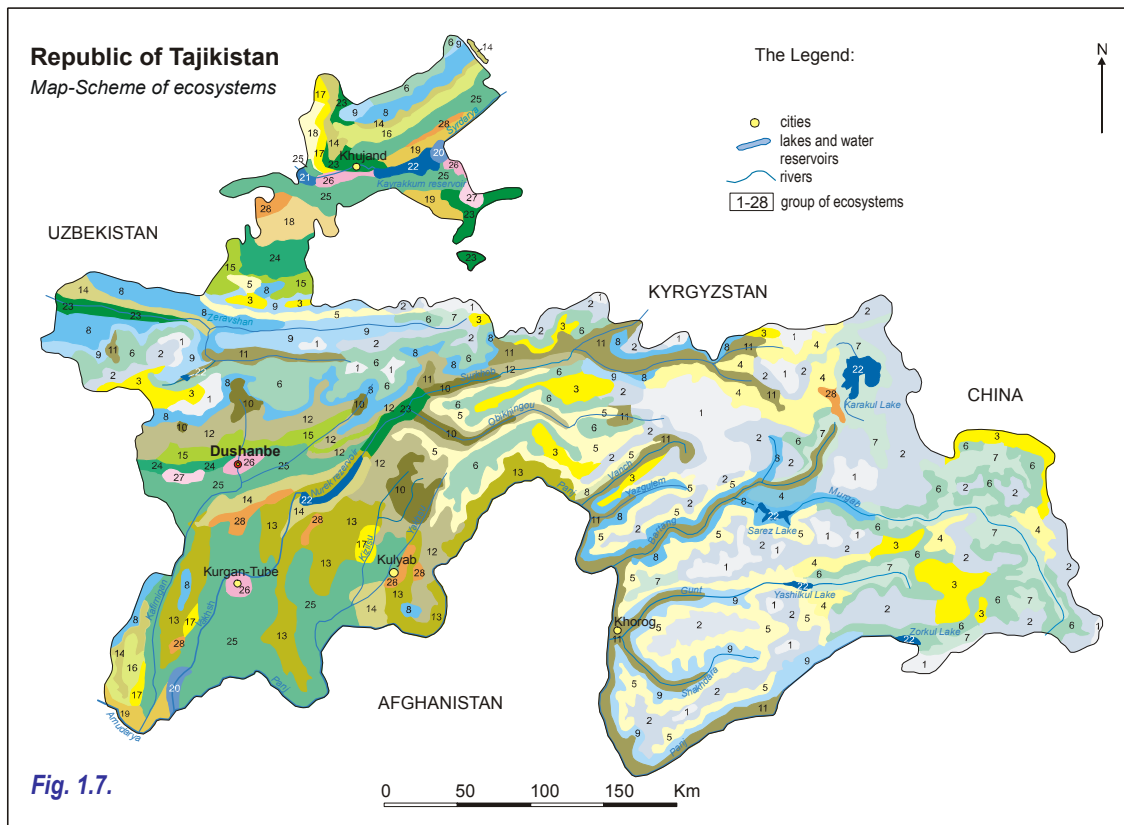


Fig. 1.7. Legend to «Map-Scheme of ecosystems»

Nival Glacier Ecosystems

- 1 Glaciers and snowfields
- 2 Rocks and taluses with rare vegetation

High Mountain Desert Ecosystems

- 3 Rare vegetation
- 4 Wormwood-teresken, steppe
- 5 Dwarf-shrub-steppe

High Mountain Meadow and Steppe Ecosystems

- 6 Forbs meadow steppe, thymes
- 7 Low-grass meadow, swamp

Mid-Mountain Conifer Forest Ecosystems

- 8 Various-shrub steppe and light forest
- 9 Forbs meadow-forest

Mid-Mountain Mesophyllic Forest Ecosystems

- 10 Broad-leaf forest
- 11 Flood-plain small-leaf forest
- 12 Light forest, foliage tree, mesophyllic shrub

Mid-Mountain Xerophytic Light Forest Ecosystems

- 13 High-grass, shrub, pistachio
- 14 Forbs wormwood, almond

Mid-Low-mountain Semisavanna (savannoide) Ecosystems

- 15 High-grass
- 16 Forbs and shrub
- 17 Low-grass semisavanna

Foothill Semidesert and Desert Ecosystems

- 18 Low-grass, saltwort-wormwood
- 19 Sand, semi-woody, shrub

Wetland Ecosystems

- 20 Tugai
- 21 Meadow, swamp
- 22 Wetland

Agroecosystems

- 23 Gardens, forest-plantations, personal plots
- 24 Rain-fed pastures
- 25 Irrigable pastures

Urban Ecosystems

- 26 Municipal
- 27 Industrial

Ruderal-degraded Ecosystems

- 28 Weed, ruderal



High mountain desert ecosystems

pis immerse, *Acantholimon diaspensoides*, *A.pamiricum*. The most valuable communities are wormwood-teresken and meadow-steppe. They include some endemic, rare, and endangered plants – Badakhshan dandelion (*Taraxacum badachschanicum*), Pamir desederia (*Desideria pamirica*), etc.

The main background animals are: argali (*Ovis ammon*), snow leopard (*Uncia uncia*), Siberian ibex (*Capra sibirica*), red marmot (*Marmota caudata*), and *Syrrhaptus tibetana*, as well as some nature embellishing butterflies: machaon (*Papilio machaon*), apollo (*Parnassius apollo*), and alexanor (*Papilio alexanor*).

As the anthropogenic impact on the vegetation and animal worlds is increasing, pastures are degrading, causing reduction of the areas and populations of wild animals.

3. High-mountain meadow and steppe ecosystems occur fragmentarily, sometimes as wide belts, in all mountain ranges of Tajikistan and are of great ecological importance. The great part of the ecosystems includes habitats of rare endemic mammals, birds, insects, and valuable vegetation communities.

The main coenosis-forming species of this type of ecosystem are: fescue (*Festuca alaica*, *F.pamirica*), feather grass (*Stipa kirghisorum*), meadow grass (*Poa alpina*), sedge (*Carex melanantha*, *C.stenocarpa*), cobresia (*Cobresia stenocarpa*), *Oxytropis savellanica*, thyme (*Thymus seravschanicus*), etc. In overgrazing areas, the ecosystems are strongly degraded (over 30% of the total area), the grass productivity being reduced from 20-25 to 10-12 centners per hectare. Periodically, the communities lose the most valuable species, including at least 150 rare and endangered species. The

animal world of these ecosystems includes: snow leopard (*Uncia uncia*), argali (*Ovis ammon*), red marmot (*Marmota caudata*), *Syrrhaptus tibetana*, Siberian ibex (*Capra sibirica*), Tibetan snow partridge (*Tetrogallus tibetanus*), etc.

4. Mid-mountain conifer forest ecosystems compose nearly 50% of the total forested areas of the country. They are common in northern Tajikistan, within the Kuramin, Turkestan, and Zeravshan ranges. Juniper and light forests are important for regulating and conserving water resources, protecting slope soils, fortifying river banks, and preventing mudflows.

Juniper forests and light forests are represented by 4 species: *Juniperus seravschanica*, *J.turkestanica*, *J.semiglobosa* and *J.sibirica*, among which Zeravshan juniper (*J.seravschanica*), Turkestan j. (*J.turkestanica*) and semicircular j. (*J.semiglobosa*) are forest-forming species.

There are some rare and endangered animal species in the juniper forests: Tien Shanian brown bear (*Ursus arctos*), urial (*Ovis vignei*), Tajik markhur (*Capra falconeri*), *Vipera lebetina*, and ring dove (*Columba palumbus*).

The most valuable communities are motley-shrub-steppe and forbs-meadow juniper forests.

5. Mid-mountain mesophyllic forest ecosystems are represented by maple-walnut and willow-poplar-birch forests with light forest mesophyllic shrubs. These forests contain a considerable number of rare endemic species of animals and plants.

