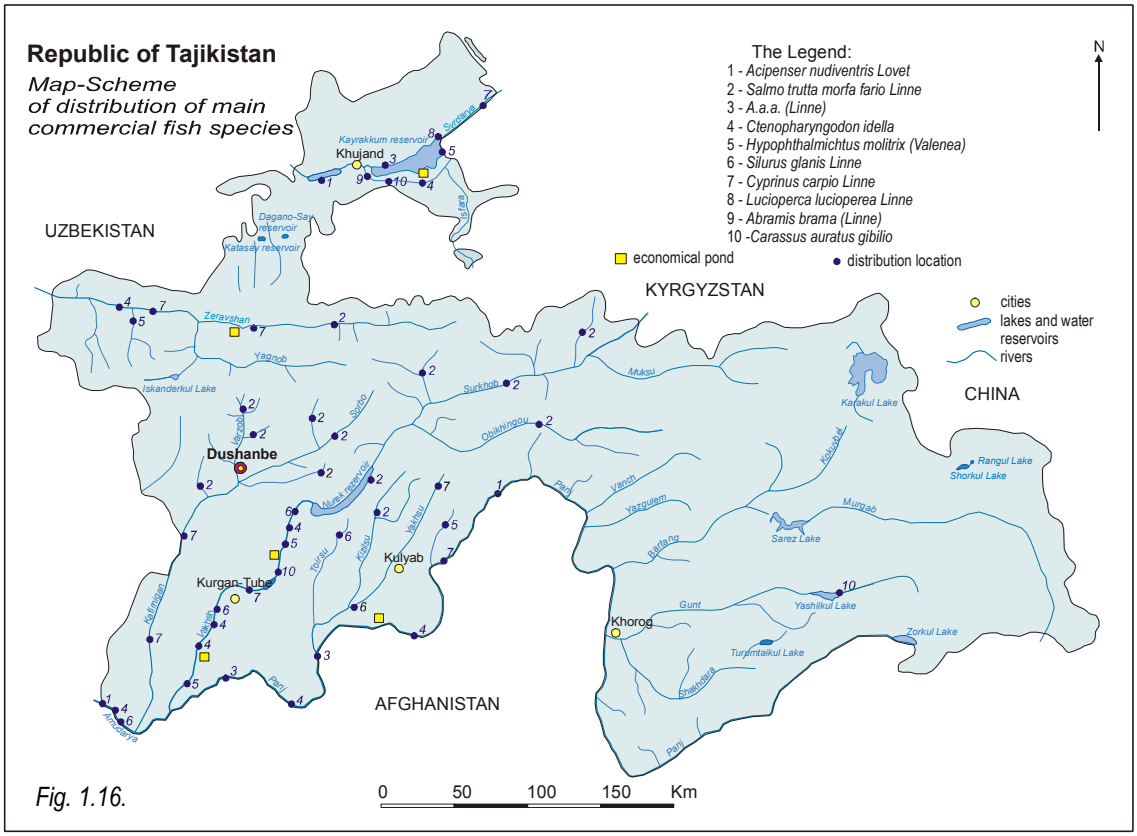

Fig. 1.16.

Table 1.12. **Game fish distribution**

Species	Water sources				
	Rivers	Lakes	Reservoirs	Springs	Ponds
Dushanbe loach *(Nemachilus pardalis)*	+				
Amudarya loach *(Nemachilus oxianus)*	+				
Gray loach *(Nemachilus dorsalis)*	+				
Aral spined loach *(Cobitis aurata aralensis)*	+		+		+
Sheatfish (*Sclurus glanis*)	+	+	+		
Bullhead *(Ictalurus punctata)* [A]	+				+
Turkestan bullhead *(Glyptosternum reticulatum)*			+		
Pike *(Esox lucius)*	+	+	+	+	
Turkestan bullhead *(Cottus spinolosus)*	+		+	+	
Mosquito fish *(Gambusia affinis)* [A]	+	+	+	+	+
Zander (*Lucioperca lucioperea*) [A]	+		+		+
Grass carp *(Ctenopharyngodon della)* [A]	+	+	+	+	+
Black carp *(Mylopharyngodon piceus)* [A]					+
Silver carp *(Hypophthalmichthus molitrix)* [A]	+	+	+		+
Motley carp *(Aristichthus nobilis)* [A]	+	+	+		+
Big-mouthed buffalo *(Ictiobus cyprinellus)* [A]					+
Small-mouthed buffalo *(I.bufalus)* [A]					+
Black buffalo *(I.niger)* [A]					+
Mirror carp *(Cyprinus sp.)* [A]			+		+
Scaly carp *(Cyprinus sp.)* [A]			+		+
Pseudorasbora parva [A]	+		+		+
Amur goby *(Neogobius amurensis sp.)* [A]	+		+		+
Snakehead *(Ophiocephalus argus warpachowski)* [A]	+		+		+
Hemiculter sp.	+		+		+

Note: «[A]» – acclimatizant

Fish population in a high-mountain lake

The ichthyofauna of Tajikistan water-courses was enriched by acclimatization of 18 valuable fish species, including: crucian carp (*Carassus auratus*), American sheatfish (*Silurus glanis*), zander (*Lucioperca lucioperea*), common bream (*Abramis brama*), grass carp (*Ctenopharyngodon idella*), silver and motley carp (*Hypophthalmichthus molitrix, Aristichthus nobilis*), American buffalo (*Ictiobus 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 fish population number is caused by hydro-power structures, chemical pollution, poaching and industrial waste discharge.

Invertebrates

By the present time, there are 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.

Of great interest are arthropods, represented by arachnoids (*Arachnida*) and insects (*Insecta*). Arachnoids are represented by: scorpions (*Scorpiones*) – 10 species, phalanxes (*Solifugae*) – 40, spiders (*Arachnei*) – 260, oribatoid ticks (*Oribatei*) – 104, tyroglyphoid ticks (*Tyroglyphoidea*) – 44, gamasoid ticks (*Gamasoidea*) – 50, ticks (*Ixodoidea*) – 82, and tetranichoid ticks (*Tetranichoidea*) – 120. 50% of spiders are endemics of Central Asia.

The sub-family of vegetarian ticks (*Tetranychoidea)* of Tajikistan consists of 4 families: web ticks (*Tetranychiidae*), briobids (*Briobidae*), *Tenuipalpidae*, and eriphoids (*Eriophidae*), most of which are cosmopolites; there are many agricultural pests among them. Of 120 tick species, 29 are endemics of Tajikistan and Central Asia, 10 species – narrow endemics of the Pamirs.

Among the invertebrates, there are many harmful species, which cause parasitoses (protozoa, parasitic worms), carry nature-focal diseases (ticks, bloodsucking dipterans), and are agricultural pests (vegetarian ticks, lepidoptera, many coleoptera, orthoptera, etc.). At the same time, there are useful species (pollinators, soil-formers, natural regulators of harmful organisms numbers, etc.) among various taxonomic groups of invertebrates. All 3 species of carmine worms of Tajikistan need restoration of their numbers.

Insects (*Insecta)* of Tajikistan include over 10 thousand species, belonging to 29 orders.

Destructive insects - aphids, scales, various species of butterflies and beetles - live on fruits and berries, and other agricultural crops. There are approximately 70 species of mantis. Many of them are endemics. Such relic species belonging to class of Insects are: *Protura, Diplura, Blattoptera, Manthoptera, Mecoptera*, as well as representatives of ancient insects — *Odonata* and *Ephemeroptera.*

Among the insects of the republic, there are many species, which are decorations of nature (dragonflies, mantis, butterflies, beetles, walking sticks), much in demand among collectors. The negative human impact is also produced on the specific composition and numbers of many groups of invertebrates. The Red Data Book of Tajikistan includes 58 invertebrate animals, 50 of

Papilio machaon

which are insects. Much more species require protection, and the list of rare and endangered species will be increasing, as the invertebrates are being studied.

Worms are one of the widespread groups of invertebrates.

Type *Plathelminthes* (flat worms). In Tajikistan, there are about 210 species of trematodes (*Trematodes*) – parasites living in internal organs of animals and carrying some infectious diseases to people and animals. In addition to trematodes, many vertebrate animals of Tajikistan are found to contain 82 species of monogenetic suckers (*Monogenea*) and 280 species of cestodes (*Cestodes*).