The most valuable communities of these ecosystems – broad-leaf mesophyllic relict forests: walnut (*Juglans regia*) and maple (*Acer*



Mid-mountain conifer forest ecosystems

turkestanicum) – are widespread in Central Tajikistan. Great areas of small-leaf forests – birch (*Betula tianschanica*) – occur in the Zeravshan River Valley, within the Karateghin Range, and in the Western Pamirs; mesophyllic shrubs are mainly observed in Central Tajikistan.

The most valuable walnut-maple forests are located in the Sarikhosor, Childukhtaron, and Dashti-Jum reserves. Among plants most valuable are: Victor's ungernia (*Ungernia Victoris*), magnificent ostrowskia (*Ostrowskia magnifica*), cousinia darvazica (*Cousinia darwasica*, *Cousinia leptocampyla*), Hissar iskandera (*Iskandera hissarica*), Yagnob feather grass (*Stipa jagnobica*); mammals: weasel (*Mustela pallida*, *M.heptneri*), Turkestan lynx (*Felis lynx isabellina*), snow leopard (*Uncia uncia*), urial (*Ovis vignei*), Tien Shan brown bear (*Ursus arctos*), yellow porcupine (*Hystrix leucura*); birds: ring dove (*Columba palumbus*), pheasant (*Phasianus colchicus*), golden eagle (*Aquila chrysaetus daphanea*), and Egyptian vulture (*Neophron percnopterus*).

The forest vegetation communities have a considerable number of wild relatives of fruits: apple (*Malus*), pear (*Pyrus*), cherry plum (*Prunus*), hawthorn (*Crataegus*), barberries (*Berberis*).

Forested areas are annually reduced, while no restoring works are carried out.

6. Mid-mountain xerophytic light forest ecosystems occupy vast areas of southern and western Tajikistan; small fragments occur in northern Tajikistan. They include: pistachio, forbs wormwood, almond. In dry hot regions, pistachio forest's function is to regulate water resources; they also are an optimal habitat for wild animals from arid zones.



Mid-mountain conifer forest ecosystems



Mid-mountain xerophytic light forest ecosystems

Of large mammals, there are: Persian gazelle (*Gazella subgutturosa*), urial (*Ovis vignei*), wolf (*Canis lupus*), fox (*Vulpes vulpes*); reptiles: Central Asian cobra (*Naja oxiana*), and steppe tortoise (*Testudo horsfieldi*).

This type of ecosystems contains wild relatives of barley (*Hordeum spontaneum*), vetch (*Vicia tenuifolia*), almond (*Amygdalus bucharica*), persimmon (*Diospyros lotus*), jujube (*Zizyphus jujuba*), pomegranate (*Punica granatum*), grapes (*Vitis vinifera*), etc. They become secondary communities due to intensive cuttings.

7. Mid-low mountain semisavanna (savannoide) ecosystems are widespread in southern and northern Tajikistan. They are developed under hot climatic conditions.

The main valuable communities of this type are high-grass and forbs-shrub communities. The dominant species are: barley (*Hordeum bulbosum*), meadow grass-sedge (*Poa bulbosa*, *Carex pachystylis*), ferule (*Ferula kokanica*, *F.kuhistanica*), Jerusalem sage (*Phlomis bucharica*), etc.

The animal world, except for insects, is represented by a small number of species with summer and winter aestivation periods. Background amphibians are: steppe tortoise (*Testudo horsfieldi*) and *Ophisaurus apodus*. Rare and endemic species are also found here: seesee partridge (*Ammoperdix griseogularis*), white bustard (*Otis tarda*), skink (*Eumeces schneideri*), Persian gazelle (*Gazella subgutturosa*), Turkestan saker falcon (*Falco cherrug*), and golden eagle (*Aquila chrysaetus*).



Low-mountain savannoid ecosystems

Vast areas of these ecosystems (70%) are strongly degraded. The main reasons of the degradation are:

- Cutting trees and shrubs;
- Intensive ploughing of steep-slope areas;
- Frequent fires;
- Complete absence of crop and pasture rotation;
- Violation of the haymaking technology;
- Unregulated cattle grazing in fall and spring period.

8. Foothill semidesert-desert ecosystems occupy high terraces of the plains in the lower reaches of large rivers: Pyandj, Vakhsh, Kafirnigan, Syrdarya, and Zeravshan.

The major communities of this type are: saxaul, black saxaul, calligonums, and perennial saltwort thickets. They play an important role in protecting soils, preventing erosion, and providing winter pasturing. These ecosystems include 30-40% of the total winter pasture areas, most of which are degraded and cultivated for irrigable agricultural crops.

The vegetation dominants are: saxaul (*Haloxylon persicum*), calligonum (*Calligonum litvinovii*), saltwort (*Salsola richteri*), wormwood (*Artemisia tenuisecta*), harmel (*Hammada leptoclada*), sedge (*Carex physodes*), halostachys (*Halostachys belangeriana*), halocharis (*Halocharis hispida*).

Mammals are represented mainly by: Persian gazelle (*Gazella subgutturosa*), jakal (*Canis aureus*), big-eared hedgehog (*Paraechinus hynomelus*), and steppe cat (*Felis ornald*). Of reptiles, there are: steppe agama (*Agama sanguinolenta*), gray monitor lizard (*Varanus griseus*), shaft-snake (*Taphrometopon*

lineolatum), and sand echis (*Echis carinatus*); of insects the xerophyllous species prevail.

In southern Tajikistan, nearly 30 thousand hectares of this ecosystem type are near-protected areas of the Tigrovaya Balka Reserve. Considerable areas of the sand-desert ecosystems are cultivated for cotton growing.

9. Wetland ecosystems include tugai (sometimes tugai forests), meadow-swamp (the river lower reaches), and wetland ecosystems.

They are very important for the preservation of the global ecological balance, particularly for regulating the numbers of waterfowls of Eurasia.

The watercourses of the southern landscapes of Tajikistan are the base of water game species development that provides sustainable reproduction of fish, fur-bearing animals, and birds.

In the presence of biomass, tugai ecosystems practically equal subtropical forests of South Asia.

The world intact tugai ecosystems have been preserved only in the Tigrovaya Balka Reserve. 645 plant species, over 70% of which are assigned solely to tugai, and nearly 30% are common of meadow-swamp and sand-desert ecosystems, are defined here.

The main vegetation dominants are: *Populus pruinosa*, elaeagnus (*Elaeagnus angustifolia*), desert thorn (*Lycium dasystemum*), macereed (*Typha angustifolia*), along grass (*Imperata cylindrica*), bur reed (*Phragmites communis*), sugarcane (*Saccharum spontaneum*), Kashgar tamarisk (*Tamarix hispida*), black grass (*Juncus articulatus*), etc.



Tugai ecosystem

Many of the animals find shelter in the tugai, where the following bird species hibernate: white and gray herons (*Egretta alba*, *Ardea cinerea*), bittern (*Botaurus stellaris*), garganey teal (*Anas querquedula*), European teal (*A. crecea*), marsh harrier (*Circus aeruginosus*), mud hen (*Rallus aquaticus*), moor hen (*Gallinula chloropus*), pheasant (*Phasianus colchicus*), pygmy cormorant (*Phalacrocorax pugmeus*), great cormorant (*Ph. carbo*), serpent eagle (*Circaetus ferox*), etc. The background species of the tugai mammals are: jungle cat (*Felis cnaans*), jakal (*Canis aureus*), Bukhara deer (*Cervus elaphus*), etc.

The biodiversity specific composition of water sources is usually variable. Mountain and high-mountain water reservoirs mainly contain the arcto-alpian species of sedge (*Carex diandra*, *C. oliveri*, *C. stenocarpa*, *C. parva*), cobresia (*Cobresia pamiroalaica*, *C. capillifolia*, *C. persica*, *C. stenocarpa*), meadow grass (*Ranunculus songoricus*), primrose species (*Primula capitellata*, *P. Kaufmanniana*, *P. algida*, *P. farinose*, etc.), while the low-mountain and plain reservoirs are characterized by the presence of common horsetail (*Equisetum arvense*), macereed (*Typha angustifolia*), potamogeton (*Potamogeton crispus*), anagalis (*Anagalis arvensis*), sedge (*Carex orbicularis*), bur reed (*Phragmites communis*), and many others.

Nearly 330 species of higher plants inhabit water reservoirs of Tajikistan; 145 of these are typical solely of the mountain and high-mountain areas, others are wetland plants in the low-mountain and plain areas of the country.

Currently, the biodiversity of foothill wetland ecosystems is in the most critical situation, as they are contaminated with a great volume of water flowing from irrigated lands.

Anthropogenic Ecosystems

These ecosystems include agricultural, urban, and ruderal-degraded areas. Over 30% of the country area has been transformed into anthropogenic systems which meet the general needs of the population. Increasing the anthropogenic impact on the environment, without considering its capacity, is dangerous for the economic development.



Agroecosystem

10. Agroecosystems (agricultural ecosystems) are located in all natural zones, from hot foothills (300 masl) to high-altitude deserts of the Eastern Pamirs (3000-3500 masl). The main varieties of agricultural crops grow on unprotected soil; considerable part of local species of wild relatives of cereals, leguminous, industrial, vegetation and melon, and forage plants (genetic resources) occur here and the area together with pastures, is estimated slightly over 4 m. ha.

1550 varieties of fruits and berries, 463 – vegetable and melon, 46 – cereal, 39 – leguminous, 25 – industrial, 39 – forage, and about 1850 – adornment crops are raised and adapted to local environment within wide range of soil and climatic conditions. Nearly 50% of the cultivated crops are local varieties. There are about 30 breeds of domestic animals. Most vivacious example of conservation of the animals genetic pool is the extension of yaks habitats within mountainous Tajikistan.

Violation of the regulations of agricultural irrigational technologies and crop rotation results in annual destruction of soil fertile layer. Steep-sloped lands are prone to landslides.

11. Urban ecosystems comprise the cities of Dushanbe, Khudjand, Isfara, Kani-badam, Istravshan, Kulyab, Kurgan-Tybe, Tur-sunzade, large settlements, and industrial enterprises. The urban zone around the cities is being increased, new system of water supply, central heating, sanitary-purifying zones, and green plantations, which is to be maintained artificially, being created. The majority of invasive species are found in urban ecosystems, including cities.

12. Ruderal-degraded ecosystems occur in all zones of human activity, being particularly well observed in cattle breeding areas.



Ruderal-degraded ecosystems

On the pastures and sown areas, the most dangerous plants for people and animals are: colchicum (*Colchicum luteum*), *Thermopsis dolichocarpa*, *Trichodesma incanum*, heliotrope (*Heliotropium dasicarpum*), and some wormwood species (*Artemisia*). The main dominant communities of ruderal ecosystems are the representatives of compositae (*Compositae*), cereals (*Gramineae*), buckwheats (*Polygonaceae*), meadow grasses (*Ranunculaceae*), St. John's-worts (*Guttiferae*), and often labiates (*Labiatae*).

Ruderal ecosystems of the foothills are generally represented by one species open plant communities: caper (*Capparis spinosa*), fragments of wall barley (*Hordeum leporinum*), annual saltworts (*Salsola pestifera*, *S.turkestanica*, *S.forcipitata*), and camel's thorn (*Alhagi kirghisorum*).

Ruderal communities of the low-mountain zone are represented by *Cynodon dactylon*, *Prosopis farcta*, cousinia (*Cousinia Olgae*, *C.polycephala*, *C.ambigens*, *C.dichromata*, *C.microcarpa*, *C.radians*, *C.pseudoarctium*, etc.), and forbs.

Licorice, together with reed (*Saccharum spontaneum*) and camel's thorn (*Alhagi kirghisorum*), are formed after cuttings in the forest ecosystem zone. *Imperata cylindrica* are usually formed in the deserted fallow lands of the light forest zone.

In the sites of long-term pasturing in the sub-alpine zone, *Rumex paulsenianus* and *Polygonum coriarum* are formed.

In the alpine zone, ecosystems are represented by wormwood species, combined with meadow-steppe vegetation.

The flora of the ruderal ecosystems consists of 690 species and 30 communities.

1.2.2. Specific diversity

For thousands of years, people of Tajikistan lived in harmony with the natural diversity of flora and fauna. In the process of historical development, they created many new forms of food, medicine, and forage crops, and domestic animals, promoted their conservation, thus enriching the natural biodiversity. The recent century was marked by an increased human impact on biodiversity, due to the population growth and active land mastering.

A. Vegetable world

The vegetable world is represented by a great genetic and environmental diversity, and a unique specific diversity; it includes 9771 species and 20 formations.

The processes of xerophytization, ephemerization, mesophyllization, cryophytization, and migration processes in Tajikistan

Table 1.2. Comparative Characteristics of Vascular Plants in Central Asian countries*

Country	Area / thous. km ²	Number			
		Species	Genera	Families	Endemics
Tajikistan	143.1	4511	996	123	882
Kazakhstan	2715	4750	1022	126	550
Uzbekistan	450	3663	880	140	366
Kyrgyzstan	198	3276	831	113	321
Turkmenistan	488	2200	683	133	325

*Flora of Tajik SSR (v. Kh. - L.: Nauka, 1991 - 624 p), Cherepanov S.K. (Vascular plants of USSR L.: Nauka, 1981, - 510 p.) - 4511 species, according to M.I. Ismailov (Identification of vascular plants of Tajikistan // Dep. in SPI center, edition 2, №44 (1186), D.: 1999.) - 4095 species. Critical inventory of flora is a priority issue in the second phase of the project

Table 1.3. Flora of Tajikistan

№	Units (type, class)	Total			Introducent			Wild relatives		
		species	genus	family	species	genus	family	species	genus	family
1.	Algae	2145	500	100	–	–	–	2145	500	100
2.	Fungi	2233	284	78	–	–	–	2233	284	78
3.	Lichenes	524	85	27	–	–	–	524	85	27
4.	Bryophyta	358	144	52	–	–	–	358	144	52
	Total:	5260	1013	257	–	–	–	5260	1013	257
5.	Pteridophyta	22	14	5	–	–	–	22	14	5
6.	Gymnospermae	35	9	5	9	6	3	26	3	2
7.	Angiospermae, including:	4454	973	113	312	106	4	4142	867	109
	• Monocotyledonae (Liliopsida)	752	161	18	22	6	–	730	155	18
	• Dicotyledonae (Magnoliopsida)	3702	812	95	290	100	4	3412	712	91
	Total :	4511	996	123	321	112	7	4190	884	116
	Grand total:	9771	2009	380	321	112	7	9450	1897	373

caused an extensive formation of flora species and forms that considerably enriched the flora specific composition as compared to other countries, the areas of which are many times bigger than that of Tajikistan (table 1.2).

In addition to the specific diversity, the flora of Tajikistan is marked by rich generic spectrum and the presence of systematic units of the highest rank – genera, family, and type (table 1.3, 1.4).

B. Valuable communities

The natural vegetation of Tajikistan annually produces over 80 million tonnes of land (31 mln.) and underground (48 mln) phytomass, a considerable part of which forms valuable communities.

Many valuable communities are in extreme conditions with narrow ecological range. They support sustainability of mountain and valley ecosystems development owing to their structure.

There are the following types of vegetation (fig. 1.8):

- broad-leaf forest (*Acer turkestanicum*, *Juglans regia*),
- tugai forest (*Populus pruinosa*, *Elaeagnus angustifolia*),
- small-leaf forest (*Betula tianschanica*),
- juniper forest (*Juniperus turkestanica*,
- *J. seravschanica*, *J. semiglobosa*,

- xerophyllous light forest (*Pistacia vera*, *Amygdalus bucharica*),
- brushwood (*Rosa kokanica*, *R. divina*, *Aflantunia ulmifolia*, *Exchorda Albertii*, *Ephedra equisitina*),
- semiwoody-semibrush vegetation (*Haloxylon persicum*, *Salsola richterii*, *Calligonum caput-medusae*, *C. griceum*, *C. arborescens*, *C. calcareum*, *Hammada leptocloda*, *Artemisia kochiiiformis*, *Ceratoides papposa*),
- *Cousinia pannosa*, *C. stephanophora*,
- steppe (*Festuca alaica*, *F. subcata*, *F. pamirica*, *Artemisia dracunculus*),
- semisavanna (*Prangos pabularia*, *Inula grandis*, *Ferula Jaeshkiana*),
- meadow (*Polygonum coriarum*, *Ligularia thomsonii*),
- *Acantholimon tatarica*, *Onobrychis echidna*.