Type *Nemathelmantes* (Nematode worms) of Tajikistan includes 250 species of phytonematodes and 450 species of zoonematodes, some of which are used as agents of the biological fight against destructive insects. The class of rotifers (*Rotatoria*) of Tajikistan has 25 species; all of them develop in water sources and are considered useful organisms. 15 species, which are parasites of invertebrate animals, are established in the class of hair-worm (*Nemathomorpha*) of Tajikistan.

Type *Acanthocephala* (Proboscis worms) of Tajikistan includes 71 species of proboscis worms – parasites of animals.

Type *Annelides* (Annelid worms). These are free-living organisms, the total specific composition of which has not been studied yet in Tajikistan; however, 30 species of oligochaete (*Oligochaeta*) have been found in reservoir benthic fauna. They serve as food for fish. In the Kairakkum Reservoir, they make 42% of the total biomass.

Zoogeographic zones

Zoogeographically, the plain territory of Tajikistan relates to Turan province. Fauna of Tajikistan belongs to three faunistic zones of Middle Asia mountain province (fig. 1.17).

The Western Tien Shan zone covers the northern side of the Turkestan Range and the Syrdarya River Valley with Farkhad and Kairakkum 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 number of endemic genera and species: *Loniceraphis (L.paradoxa), Ferganaphis (F.lonicericola,*

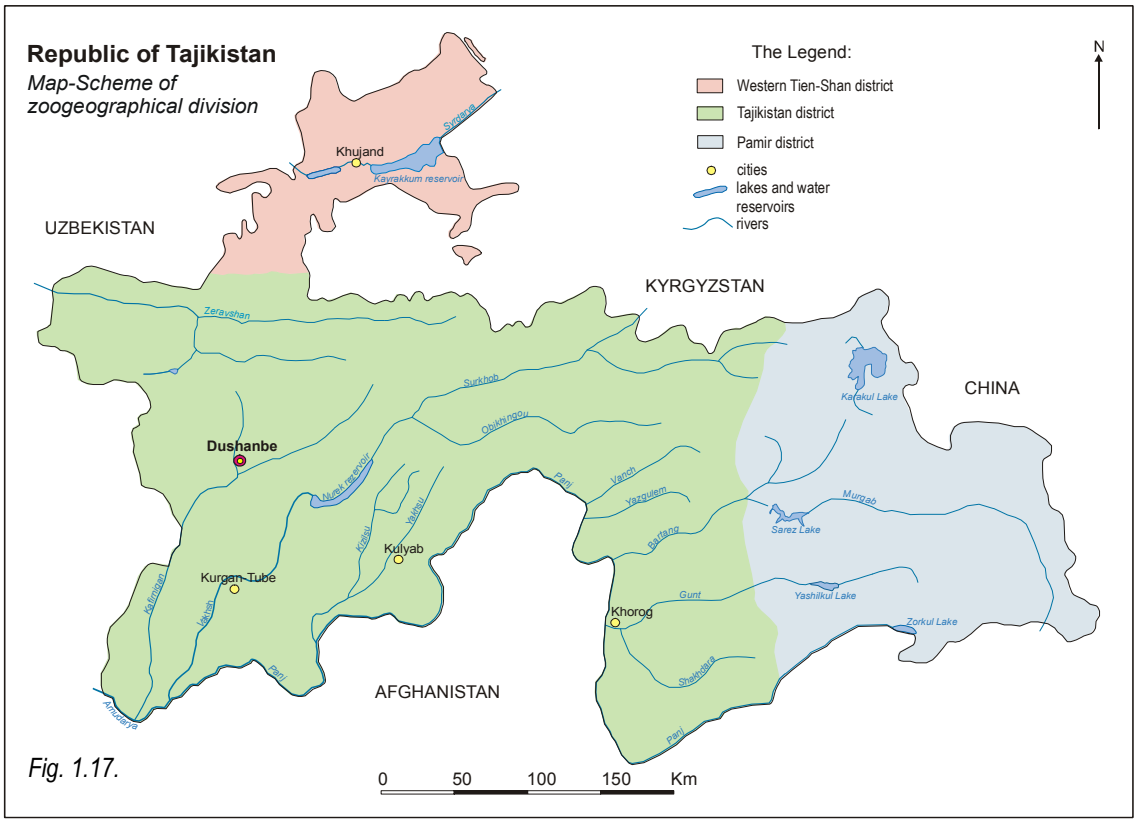

Fig. 1.17.

F.alticola alticola, F.tschatcalica), Aphiduromyzus (A.rosae), Prociphilus umarovi, Rhopalomyzus lonicerina, Ruceraphis pilosa, and *Dicraeus 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 (e.g. Bukhara shrew (*Sorex buchariensis*), Pamirian shrew (*Crocidura pergrisea*), *Barbastella leucomelas, Rhinolophus bocharicus*, Tajik markhur (*Capra falconeri*) , etc.

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. Amphibians and reptiles are represented by inconsiderable specific composition. Mammals are presented by 15 species.

Lowlands, deserts of south-western and northern Tajikistan relate to Middle Asian deserted area of Turan province. Here animal world is adapted to hot and dry climate. Here species inhabiting deserts are met (lizards, jerboa, gopher, gazella, insects related to desert flora, etc.).

D. Microorganisms

Protists are cosmopolites. They occur in all biotopes: water, soil, air, animal and plant organisms. The protist fauna of Tajikistan, particularly free-living, inhabitants of internal and external organs of invertebrates, symbionts and commensals of multicellular organisms, is insufficiently studied. According to the approximate data, there are 300 species of protists, including 112 species of the Nurek Reservoir, in Tajikistan. The specific composition of the *Phitomastigophora* Class in Tajikistan exceeds 200 species. They serve as food for young fish and other small organisms.

Much better studied are parasitic protists – pathogenic organisms (causing people and animals diseases) of *Sarcomastigophora* type. The sarcomastigophors, found in Tajikistan, contain free-living species, as well. Tajikistan is known to have several species of amebas (*Amoeba proteus, A.linax*). In shallow ponds and reservoirs, there are fresh-water shelly rhizopods from the genera *Arcella* and *Difflugia* (e.g. *Arcella vulgaris, A.discoides, Diffluggia ablonga lacustris, D. ablonga caudata*), which, being components of wetland benthos, serve as food for other water organisms.

Among flagellates, there are protists of the genera *Lamblia* and *Trichomonas*. Parasitic protists, living in blood of agricultural animals, birds, fish, and some wild mammals, are: *Apicomplexa* (class *Sporozoa*), *Microspora*, *Myxozoa*, *Ciliophora*. 69 species of fish parasites, including 6 species of blood parasites, 48 – *Mixosporidia*, 1 – *Microsporidia*, 1 – *Apicomplexa*, 13 species of infusoria (*Ciliophora*), are established.

The group of Sporozoa includes 4 species of pyroplasmids: *Piroplasma bigeminum, Babesia bovis, Theileria annulata, Th.sergenti*, and 44 species of coccidia.

Pathogenic organisms causing malaria (*Plasmodium vivax, P.malariae, P.phalciparum*) are common.

I. Alien and Invasive species

More than 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.

In addition to alien species (table 1.13), local invasive species, common at various altitudes, in various climatic zones, and ecological areas, have developed in Tajikistan, with considerable anthropogenic impact.

E.g., semiparasitic dwarf subshrub (*Arceuthobium oxycedri*), is very harmful for juniper and causes its death.

One of the main factors of zonal invasion is the many-year driving of cattle from winter to summer, and back to winter, pastures. As a result of annual cattle driving, seeds of drought-resistant plants – cornflower (*Centaurea*), wormwood (*Artemisia*), mallow representatives (*Malvaceae*), *Gentiana*, *Thermopsis*, *Boraginaceae*, etc. – are spread over all mountainous zones. These species, inhabiting new areas, start forming independent coenosis, which replace communities of valuable indigenous high-productive plants.

Summer pastures are choked with rude grasses – goat grass *Aegilops triuncialis*, *Taeniatherum crinitum*, *Ceratocephalus testiculatus*, and noxious plants – heliotrope (*Heliotropium ellipticum*), trichodesma (*Trichodesma incanum*), thermopsis (*Thermopsis dolichocarpa*), (*Conium maculatum*), which are not eatable by animals.

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.

Tajikistan is marked by climatic invasive processes, resulting from annual and perennial temperature and precipitation fluctuations, as well as the global climate change. When the meteorological conditions are locally and globally changed, the invasion of more drought-resistant plants (e.g. wormwoods) from desert and semidesert zones into mountains can be observed. In places where forested areas are reduced, brushwoods of shrub and dwarfs, and pastures with abundant noxious and rude grass – goat grass, trichodesma, thermopsis, etc. are formed.

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 (table 1.14), the most harmful of which are 5 species of *Cuscuta*: *Cuscuta 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 digi-*

Table 1.13. **Alien and invasive species**

Name	Alien (introducent) species								Invasive species		
	Forage	Fruit-berry and nuts	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**

Table 1.14. **Ratio of weed plants in regions and arable lands**

Name	Number of species
Cotton fields in regions:	
Syrdarya Region	95
Hissar District	33
Kulyab District	35
Vakhsh District	54
Kofarnigon District	15
Crops choking:	
Alfalfa (greater part of Tajikistan)	43
Spring wheat, irrigable (Kuramin Range)	35
Fall wheat, irrigable (Asht District)	21
Other crops (Kuramin Range)	21
Cereals (Asht District)	55
Crops (Isfara District)	64

taria), 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 ichthyofauna.

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

Increase of negative impact caused by 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.

1.2.3. Fossil Fauna and Flora

The stone history of the mountainous nature of Tajikistan is well-exposed and easily accessible to study. There are numerous deposits of fossil fauna and flora, tens of which are unique; however, none of these is protected by the state. Some of the easily accessible deposits of fossils are now under the threat of destruction due to human activity.

Identification of the logic of the origin, development and extinction of ancient biosystems allows to learn more about the present biodiversity, reasons for survival, vulnerability, fragility and instability, and to work out the best solutions on species conservation.

Precambrian (more than 570 m.y.) fossils are rare in Tajikistan; they are represented by the remnants of primitive algae and rare invertebrates.

The oldest precise age of fossils found in Tajikistan is Paleozoic (570-230 m.y. ago). The Paleozoic organic world of Tajikistan is rich in composition. The territory of Paleozoic Tajikistan was occupied by tropical sea. At the end of Paleozoic, the total area of the present Northern, Central, and, partly, Eastern Tajikistan was free of water. That was the age when spore-bearing and gymnosperm plants developed. All classes of cold-blooded vertebrates (agnathous, fish, amphibian, and reptiles) appeared in Paleozoic. The invertebrates of the Paleozoic were represented by conodonts, brachiopods, rugoses, and tabulates; the first half of Paleozoic – by trilobites, archaeocyathids, graptolites, tentaculites, nautiloids, and endoceratites; in the second half of Paleozoic, goniatites and foraminifers were common. Peaks of sea invertebrate biodiversity were in Late Cambrian, Middle Ordovician, Early Devonian, Early Carboniferous, and Early Permian. Paleozoic fossils are found in numerous deposits of Tien Shan and the Pamirs (table 1.15). By the beginning of *Mesozoic* (230-67 m.y. ago), the northern, Northeastern, Central, and a part of Southern Tajikistan was occupied by land, with young mountains; the Southern Tajikistan was a sea bottom. In Mesozoic, gymnosperms and filices dominated here. In the second half of Cretaceous, higher angiosperms were dominating. Of vertebrates, reptiles were common. Warm-blooded animals – mammals and birds – also appeared in Mesozoic. Invertebrates of Tajikistan were widely represented by ammonoids, bivalves

(oysters, rudists); in early Mesozoic – by conodonts, in late Mesozoic – by echinoids. Peaks of sea invertebrate biodiversity were reached in Late Triassic, Middle Jurassic, and Middle Cretaceous. The Mesozoic fossils of Tajikistan were defined from numerous deposits of Tien Shan and the Pamirs (table 1.16). In the Cainozoic era (for 67 m.y. till now), including the present stage of evolution, the alpine epoch of folding and mountain-formation that shaped the present appearance of mountains manifested itself. This epoch still continues on the territory of in the country. In the late Early Cainozoic, the sea completely regressed from the territory of Tajikistan and a continental regime was established everywhere in the country. Cainozoic is the time when all present families and genera of animals and plants appeared. A specific feature of the Cainosoic era is domination of higher angiosperms. Higher placental mammals that were common on Earth as early as the beginning of the era, develop; they inhabited land and accommodated to life in water and on land.

The localities of Cainosoic fossils and archaeological monuments are in the Kuramin, Turkestan, Zeravshan, Hissar, Karategin, Peter the Great, Zaalay, and Darvaz ridges; in the Fergana, Maghian, and Tajik depressions; and in the Pamirs.

Mass extinction of higher plant groups, as a rule, does not coincide with that of animals, it occurred approximately half geological era earlier.

Table 1.15. **Distribution and number of sea invertebrates, terrestrial and sea plants in Mesozoic**

Period	Age	Spore-bearing plants				Gymnosperms						Angio-sperms		Others	Total
		Psilophytes	Lycopodae	Articulo-Caulescent	Filices	Cordaits	Cycadophyte	Glossopterids	Gingko	Bennettites	Coniferous	Woody	Grasses		
Quarter-nary	Q_{1-3}	–	–	–	3	–	–	–	–	–	11	52	10	10	86
Neogene	N_2	–	–	–	2	–	–	–	–	–	11	52	18	10	93
	N_1	–	–	–	1	–	–	–	–	–	7	12	7	–	27
Paleogene	Pg_2^{2-3}	–	3	–	10	–	–	–	1	–	12	40	13	–	79
	Pg_2^1	–	2	–	13	–	–	–	1	–	6	33	2	–	57
Cretaceous	K_2	–	2	–	16	–	–	–	1	1	8	6	–	–	34
	K_1	–	1	1	10	–	1	–	–	–	6	–	–	1	20
Jurassic	J	–	2	1	29	1	1	–	1	1	11	–	–	5	52
Triassic	T_1	–	2	6	4	4	5	10	8	–	15	–	–	12	66
Permian	P_2	–	4	11	8	7	8	11	8	–	16	–	–	25	98
	P_1	–	6	12	8	13	10	10	6	–	14	–	–	17	96
Carbonife-rous	C_3	–	10	15	8	13	12	9	5	–	8	–	–	10	90
	C_2	–	16	15	6	12	13	9	4	–	1	–	–	7	83
	C_1	–	22	13	3	6	7	4	–	–	–	–	–	5	60
Devonian	D_3	2	9	5	2	1	1	–	–	–	–	–	–	5	25
	D_2	10	6	3	2	–	–	–	–	–	–	–	–	2	23
	D_1	12	3	1	1	–	–	–	–	–	–	–	–	1	18
Silurian	S_2	2	–	–	–	–	–	–	–	–	–	–	–	–	2

Table 1.16. **Distribution and Number of Sea Invertebrates, Terrestrial and Sea Plants in Mesozoic Era**

Period	Age	Brachiopods	Gastropods	Conodonts	Bryozoan	Foraminifers	Poriferan	Corals	Bivalves	Crinoids	Ammonoids	Ostracodes	Echinoids	Terrestrial plants	Others
Palaeogene	Pg_1	6	5	–	–	30	–	2	26	–	–	7	14	?	–
Cretaceous	K_{2m}	17	15	–	–	80	–	7	35	–	16	13	20	34	–
	K_{2kp}	6	30	–	–	70	–	4	44	–	20	16	20		–
	K_{2k-s}	6	44	–	–	72	–	5	40	–	18	15	21		–
	K_{2s}-t	13	58	–	–	110	–	7	75	–	80	28	30		–
	K_{1al}	4	45	–	–	70	1	12	80	–	60	20	10	20	–
	K_{1ap}	6	50	–	–	40	–	14	66	–	20	21	5		–
	K_{1b}	6	24	–	–	40	–	25	56	–	9	25	6		–
	K_{1h}	7	15	–	–	20	–	21	42	–	10	17	6		–
	K_{1v}	8	27	–	–	20	–	5	50	–	11	20	4		–
	K_{1b}	10	10	–	–	30	–	–	40	–	11	21	6		–
Jurassic	J_{3t}	7	7	–	–	20	–	6	23	–	9	10	7	52	–
	J_{3k}	12	11	–	–	23	–	25	56	–	10	10	–		–
	J_{3o}	26	16	–	–	40	15	34	100	–	25	30	–		–
	J_{2k}	45	10	–	–	50	25	32	110	–	60	50	7		–
	J_2bt	23	–	–	–	35	–	30	100	–	32	20	20		–
	J_2b	24	–	–	–	20	1	22	90	–	32	5	3		–
	J_2a	7	–	–	–	16	–	2	50	–	20	–	–		–
	J_1p-t	5	–	–	–	9	–	–	30	–	13	–	–		–
	J_1 h-s	4	–	–	–	10	6	24	21	–	5	–	–		–
Triassic	T_3r	20	–	–	–	15	27	30	24	–	15	–	–	66	–
	T_3n	30	–	–	–	40	50	40	40	–	30	10	–		–
	T_3k	12	6	–	–	25	20	23	30	–	10	–	–		–
	T_2	10	7	?	–	20	15	10	25	?	15	–	–		–
	T_1o	4	8	7	2	6	–	–	35	–	42	2	–		60
	T_1 l	–	–			3	–	–	14	?	1	3	–		

1.2.4. Agricultural biodiversity

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

Almost all lands, suitable for ploughing, are currently occupied by agricultural crops, settlements, transport and irrigation systems, and industrial enterprises.