Prunus

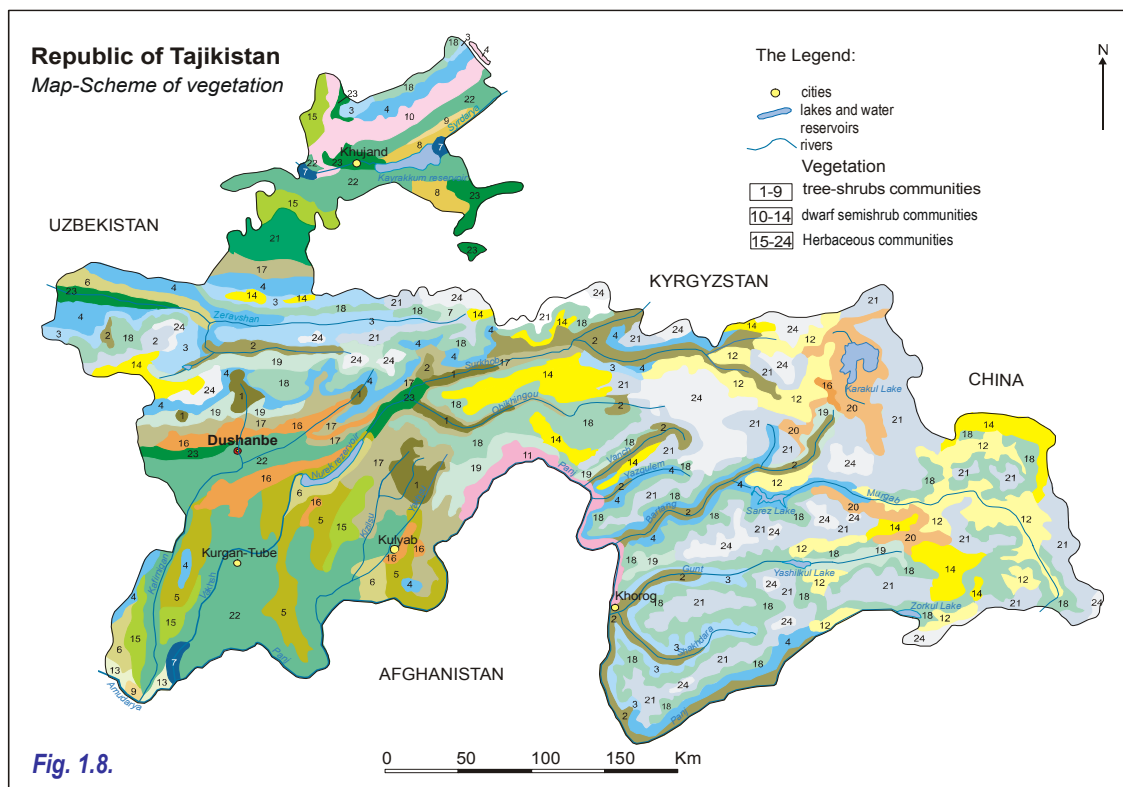


Fig. 1.8.

Fig. 1.8. Legend to «Map-scheme of vegetation»

Woods and shrubs			
1	Deciduous maple-shrub-walnut forests	12	High mountain East Pamir-like deserts with domination of aiania-ceratoides-sagebrush communities
2	Small-leaf meadow-sea buckthorn-birch forests	13	South Tajikistan-like deserts with domination of ephemeroïd-sagebrush-hamada communities
3	Juniper forests in combination with shrubs, meadows and steppes	14	Traganthoides with domination of thorn pulvinate-prickly herb-cousinia communities
4	Open juniper forests in combination with tall-herbs, xerophytes and shrubs	Herbaceous vegetation	
5	Xerophytic open ephemeroïd-maple-pistachio woodlands	15	Semi-savannas with domination of low herbs
6	Xerophytic open ephemeroïd-sagebrush-zygophyllaceous-almond woodlands	16	Semi-savannas with domination of tall grasses
7	Tugai with domination of meadow-marsh-oleaster-poplar communities	17	Semi-savannas with domination of tall herbs
8	Psammophytic vegetation ephemeroïd-halophytic-perennial saltwort-saxaul	18	Steppe with domination of forb-tussock-grasses
9	Halophytic saltwort-ephemeroïd vegetation	19	Sub alpine tall herb meadows
Dwarf semishrub communities		20	Cryophytic meadows dominated with sedge and cobresia
10	Fergana-like deserts with domination of saltwort-ephemeroïd-sagebrush communities	21	Cryophytic-petrophytic vegetation
11	West Pamir-like deserts with domination of acantholimon-sagebrush communities	22	Irrigated lands
		23	Rain feed lands
		24	Glaciers

fig. 1.8.



Sub-alpine meadows

More than 70 species of valuable communities form independent vegetation formations. Among them the most valuable communities are: nuts (*Juglans regia*), apples (*Malus Sieversii*), maples (*Acer turkestanicum*), junipers (*Juniperus seravschanica*, *J.semiglobosa*, *J.turkestanica*, *J.sibirica*), birches (*Betula tianschanica*), sea buckthorns (*Hippophae rhamnoides*), populus (*Populus pruinosa*), elaeagnus (*Elaeagnus angustifolia*), pistachios (*Pistacia vera*), common jujube (*Ziziphus jujuba*), figs (*Ficus carica*), hawthorns (*Crataegus pontica*), saxaul (*Haloxylon persicum*).

The woody and shrub plants of Tajikistan make over 60% of valuable juniper, 50% of pistachios, 95% of tugai, 65% of mesophyllic, 20% of small-leaf and mesophyllic-shrub communities of Central Asia. 90% of large mammals inhabit these communities formed by these communities.

Valuable communities occur almost on the total area of Tajikistan (fig. 1.9), considerable part of them are high-productive pastures, hayfields, and food, medicinal, and technical resources.

Grass communities are most diverse in composition and structure. They include 10 of 20 types of vegetation, 4 of them belong to subshrubs and 6 – to woody-shrubs.

Grass and subshrub communities make over 70% of arable lands (3.5 million hectares of pastures) and 90% of natural medicinal resources of vegetable origin.

The most valuable communities of medicinal plants are the following formations: licorice (*Glycyrrhiza glabra*), origanum (*Origanum tyttanthum*), *lagochilus seravschanicus*, bunium persicum, rhubarb (*Rheum maximoviczii*), inula

(*Inula grandis*), *ungernia tadshicorum*, allseed (*Rhodiola heterodonta*), ferule (*Ferula foetidissima*, *F.violacea*), onion species (*Allium stipitatum*, *A.seravschanicum*, *F.Suvorovii*).

All these formations are preserved as small communities, including numerous relic and endemic species and genera (*Ostrovskia*, *Cephalopodium*, *Spyrostegia*, *Kuhitangia*, *Korshinskya*, *Paulia*, *Thlaspidium*, *Chaetolimon*).

Of ancient Mediterranean flora elements, communities of broad-leaf forests or xerophytic light forests (*Fraxinus raibocarpa*, *Calophaca grandiflora*, *Keyscringia mollis*), mesophyllic forests, deciduous forests (*Juglans regia*, *Acer turkestanicum*, *Exchorda Alberti*, *Aflatunia ulmifolia*), numerous relic shrubs (*Ribes*, *Lonicara*, *Cotoneaster*, *Fraxinus*), and herbaceous plants (*Buchingera*, *Ostrovskia*, *Petilium*, *Imperata*) still exist in Tajikistan.