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.

Some agrocoenosis are transformed natural ecosystems, often with destructed vegetation cover and extremely reduced specific composition. The ruderal species have favorable conditions for reproduction and often become mass weeds.

The main crop of irrigated lands in the valleys is cotton (40% of crop areas). In southern Tajikistan – the warmest part of country, – mostly fine-filament cotton (*Gossipium barbadense*) is grown at the elevation of 1100 masl. The fine-filament cotton is also grown in a number of districts of northern Tajikistan.

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 crops of onion (*Allium cepa*), carrot (*Daucus carota*), garlic (*Allium sativum*), melon (*Cucumis melo*), water-melon (*Citrullus aedulis*), pumpkin (*Cucurbita*), cucumber (*Cucumis sativa*), etc.

Gossipium barbadense

The total cultivated area of the republic varied in different years from 731 to 850 thousand hectares. In the recent 10 years, the areas of cereal and leguminous crops have become twice as large (table 1.17). Wheat is the leading crop (343.1 th. ha in 2000, as compared to 143.5 in 1991). 230-250 th. ha of irrigated land are annually occupied by cotton.

The overwhelming majority of species of animal agrobiocoenosis is considered useful and are the major natural regulators of destructive species populations. Nearly 80% of 300 fauna species of the cotton fields are useful predators and parasites. The areas under cereal crops are contaminated by 70 species of pests.

Domestic animals are an integral part of the country biodiversity (table 1.18).

Cattle-breeding, as a branch, is currently being on the decline. For the period from 1990 to 2000, the public sector lost nearly 287.5 th. head of cattle and 1337.2 th. sheep and goats. The to-

Table 1.17. **Areas Under Agricultural Crops (ths ha)**

Name	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total area under crops. *including:*	**807.7**	**798.1**	**781**	**767.6**	**747.9**	**762**	**805.6**	**814.4**	**836.7**	**849.6**
Cereals and leguminous plants (including great corn), *including:*	226.8	259.9	274.6	252	263	356.8	422.9	405.4	405.9	421
Industrial crops, *including:*	302.6	287.8	281.3	290.5	277.6	234.3	228.6	264.1	272.8	263.5
Potato and vegetable-and-melons, *including:*	51.7	49.7	44.5	49.0	45.7	42.1	46.5	55.3	66.5	65.9
Forage crops	226.6	200.7	180.6	176.1	161.6	128.8	107.6	89.6	91.5	99.2
Gardens, grapes	**117.7**	**119.8**	**123.9**	**124.1**	**134.6**	**129.4**	**109.1**	**108.7**	**109.3**	**140.5**
Fruit-and-berries (including citrus plants)	78.7	80.4	84.7	85.1	96.4	93.2	71.0	74.4	74.4	104.7
Grapes	39.0	39.4	39.2	39.0	38.2	36.2	38.1	34.3	34.9	35.8

tal number of cattle in private property increased slightly – by 106.8 th.

Tajikistan is a unique yak-breeding country, where selection and genetic materials, as well as productivity of the Pamir Yak are preserved and improved. Yaks have important economic meaning and are mostly adapted to severe conditions in the Pamirs. They are valued by their meet, wool and milk characteristics. The Pamir Yaks are bred in Murgab, Shugnan, Roshtkalinsky, Ishkashimsky and Rushansky regions. Plains of the high-mountainous Pamirs – the unique sub-region of Tajikistan – stretch over 4.5 th. masl. In recent years the yaks are bred in other mountain regions of the republic.

Experience of Tajikistan in yaks breeding has contributed in the global gene pool of this useful wild animal species, well adapted to domestication.

Many-year research works of tajik scientists allowed to make hybridization of yaks with horned cattle, particularly with meet Calmyk breed. The hybrids have more weight, high fat content of milk comparing with thoroughbred cattle.

Pamir Yaks in Gorno-Matchinsky Region

Research results have proved that Pamir Yaks are capable to preserve their natural biological characteristics and transfer their high genetic qualities to further generations. This fact helped to widen the area of yaks breeding till Gorno-Matchinsky region, where there are vast natural pastures.

In Tajikistan yaks breeding allows to solve the problem of poverty alleviation in the most economically weak high-mountainous regions, as for their grazing there are over 3 th. ha of pasture lands in the country. Moreover these animals are unpretentious and are widely used by local farmers.

Table 1.18. **Main Breeds of Domestic Animals**

Breed	Range
CATTLE – LOCAL BREEDS	
Black-mottley cattle, Tajik type	Sogd Region, Hissar Valley districts
Sweat-zebu cattle, Tajik type	Khatlon Region, Hissar Valley districts
Sweat cattle	GBAO (Gorno-Badakhshan Moutainous Region), Khatlon Region, Hissar Valley districts
Local Zebu cattle	Sogd region, Khatlon Region, GBAO, Hissar Valley districts, Rasht Zone
Kazakh white-headed	*Mountainous zone, Khatlon Region*
Kalmyk	Mountainous zone, Khatlon Region
Aberdin-Anguss	Mountainous zone, Khatlon Region
Yaks	GBAO, Mountainous zone of Sugd Region
SHEEP	
Hissar	Khatlon Region, Hissar Valley districts
Jaidara	Sogd Region
Tajik	Khatlon Region
Fine-fleeced	Mountainous zone, Khatlon Region
Karakul	Khatlon Region
GOATS	
Local coarse-woolly	All over the republic territory
Soviet woolly	Sogd Region
Down	GBAO
HORSES	
Lakai	*Khatlon Region*
Tajik	Khatlon Region, Districts of Republican subordination
Karabair	Sogd Region

1.3. Main Trends of Biodiversity Transformation

The ecological imbalance observed in recent decades resulted in the great change of biodiversity composition and structure at all levels – from ecosystems, communities, and species to populations. Many ecosystems are preserved in narrow ecological "niches".

The main factors of influence on biodiversity are:

- Increasing ploughed lands in the areas of natural ecosystems and valuable vegetation communities;
- unregulated hunting for rare endemic species of animals and plants;
- uncontrolled gathering of medicinal, food, and forage plants;
- trees and shrubs cutting;
- livestock overgrazing;
- construction of roads, electric power lines, communication and irrigation systems;
- fires;
- location of industrial enterprises and constructions in the zones of unique ecosystems without consideration of their ecological capacity;
- development of mining industry;
- local and global climate change.

The main socio-economic reasons for biodiversity degradation are:

- uneven spread of the population and productive forces in natural and administrative zones;
- lack of territorial, environmental, and nature-management plans and programs not considering ecological capacity;
- lack of economic and financial incentives and mechanisms in biodiversity conservation;
- lack of real economic evaluation of biodiversity as a national heritage of the country;
- uncontrolled sale of biodiversity components at internal and external markets;
- low level of environmental education of the population;
- consumers' use of biodiversity;
- barriers between branch institutions in the realization of programs on the conservation and rational use of biodiversity;
- lack of relevant legislative acts and inefficiency of current laws on biodiversity conservation;
- insufficient status and power of environmental authorities, including the CBD National Focal Point;
- non-observance of state, institutional, and international decisions on the part of environmental bodies and local Khukumats;
- absence of the State biodiversity monitoring system;
- non-observance of the requirements of the Convention on providing information to the authorized body of National Biodiversity Strategy and Action Plan (NBSAP) development and irresponsibility of organizations managing unique areas;
- reducing activity in agroecosystem exploitation;
- increasing pasturing areas in the localities of unique ecosystems.

Specific natural factors (climate, surface flow type, water and wind erosion) and their sharp change promote the impoverishment of the specific diversity of flora and fauna.

Considerable transformation of biodiversity is caused by anthropogenic factor that consists of many components (fig. 1.18). The main anthropogenic factor for the specific diversity alteration is the ecologically imbalanced scheme of nature use in natural ecosystems.

The anthropogenic impact caused the violation of natural ecosystems in the zones of rain-fed farming, natural pastures and forests. This process tends to grow, accompanied by reducing the diversity of population, species, and biocoenosis and lowering the species resistance.

Formation of anthropogenic ecosystems leads to the creation of secondary phytocoenosis with poor specific composition and structure.

Altogether, anthropogenic factors promote the quantitative and qualitative impoverishment of biodiversity and, consequently, the transformation of natural ecosystems (table 1.19).

The partial transformation of flora and fauna habitats caused by the human activity is associated with the environmental pollution, construction, expansion of cities and villages.

Direct factors influencing the specific diversity are as follows:

- Destruction of natural ecosystems, ploughing steep-slope and forested areas;

Fig. 1.18. **Main Factors of Anthropogenic Impact on Biodiversity**

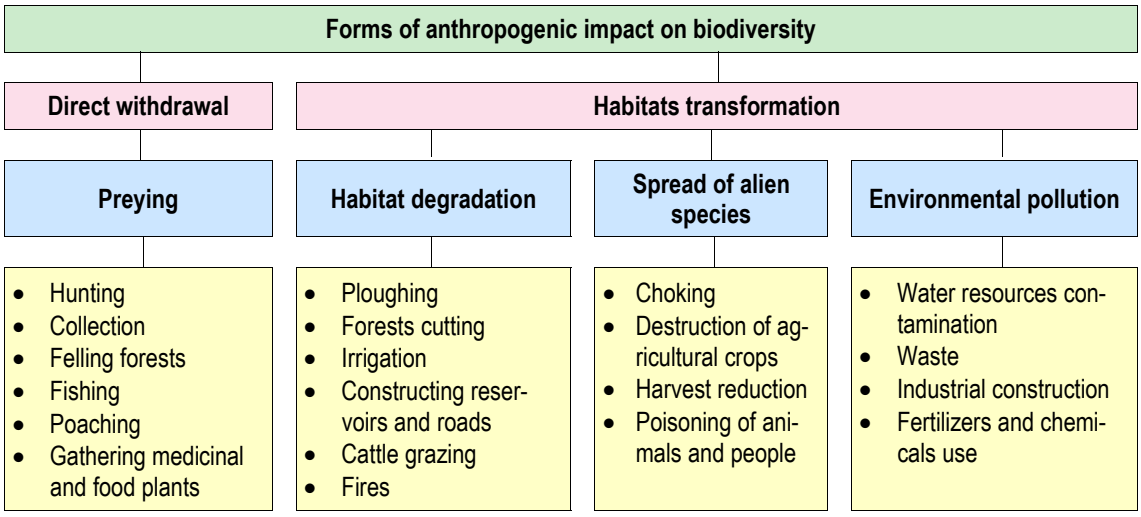

Table 1.19. **Ratio of Ecosystems for the Period from 1950 to 2002**

No.	Type of ecosystem	1950		1970		1990		2002	
		Area, m. ha	*Number of species	Area, m. ha	*Number of species	Area, m. ha	*Number of species	Area, m. ha	*Number of species
1.	Nival glacier	3.0	130 10	3.0	130 12	2.95	140 15	2.9	180 16-17
2.	Subnival high-mountain desert	3.1	1500 700	3.1	1400 690	3.2	1300 680	3.4	1100 650
3.	High-mountain meadow-steppe	3.1	2500 750	3.1	2450 750	3.05	2400 730	3.150	2400 730
4.	Mid-mountain juniper forest	0.9	3000 1300	0.9	3000 1300	0.88	2350 1290	0.8	2900 1280
5.	Mid-mountain mesophyllic forest	0.25	3500 1800	0.15	3450 1790	0.25	3400 1710	0.2	3390 1700
6.	Mid-mountain xerophytic light forest	0.67	6000 2500	0.65	6000 2500	0.6	5980 2450	0.58	5950 2400
7.	Mid- low-mountain savannoide	1.1	5000 700	1.05	4900 550	1.0	4800 500	1.0	4500 450
8.	Foothill semidesert and desert	0.7	2500 620	0.66	2400 580	0.57	2200 550	0.34	2000 520
9.	Wetland	0.4	5000 600	0.5	4500 530	0.5	4200 450	0.5	4000 400
10.	Agroecosystem	0.7	3500 1200	0.73	3200 1100	0.82	3100 1000	0.85	3000 900
11.	Urban	0.19	2800 250	0.225	2500 200	0.237	2200 180	0.229	2000 250
12.	Ruderal-degraded	0.2	850 25	0.24	750 30	0.25	1000 50	0.36	2000 70

** numbers of plants (denominator) and animals (numerator)*

- Destruction of great numbers of animals and plants preyed and gathered for commercial purposes and collections;
- Loss of animals at engineering construction sites and automobile roads;
- Mining natural resources within unique ecosystems;
- Complete water intake and exsiccation of small rivers;
- Water contamination in the areas of unique animal species and ecosystems.

Particularly rapid is the deterioration of the ecological situation in valleys where large industrial enterprises and major arable lands are concentrated.

The road network development in recent 50-60 years caused partial, and sometimes complete fragmentation of ecosystems and impeded animal migration. Wild ungulate mammals suffered most of all because their areas were fragmented.

Change in the land-use structure, without considering the ecological capacity of the country, led not only to a change in the vegetation composition, landscapes, and ecosystems but also in speeding up the process of land degradation and desertification (fig. 1.19). The most considerable land degradation takes place in the zones of semisavanna, xerophytic light forest, and partially of broad-leaf forests.

Land ploughing caused the reduction of valuable populations of some forage plants: bulbous meadow grass (*Poa bulbosa*), hair wheat grass (*Elytrigia trichophora*), bulbous barley (*Hordeum bulbosum*), *Botriochloa ischaemum*, thin-leaf vetch (*Vicia tenuifolia*), alfalfa (*Medicogo sativa*), esparcet (*Onobrychis pulchella*), milk vetch (*Astragalus sp.*), and others that are a valuable genetic resource for selection and introduction.

The ploughed area of the republic is 849,6 ths ha (5.9% of the total area). During the last 40 years, the area of irrigated lands increased twice due to the use of areas with valuable plant communities.

The unique tugai forests and desert-sandy ecosystems of southern and northern Tajikistan have reduced to small (10-30 ths ha) islands, due to urbanization and expansion of ploughed land areas (fig. 1.20). Destruction of the tugai forests vegetation caused disappearance of many specific communities in southern and northern Tajikistan.

During the last decades, deforestation has become really threatening. The area of valuable juniper (*Juniperus*), walnuts (*Juglans*), birch (*Betula*), and pistachio (*Pistacia*) forests has been reduced by 20-25%. This produces a negative impact on the state of natural ecosystems and coenosis structures. The specific diversity is gradually transforming, and community compositions loosing over 8-10 types of ecosystems in the period of 3-7 years. Tree cutting leads to an outbreak of weeds, alien and quarantine plant species, erosion, and a progressive insiccation and impoverishment of winter pastures. Shrub vegetation is being eradicated and used as fuel. In spite of slightly increased forest areas, the average resource of woods in Tajikistan is being steadily reduced.

The existing trees “heavens”, preserved by the present day in semisavannas and deserts, are just a small part of forests of the past.