C. Animal World

A considerable diversity of environmental conditions, ecosystem variations and plant communities rich in composition and structure, as well as ancient many-pole faunogeneses promoted the conservation and development of about 13 thousand species of invertebrates and 531 species of vertebrate animals on the territory of Tajikistan (table 1.4).

Vertebrates

Mammals (*Mammalia*) of Tajikistan include 84 species, grouped in 47 genera, 22 families, and 6 orders: insectivorous, cheiroptera, hares, rodents, carnivorous, and ungulates.

Insectivorous Order (Insectivora) – the oldest branch of mammals in Tajikistan - is represented by only 6 species, belonging to 4 genera and 2 families.

Cheiroptera Order (Chiroptera) of Tajikistan includes 19 species of bats, belonging to 3 families and 9 genera.

Order Rodentia (rodents) is the most numerous orders of mammals in Tajikistan, represented by 29 species, belonging to 7 families and 17 genera.

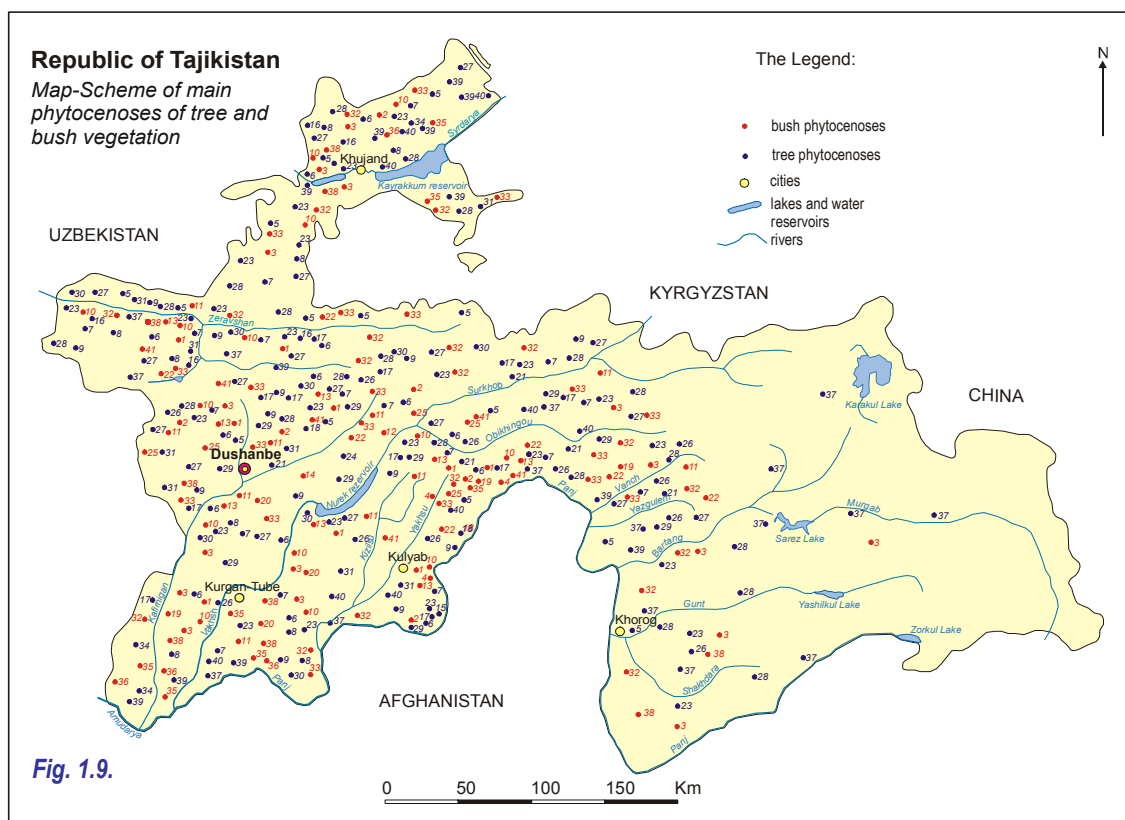


Fig. 1.9. Legend to «Map-scheme of main phytocoenosis of tree and bush vegetation»

No.	Latin Names	1	2
1	<i>Zizyphus jujuba</i>	22	<i>Betula tianschanica</i>
2	<i>Cercis griffithii</i>	23	<i>Juniperus seravschanica</i>
3	<i>Cerasus verrucosa, C.erythrocarpa</i>	24	<i>Biota orientalis</i>
4	<i>Punica granatum</i>	25	<i>Exochorda alberti</i>
5	<i>Celtis caucasica</i>	26	<i>Juglans regia</i>
6	<i>Pistacia vera</i>	27	<i>Juniperus turkestanika, J.sibirica, J.semiglobosa</i>
7	<i>Amygdalus bucharica</i>	28	<i>Populus bachofenii, P.tadshikistanica</i>
8	<i>Amygdalus spinosissima</i>	29	<i>Platanus orientalis</i>
9	<i>Acer regelii, A.pubescens</i>	30	<i>Acer turkestanicum</i>
10	<i>Ephedra equisetina, E.intermdia</i>	31	<i>Fraxinus sogdiana</i>
11	<i>Fraxinus raibocarpa</i>	32	<i>Cotoneaster hissaricus, C.nummularius</i>
12	<i>Calophaca grandiflora</i>	33	<i>Rosa divina, R.ecaе, R.ovczinnikovii</i>
13	<i>Rhus coriaria</i>	34	<i>Haloxylon persicum</i>
14	<i>Palinrus spina-christi</i>	35	<i>Salsola paletzkiana, S.richteri</i>
15	<i>Ficus carica</i>	36	<i>Calligonum microcarpum, C.litvinovii</i>
16	<i>Pyrus regelii</i>	37	<i>Hippophae rhamnoides</i>
17	<i>Pyrus bucharica</i>	38	<i>Tamarix arceuthoides, T.ramosissima</i>
18	<i>Diosphyros lotus</i>	39	<i>Elaeagnus angustifolia</i>
19	<i>Zigophillum gontscharovii</i>	40	<i>Populus pruinosa</i>
20	<i>Vitex agnus-castus</i>	41	<i>Restella alberti</i>
21	<i>Malus sieversii</i>		

fig. 1.9.

Table 1.4. Specific diversity of animals

Taxa	Number		
	Total	En- demic	Listed in the Red Data Book
Invertebrates	12619	799	58
Protozoa	300	–	–
Vermes	1400	–	–
Arachnida	715	–	–
Insecta	10 000	796	50
Mollusca	204	3	8
Vertebrates	531	1	104
Amphibia	2	–	–
Reptilia	47	–	21
Pisces	52	–	4
Aves	346	–	37
Mammalia	84	1	42
Total:	13150	800	162

The family of squirrels (*Sciuridae*) of Tajikistan includes 5 species: *Spermophilopsis leptodactylus*, relic (*Citellus relictus*), and yellow squirrels *C.fulvus*, red marmot (*Marmota caudata*), and Menzbier's marmot (*M.menzbieri*). Populations of *Spermophilopsis leptodactylus* and yellow squirrels are on the verge of vanishing.

Endemic of Western Tien Shan is Menzbier's marmot (*Marmota menzbieri*). Due to the industrial development of the Aktash upper reaches and the adjacent parts of the Kuramin Range, the isolated population of the marmot completely disappeared from Tajikistan in the early 1980s of 20 century.

The rare representatives of the rodents order also include small five-toed jerboa (*Allactaga elater*) and Severtzov's jerboa (*A.severtzovi*), which are narrow-area species within Tajikistan territory; their sparse settlements are preserved at clay, rubble, and saline areas of deserts in northern and southeastern Tajikistan.