Table 1.20. **Type Classification of Forested Areas and Plant Resources**

Name	Total Area ths ha
Conifers. *including*:	146.5
Juniper (*Juniperus*)	146.5
Hard-leaf. *including:*	62.8
Saxaul (*Haloxylon persicum*)	11.4
Elm (*Ulmus*)	0.7
Ash-tree (*Fraxinus*)	0.7
Maple (*Acer*)	49.1
Bastard acacia *(Robinia pseudacacia*)	0.9
Soft-leaf. *including:*	14.9
Birch (*Betula*)	1.9
Poplar (*Populus*)	9.3
Tree willow (*Salix sp. div*)	3.7
Total of major forest-forming breeds	**224.2**
Other tree breeds. *including*:	110.3
Almond (*Amygdalus*)	17.6
Walnut (*Juglans regia*)	11.2
Cherry plum (*Prunus sogdiana*)	2.6
Pistachio (*Pistacia vera*)	78.9
Shrubs. *including*: Tamarisks (*Tamarix*) Wild rose (*Rosa*). barberry (*Berberis)*	66.5
Total:	**401**

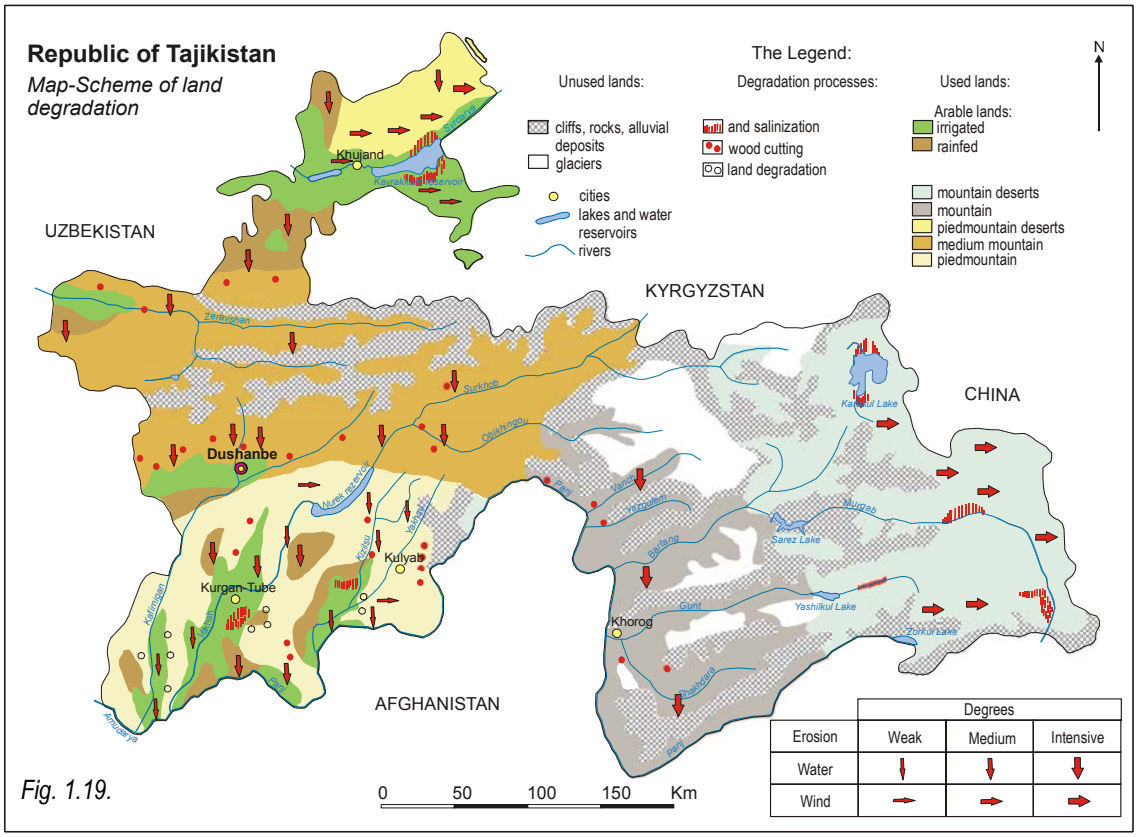

Fig. 1.19.

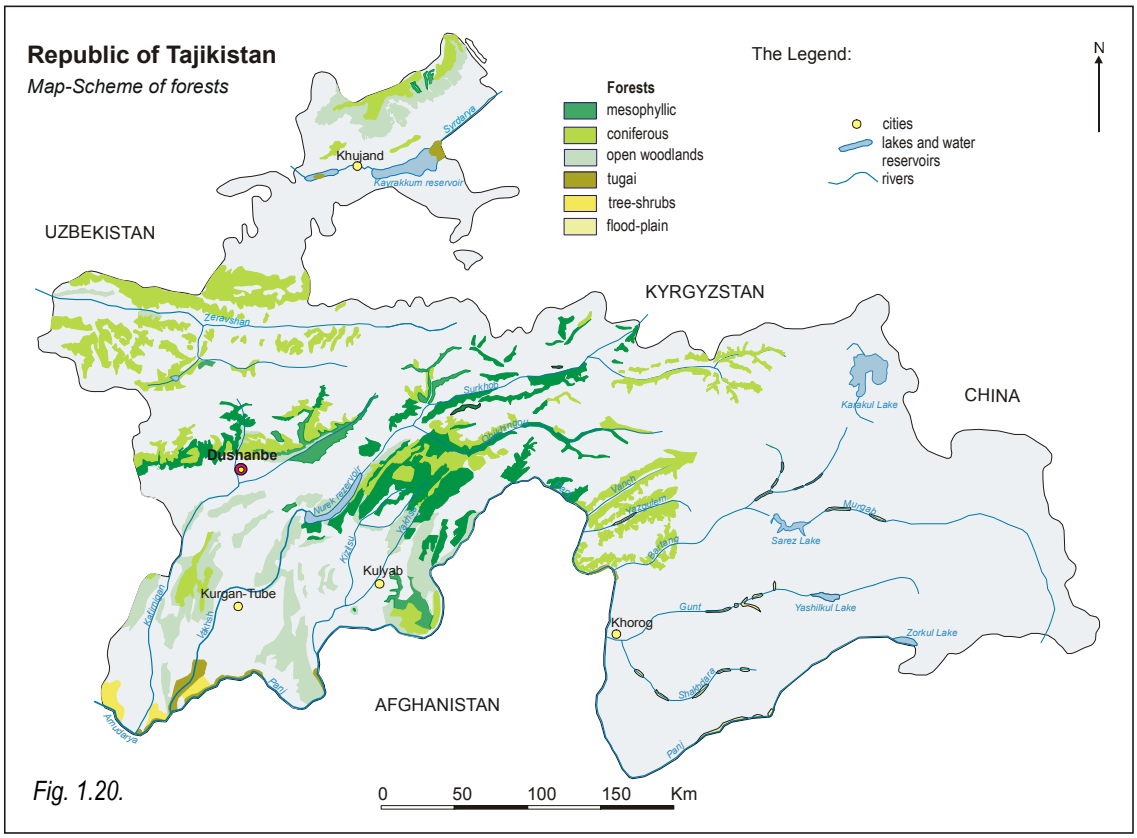

Fig. 1.20.

Due to an extensive and unregulated overgrazing, the composition of pasture natural vegetation tends to alter causing pasture degradation. The fall-winter-spring ephemeral-ephemeroid and wormwood pastures of southern and northern Tajikistan and the summer steppe pastures of the Kuramin Range suffered most of all. Forage crops yield is dropping increasingly; pastures are being choked with weeds. The forage grass productivity reduced by 5-10 times. Due to the overgrazing, the wormwood-ephemeral pastures lost the following grass species: bulbous meadow grass, sedge, Turan wormwood. Some annual cereals appeared while the yield of dry forage mass having reduced (table 1.21).

Annual systematic mowing of semi-savannah sward at the middle and high-grass mountainous meadows reduced the productivity of leguminous and other cultures. This caused an increase in the dissemination of a rougher, less popular cereal of barley (table 1.22).

Only for the recent 50 years, due to the impact of anthropogenic factor, 226 plant taxa and 162 animal species have become rare or endangered and are listed in the Red Data Book of Tajikistan (fig. 1.21-1.23, 1.25-1.27); 10 vertebrate species are listed in the Red Data Book of the IUCN.

3 species of animals and 16 species of plants are extinct (fig. 1.24).

Table 1.21. **Dynamics of Natural Pastures Yield** (dry mass, ths/ha)

Name	1960	1970	1980	1990	2000
Low grass semisavanna	0.75	0.37	1.50	1.35	0.64
High grass semisavanna	2.21	2.58	1.70	1.92	2.0
Mountain steppe	0.72	1.08	1.01	1.48	1.11

List of Extinct Species of Plants and Animals

Name
Plants
Silene caudata
Juno popovii
Juno tadshikorum
Astragalus darvasicus
Hedysarum korshinskyanum
Oxytropis mumynabadensis
Allium gracillimum
Allium incrustatum
Allium minutum
Allium paulii
Allium schugnanicum
Bellevalia inconspicua
Eremurus micranthus
Tulipa anisophylla
Delphinium nevskii
Populus cataracti
Animals
Panthera tigris virgata
Marmota menzbieri
Pseudoscaphirinchus fedtschenkoi

The most vulnerable have become reptiles and mammals. Of total species, 50% of mammals and 44.7% of reptiles are listed in the Red Data Book of Tajikistan.

Among the vertebrates of Tajikistan, the psammobiont forms of reptiles – *Crossobamon eversmanni, Teratoscincus scincus, Phrynocephalus myctaceus, Echis carinatus*, etc. turned to be the most vulnerable to the anthropogenic transformation.

Destruction of native habitats and the deterioration of the environment in 1954 caused the complete disappearance of the Turan tiger *(Panthera tigris virgata*) from Tajikistan area and from the face of Earth.

Table 1.22. **Change of Dominants (in % to total weight) of High Grass Semisavanna and Medium-high Grass Meadow of the Hissar Range** (by years)

Name	Species	1970	1980	1990	2000
Bulbous barley wheat grasses. high-grass semisavanna	Hair wheat grass	75.5	36.7	7.6	7.5
	bulbous barley	13.5	37.0	39.0	44.3
	Other plants	11.0	26.3	53.4	48.2
Forb-grass and black-grass meadows	Zeravshan black grass	21.2	45.3	–	–
	Devil's grass	16.1	1.0	–	–
	Other plants	62.7	53.7	–	–

Almost all large mammals avoid anthropogenic landscapes and only some of the species: wild boar (*Sus scrofa*), Tien-Shan brown bear (*Ursus arctos*), fox (*Vulpes vulpes*), jackal (*Canis aureus*), porcupine (*Hystrix indica*) can appear there in search of food.

Habitats narrowing leads to a drop in numbers of wild animal populations, particularly in natural ecosystems. Uncontrolled hunting, collecting, and killing caused the incapability of some species to reproduce. Some of them are still preserved as small populations and individuals in restricted areas (table 1.23, fig.1.28-1.30).

Annually, the following species are killed or illegally exported from Tajikistan by poachers: snow leopard (*Uncia uncia*) –10-12, urials (*Ovis vignei*) – 10-15, birds of prey (peregrine falcon (*Falco peregrinus*), saker falcon (*Falco cherrug*), serpent eagle (*Circaetus ferox*) – 50-70, argali

Myocastor coypus

Table 1.23. **Dynamics of Some Wild Animal Populations (for the 1990-2001 period)**

Species	Total in the Republic		Including					
	1990	2001	In RT Forestry Department		In Reserves		In Zakazniks	
			1990	2001	1990	2001	1995	2001
Siberian ibex (*Capra sibirica*)	28000*	18000	4425	1382	204	67	3205	664
Pamir argali (*Ovis ammon polii*)	10000	3500-4000	4200	1235	–	208	3010	27
Jackal (*Canis aureus*)	610	408	610	418	97	237	–	12
Red marmot (*Marmota caudata*)	180000	130000	5687	2948	120	0	240	1347
Tibetian snow partridge (*Tetraogallus tibetanus*)	3220	1231	3220	1231	290	13	910	505
Partridge (*Alectoris kakelik*)	442300	253560	4420	37600	7500	5300	5980	8160
Bar-headed goose (*Anser indicus*)	1100	800	740	470	100	800	890	–
Sika deer (*Cervus nippon*)	280	173	280	153	280	153	–	–
Tajik markhur (*Capra falconeri*)	200-250	170-180	250	180	250	180	–	–
Pheasant (*Phasianus colchicus*)	150000	130000	585	600	300	410	149	170
Porcupine (*Hystrix leucura*)	1260	1100	413	280	387	264	26	16
Bukhara wild ram (urial) (*Ovis vignei*)	1500-2500	300-350	1171	145	712	100	15	23
Bukhara or tugai deer (*Cervus elaphus bactrianus*)	650	350	305	186	407	144	13	–
Snow leopard (*Uncia uncia*)	160-200	100-120	53	100	22	20	29	36
Wolf (*Canis lupus*)	1200	1000	995	625	19	10,4	380	263
Persian gazelle (*Gazella subgutturosa*)	250-200	80	130	111	130	111	–	–

**Number of animals are noted considering varying in number to 10% on ascending and descending scale*

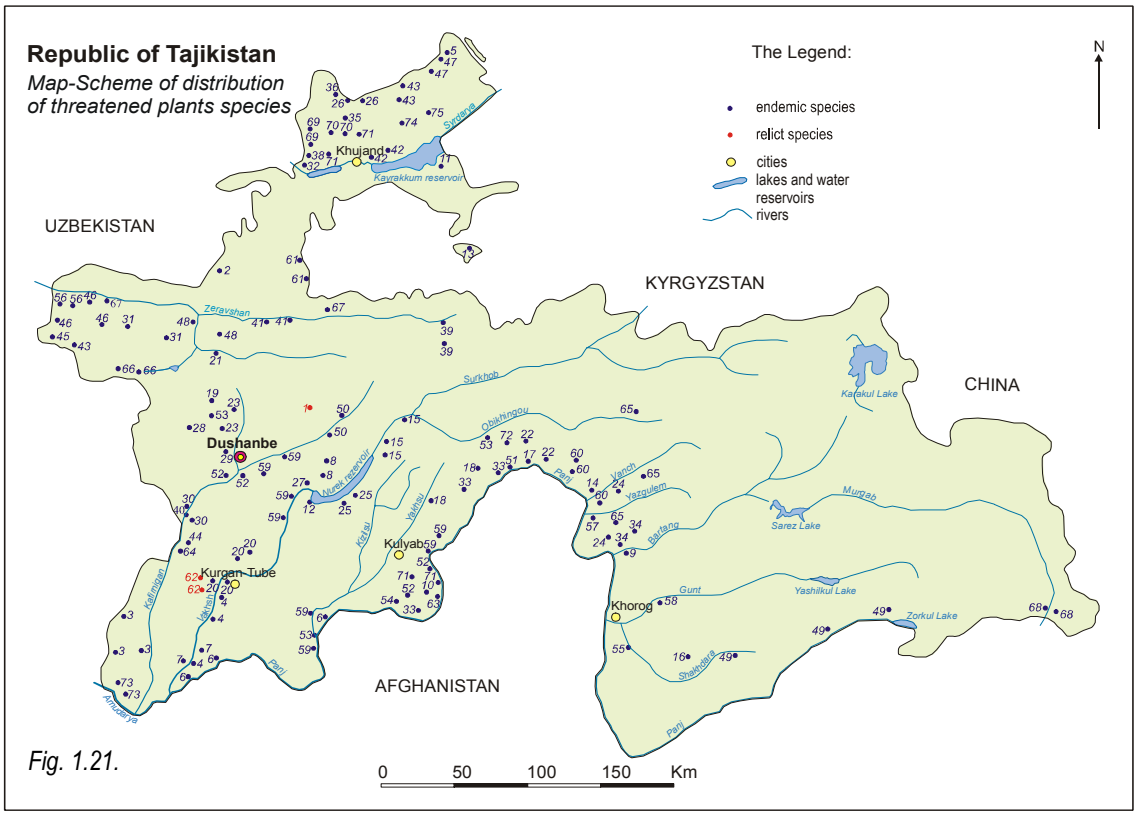

Fig. 1.21.

Fig 1.21. **Legend to Map-scheme of Distribution of Threatened Plants Species**

No.	Latin Names
1	2
1	*Thuja orientalis L.*
2	*Ungernia oligostroma M. Pop.et Vved.*
3	*Cleome lipskyi M. Pop.*
4	*Halocharis gossypina Korov.et Kinzikaeva*
5	*Polycnemum perenne Litv.*
6	*Salsola drobovii Botsch.*
7	*Cousinia agelocephala Tschern.*
8	*Cousinia corymbosa C. Winkl.*
9	*Cousinia hilariae Kult.*
10	*Jurinea impressinervis Iljin*
11	*Jurinea pteroclada Iljin*
12	*Jurinea tadshikistanica Iljin*
13	*Pyretrum mikeschinii Tzvel.*
14	*Saussurea caprifolia Iljin et Zapr.*
15	*Saussurea tadshikorum Iljin et Gontsch.*
16	*Taraxacum schugnanicum Schischk.*
17	*Thelycrania darvasica Pojark.*
18	*Arabidopsis bactriana Ovcz.et Junussov*
19	*Phaeonychium abalakovii Junussov*

1.21.