Order *Lagomorpha* (hares) includes 3 species, belonging to 2 families: hares (*Leporidae*) – 1 species, piping hares (*Lagomyidae*) – 2 species. The Tolai hare (*Lepus tolai*) has a wide geographic and vertical range (300-5100 masl), occurs from the river valleys and deserts to the mountainous forests and highlands. The mountainous representative of hares – large-eared piping hare (*Ochotona*

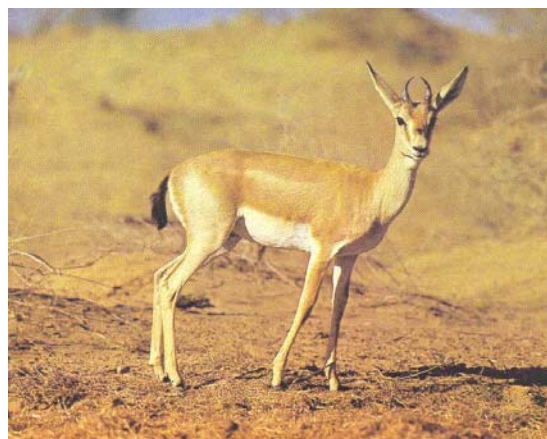


Lepus tolai

roylei) – is common in Badakhshan and the Pamirs (2200-4800 masl), while red piping hare (*Ochotona rutila*) occurs only in the Pamirs.

Order *Artiodactyla* (cloven-ungulate) is presented by 7 species of cloven-hoofed animals in Tajikistan, belonging to 3 families and 4 genera. A widespread representative of this order is wild boar (*Sus scrofa*). Bukhara Red deer (*Cervus elaphus bactrianus*), the largest representative of cloven-ungulate mammals of Tajikistan is listed in the Red Data Book of the IUCN. The native habitats of the Bukhara Red deer – tugai – due to agricultural development they are almost entirely transformed. At present Bukhara Red Deer is really threatened. Its *in-situ* dwelling is in Tigrovaya Balka reserve and in tugai of right side of Pyanj river till Afghanistan border. Introducent populations of Bukhara Red Deer are preserved in Zeravshan zakaznik, Sarikhosor and in Shakhriatau nursery.

Persian gazelle (*Gazella subgutturosa*) inhabits semi-desert hard-soiled areas, flat foothill plains, and lowlands (400-1800 masl). The Persian gazelle became very rare, listed in the



Gazella subgutturosa



Uncia uncia

Red Data Books of IUCN and Tajikistan. The Persian gazelle is an endangered species, because of poaching and habitat degradation, its population in the country not exceeding 80.

Siberian mountain goat (*Capra sibirica*) is a common representative of cloven-ungulate animals in Tajikistan, occurring at 1600-5000 masl. In recent 10-15 years its population is threatened by poaching.

Markhur (*Capra falconeri*) is an endangered species listed in the Red Data Book of the IUCN. At present the markhur's population of the Dashti-Jum reserve counts 120-130 individuals.

Urrial (*Ovis vignei bochariensis*) was a very common species in the past. Only 400-500 individuals are preserved at the present time.

Argali or wild ram (*Ovis ammon polii*) – the largest representative of wild rams of Central Asia and a pride of the Pamirs mountainous fauna. The uncontrolled international hunting and poaching considerably reduced its resources in recent 10-15 years.

Order *Carnivora* (carnivorous) includes 20 species, belonging to 5 families and 10 genera. The most common representative of the family is stone marten (*Martes foina*), inhabitant of broad-leaf and juniper forests.

There is only one species of the hyenas family (*Hyaenidae*) in Tajikistan: striped hyena (*Hyaena hyaena*). Owing to active developing the lands of its natural habitats and direct killing, the population of the hyenas has been shrinking rapidly all over the republic.

The cat family (*Felidae*) of Tajikistan is represented by 5 species: Turan tiger (*Panthera tigris virgata*), leopard (*Pardus pardus*), snow

leopard (*Uncia uncia*), Turkestan lynx (*Felis lynx*), jungle cat (*Felis chaus*), and wild cat (*Felis libyca*). Turan tiger has become extinct.

Earlier, the leopard (*Pardus pardus*) was common in the mountains of southwestern Tajikistan. In recent years, there have been no valid data on the presence of leopard in Tajikistan.

Snow leopard or irbis (*Uncia uncia*) is quite common, but it is not numerous. This species area covers the total mountainous zone of Tajikistan. The typical habitats are at 2500 to 5500 masl.

Brown bear (*Ursus arctos*) is common in the mountain ranges of Northern, Central Tajikistan, Badakhshan, and the Pamirs. Poaching and mountainous forest mastering are factors promoting the decline of the brown bear's population.

Among mammals, the narrow-endemic species is: Menzbier's marmot. 11 of 84 mammal species are assigned to game species.

Aves (birds) is the most numerous (in specific composition) class of vertebrates of Tajikistan. Ornithofauna includes 346 species related to 16 orders. Nearly 10% (37 species) are assigned to rare or endangered. The most critical species are falcons and bustards.

Resident birds include 82 species, nesters – 150, migratory – 108, wintering – 80, and birds of passage – 21. Among waterfowl and near-water birds, over 20 species of ducks and sandpipers, wintering at wetlands, lakes, reservoirs, man-made ponds, and rivers, are important game species. The representatives of the order of gallinaceous (*Galliformes*) – partridge (*Alectoris kakelik*), quail (*Coturnix coturnix*), Ti-



Falco cherrug

Table 1.5 Dynamics of Numbers of Some Game Birds (individuals)*

Name	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Tibetan snow partridge (<i>Tetraogallus tibetanus tibetanus</i>)	3220	3350	3250	3000	3050	3749	4239	3988	9533	2713	1232
Pheasant (<i>Phasianus colchicus</i>)	585	565	571	570	610	790	565	405	404	321	310
Bar-headed goose (<i>Anser indicus</i>)	740	730	680	660	640	630	704	783	805	652	652
Partridge (<i>Alectorius keklik</i>)**	44.2	44.5	45.2	44.8	45.0	45.8	40.5	47.5	37.9	44.8	26.0
Pigeon (<i>Columba leuconota</i>)**	9.2	9.5	9.3	8.0	9.0	10.4	10.1	20.0	30.3	25.7	25.1
Waterfowls**	34	35	35	35	33	37	38	69	69	134	57

*Number range is 8-10%

**Thousands

betan snow partridge (*Tetraogallus tibetanus*), and pheasant (*Phasianus colchicus*) – are also assigned to game species.

Reptiles (Reptilia) of Tajikistan are very diverse, being represented by 47 species (table 1.6), included in 2 orders, 13 families, and 23 genera.

The richest specific diversity is observed in lizards – 30 species. There are 16 species of snakes and 1 species of tortoise. The Red Data Book of Tajikistan comprises 21 species of reptiles.

Numerous and common representative of reptiles is steppe tortoise (*Testudo horsfieldi*), which occurs in loess adyrs and foothill steppes. In recent years, poaching and illegal exporting has negative impact on the population of this species in the country. Lizards, inhabiting deserts, semi-deserts, foothill steppes, and (to a lesser degree) mountains, are also common and numerous (30 species).



Varanus griseus

Table 1.6. Systematic structure of reptile specific diversity

Name	Number of species
Order Testudines (Tortoise)	1
Hidden-neck turtle Suborder (Cryptodira)	1
Land tortoise Family (<i>Testudinidae</i>)	1
Order Squamata (Scaly animals)	46
Suborder Sauria (Lizards)	30
Gecko Family (<i>Gekkonidae</i>)	5
Agama Family (<i>Agamidae</i>)	9
Monitor lizard Family (<i>Varanidae</i>)	1
Anguidae Family	1
Lizard Family (<i>Lacertidae</i>)	9
Family Skink (<i>Scincidae</i>)	5
Suborder Ophidia, seu Serpentes (Snakes)	16
Blind-snake Family (<i>Typhlopidae</i>)	1
Boa Family (<i>Boidae</i>)	1
Grass-snake Family (<i>Columbridae</i>)	8
Asp Family (<i>Elapidae</i>)	1
Viper Family (<i>Viperidae</i>)	4
Crotalidae Family	1

Of 16 snake species, the most critical ones are: sand snake (*Echis carinata*), blind snake (*Typhlops vermicularis*), Central Asian cobra (*Naja oxiana*), the populations of which are being less and less numerous, because of illegal catching and keeping them in serpenteria, aimed at receiving snake's venom.

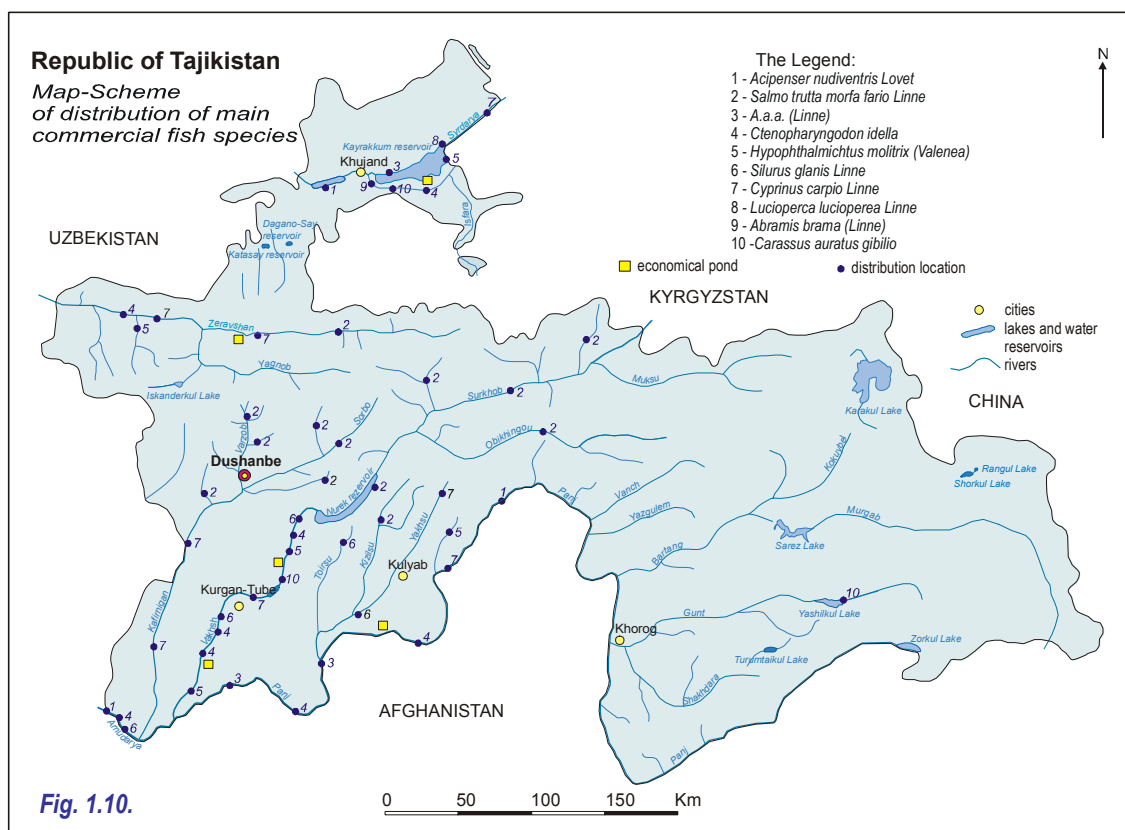
Amphibians (Amphibia) are represented by 2 species: – lake frog (*Rana ridibunda*) and green toad (*Bufo viridis*). The cultivation and watering of desert and fallow lands caused the lake frog area expansion.

Fish (Pisces). Numerous watercourses of Tajikistan are currently inhabited by 52 species and forms of fish, belonging to 12 families. The most diverse fish populations are those of rivers – 52 species, ponds – 17, lakes – 20, springs – 10. The whole diversity of fish has nearly 20 game species (fig. 1.10), including Amudarya trout (*Salmo trutta morfa fario*), pike (*Esox lucius*), *Schizothorax intermedius*, *Scardinius erythrophthalmus*, *Varicorhynchus capoeta heratensis*, redeye (*Scardinius erythrophthalmus*), Aral asp (*Aspius aspius taeniatus*), etc. The relic and endemic species contain 3 sturgeon species (genus of shovel-nosed pseudosturgeons): Amudarya great – (*Pseudoscaphirhynchus kaufmannii*), Amudarya small (*P. hermannii*) and Syrdarya pseudosturgeon (*P. fedtschenkoii*). Some valuable game fish – pike-asp (*Aspiolucius esocinus*), Aral barbel (*Barbus brachycephalus*) – are listed in the Red Data Book. In recent years, Aral asp (*Aspius aspius taeniatus*), *Acipenser nudiventris* have become less numerous, rare, and endangered.



Fish population in a high-mountain lake

The ichthyofauna of Tajikistan watercourses was enriched by acclimatization of 18 valuable fish species, including: crucian carp (*Carassus auratus*), American sheatfish (*Silurus glanis*), zander (*Lucioperca lucioperca*), com-



mon bream (*Abramis brama*), grass carp (*Ctenopharyngodon idella*), silver and motley carp (*Hypophthalmichthys molitrix*, *Aristichthys nobilis*), American buffalo (*Jctiobus bufalus*), a new breed of carp (*Cyprinus sp.*), a hybrid of beluga (white sturgeon) and sterlet, Siberian peled (*Coregonus peled*), etc.

A significant damage to specific biodiversity and number of *Pisces* is caused by hydro-power structures, chemical pollution, poaching and industrial waste discharge.

Invertebrates

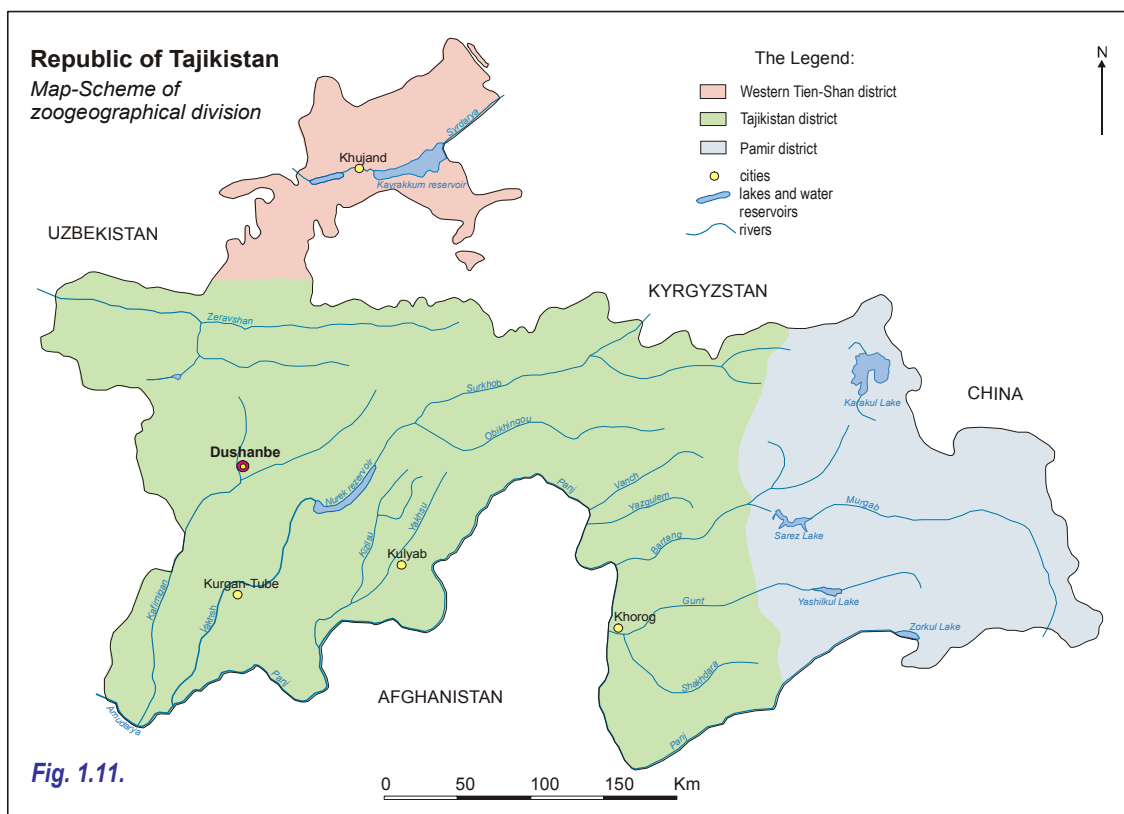
By the present time, there are about 13 thousand species of invertebrate (*Invertebrata*) animals in Tajikistan, including: protists (*Protozoa*) – 300 species, parasitic worms (*Vermes*) – 1400, arachnoids (*Arachnida*) – 715, insects (*Insecta*) – 10000, mollusks (*Mollusca*) – 204.

Zoogeographic zones

Zoogeographically, plain territory of Tajikistan relates to Turan province. The mountainous fauna of Tajikistan belongs to three faunistic zones of Middle Asia mountain province (fig. 1.11).

The Western Tien Shan zone covers the northern side of the Turkestan Range and the Syrdarya River Valley with Farkhad and Kairakum reservoirs. Here, typical animals of the mountain-forest zone, river valleys, and arable lands, including 35 species of mammals, occur. Among insects there is a considerable part of endemic genera and species: *Loniceraphis* (*L. paradoxa*), *Ferganaphis* (*F. lonicericola*, *F. alticola alticola*, *F. tschatcalica*), *Aphiduro-myzus* (*A. rosae*), *Prociphilus umarovi*, *Rhopalomyzus lonicerina*, *Ruceraphis pilosa*, and *Di-craeus kirgisorum*.

Tajikistan (*Bukhara*) zone includes lands from the southern slopes of the Zeravshan Range to the western and southwestern borders of the Pamirs, covering the total system of the Western Pamirs and Hindu-Kush. Amphibians are represented by 2 species, while reptiles – by 40 species. Nesting birds are typical; 70 species of these are common in Palearctic, 22 species are European, 33 – of Central Asian origin, 20 – Iranian and Turkestanian, 7 – Indian and African, 14 – Chinese, 12 – Tibetan, and 6 – Mongolian. This zone is rich in theriofauna (45 species); it contains many endemics and subendemics.



The Pamirs zone includes the eastern Pamirs and a part of the Alay Valley; it is characterized by severe climatic conditions, poor flora and fauna. Nearly 120 species of birds are found here; among them, there are: settled species – 10-12, migratory-nesting – 45-47, wintering – 4-5; other species belong to birds of passage – 65-67 species. Mammals are presented by 15 species.

Lowlands, deserts of South-Western and Northern Tajikistan relate to Middle Asian desert area of Turan province. Here animal world is adapted to hot and dry climate. Here species of deserts are met.

D. Microorganisms

Protists are cosmopolites. They occur in all biotopes: water, soil, air, animal and plant organisms. The protist fauna of Tajikistan is insufficiently studied. According to the approximate data, there are 300 species of protists in Tajikistan, including 112 species of the Nurek Reservoir. The specific composition of the *Phytomastigophora* Class in Tajikistan exceeds 200 species.

E. Alien and Invasive species

About 2500 species of plants are defined in flora from other nature-geographic areas of Tajikistan. Some of these are cultivated flora introduced in botanical gardens and parks and grown on the slopes as fast-growing woody plants.

The most typical species, common in Tajikistan, are: pine (*Pinus*), spruce (*Picea*), oak (*Quercus*), bastard acacia (*Robinia pseudacacia*), chestnut (*Aesculus*), soapberry tree (*Koelreuteria paniculata*), oriental tree of heaven (*Ailanthus orientalis*), cypress (*Cupressus*), and many others. All are used for planting out.

Along with useful introducents biodiversity of Tajikistan is invaded by some alien species which pose great threat to the biodiversity of Tajikistan. In recent years the risk has been increased due to the numerous imported and cultivated species of forage, food, medicinal, decorative, and other species.

Local invasive species, have developed in Tajikistan, with considerable anthropogenic impact (table 1.7).

Many invasive species, having been included in valuable communities and agricultural crops, start progressing when the climatic conditions are slightly changed. These species include: *Cuscuta*, wormwood (*Artemisia*), heliotrope (*Heliotropium*), portulaca (*Portulaca*), etc. They occupy vast pasture and arable land areas and make great harm to ecosystems, decreasing their productivity. Annually, the yield of agricultural crops is reduced to 30% solely due to field choking.

During recent five years, 15 wheat and 18 potato sorts were imported and tested at controlling and demonstration grounds in many regions of the republic. Those sorts were accompanied by many weed plants, the most harmful of which are 5 species of *Cuscuta*: *Cus-*

Table 1.7. Alien and invasive species

Name	Alien (introducent) species								Invasive species		
	Forage	Fruit-berry	Vegetable and melon	Cereals	Leguminous	Oil-bearing	Industrial	Decorative	Parasites	Weeds	Fungi
Wood	–	20	–	–	–	–	–	735	–	–	–
Shrub	–	15	–	–	–	–	–	1030	–	–	–
Sub-shrub	–	–	–	–	–	–	–	–	1	–	–
Herbaceous	16	1	30	11	9	3	5	500	51	650	–
Fungi	–	–	–	–	–	–	–	–	–	–	2000
Total:	16	36	30	11	9	3	5	2265	52	650	2000

cuta campestris, *C.lehmanniana*, *C.bucharica*, *C.approximata*, *C.monogyna*, as well as *Orobonche aegyptiaca*, *Acroptilon repens*, *Sorghum halepense*, *Eriochloa succincta*, nut grass (*Cyperus rotundus*), paspalum (*Paspalum digitaria*), elliptical heliotrope (*Heliotropium ellipticum*), trichodesma (*Trihodesma incanum*).

Great number of quarantine species were imported into Tajikistan and included in its plant communities. Over 50 species of only two genera – *Cuscuta* and *Orobonche* – are parasitizing on cultivated and decorative plants. Weed plants of Tajikistan are represented by 600-650 species.

The most persistent weed species are: spore-bearing – 2, and flowering (mass) – 78.

At present fauna of Tajikistan consists of about 50 alien species. Among them about 30 species are invasive.

Enthomofauna of the republic is presented by 20 alien species of insects. Almost all of them relate to invasive species. *Leptinotarsa desemlineata*, *Pseudococcus comstocki*, *Eriosoma lanigerum* invaded in the republic cause a great damage to potato cultivation, fruits and cotton. Among vertebrates the class of Pisces is mostly introduced by alien species (about 20 species). Due to the introduction valuable fish species are filled with accidental invaders, which caused a negative impact on local ichtyofauna.

Of 3 alien species of mammals: nutria (*Myocastor coypus*), muskrat (*Ondatra zibethica*), Norway rat (*Rattus norvegicus*); birds – 2 species: Indian starling (maina – local name) (*Acridothera tristis*), collared turtledove (*Streptopelia decaocto*).

Increase of negative impact caused from alien and invasive species on biodiversity and the environment predetermine extension of works on invasive species and development of measures on prevention of their negative impact.



Gossipium barbadense

1.2.3. Agricultural biodiversity

Farming had been developed in Tajikistan since the II millennium B.C. At present main agricultural areas occupy over 7% of the country territory.

The cultivated landscapes, particularly agrocoenosis, have preserved 1 thousand of the flora species. In Tajikistan, at different vertical zonation, there are cultivated over 85 species and 360 sorts of cultivars and hybrids of various plants.

The main crop of irrigated lands in the valleys is cotton (40% of crop areas).

The main agricultural crops cultivated in many regions of Tajikistan are cereals, leguminous plants, industrial crops, forage plants, fruit-and-berries, vegetables, and melons.

For many centuries, people have been carefully conserving and successfully growing useful crops of onion (*Allium cepa*), carrot (*Daucus carota*), garlic (*Allium sativum*), melon (*Cucumis melo*), water-melon (*Citrullus aedulis*), pumpkin (*Cucurbita*), cucumber (*Cucumis sativa*), etc.