1	2
20	*Stroganovia tolmaczevii Junussov*
21	*Stipa jagnobica Ovcz.et Czuk.*
22	*Juno baldshuanica O. et B. Fedtsch. Vved.*
23	*Dracocephalum formosum Gontsch.*
24	*Erianthera rhomboidea Benth.*
25	*Salvia baldshuanica Lipsky*
26	*Salvia glabricaulis Pobed.*
27	*Salvia gontscharovii Kudr.*
28	*Astragalus artemisiformis Rassul.*
29	*Astragalus subspongocarpus Ovcz. et Rassul.*
30	*Chesneya neplii Boriss.*
31	*Ewersmannia sogdiana Ovcz.*
32	*Hedysarum hemithamnoides E. Korotk.*
33	*Keyserlingia mollis Royle Boiss.*
34	*Oxytropis astragaloides Boriss.*
35	*Oxytropis kuramensis Abduss.*
36	*Tragacantha dolona Rassul. et B. Scharipova*
37	*Allium elegans Drob.*
38	*Allium ferganicum Vved.*

1.21.

1	2
39	*Allium glaciale Vved.*
40	*Allium gypsodictyum Vved.*
41	*Allium laeniopetalum M. Pop et Vved.*
42	*Eremurus hilariae M.Pop. et Vved.*
43	*Eremurus korovinii B. Fedtsch.*
44	*Eremurus lachnostegius Vved.*
45	*Eremurus pubescens Vved.*
46	*Tulipa ingens Hoog*
47	*Tulipa kaufmanniana Regel*
48	*Acantholimon komarovii Czerniak. Ex Lincz.*
49	*Acantholimon varivtzevae Czerniak.*
50	*Acantholimon zaprjagaevii Lincz.*
51	*Jasminum revolutum Sims.*
52	*Eulophia turkestanica Litv. Schlechter*
53	*Zeuxine strateumatica L. Schlechter*
54	*Atraphaxis avenia Botsch.*
55	*Atraphaxis karataviensis Lipsch. et Pavl.*
56	*Rheum hissaricum Losinsk.*

1.21.

1	2
57	*Androsace bryomorpha Lipsky*
58	*Primula flexuosa Turkev.*
59	*Anemone bucharica Regel Fin. et Gagnep.*
60	*Aquilegia darwasi Korsh.*
61	*Atragene sibirica L.*
62	*Ranunculus chodzhamastonicus Ovcz.et Junussov*
63	*Crataegus darvasica Pojark.*
64	*Crataegus pamiroalaica Zapr.*
65	*Bergenia stracheyi Hook. f.et Thoms Engl.*
66	*Ribes malvifolium Pojark.*
67	*Saxifraga albertii Regel et Schmalh.*
68	*Saxifraga pulvinaria H. Smith.*
69	*Ferula mogoltavica Lipsky ex Korov.*
70	*Korshinskya bupleuroides Korov.*
71	*Parasilaus asiaticus Korov. M. Pimen.*
72	*Seseli sclerophyllum Korov.*
73	*Zygophyllum bucharicum B. Fedtsch.*
74	*Zygophyllum macrophyllum Regel et Schmalh.*

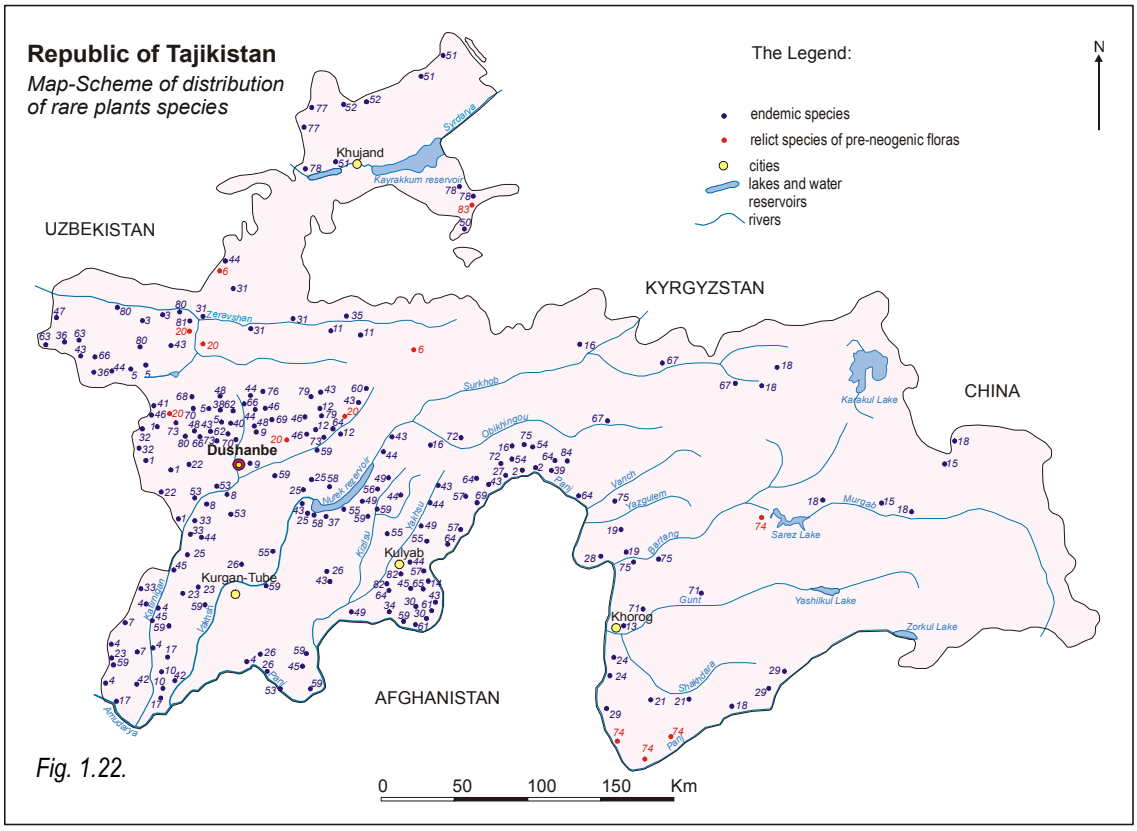

Fig. 1.22.

Fig. 1.22. **Legend to Map-scheme of Distribution of Rare Plants Species**

No.	Latin Names
1	2
1	*Ungernia victoris Vved.*
2	*Gymnospermium darvasicum Regel Takht.*
3	*Cryptocodon monocephalus Trautv Fed.*
4	*Capparis rosanoviana B. Fedtsch.*
5	*Lonicera heterotricha Pojark.et Zak.*
6	*Lonicera paradoxa Pojark.*
7	*Gypsophila tadshikistanica Botsch.*
8	*Gypsophila vedeneevae Lepesch.*
9	*Silene subadenophora Ovcz.*
10	*Salsola pulvinata Botsch.*
11	*Cousinia darwasica C. Winkl.*
12	*Cousinia leptocampyla Bornm.*
13	*Erigeron badachschanicus Botsch.*
14	*Jurinea darvasica Iljin*
15	*Taraxacum badachschanicum Schischk.*
16	*Rosularia lutea Boriss.*
17	*Catenularia hedysaroides Botsch.*
18	*Desideria pamirica Suslova*
19	*Draba odudiana Lipsky*
20	*Iskandera hissarica N. Busch*
21	*Megacarpaea schugnanica B. Fedtsch.*
22	*Spryginia pilosa Botsch.*
23	*Bryonia lappifolia Vass.*
24	*Stipa pamirica Roshev.*
25	*Iris lineata Foster ex Regel*
26	*Juno leptorrhiza Vved.*
27	*Kudrjaschevia korshinkyi Lipsky Pojark.*
28	*Kudrjaschevia nadinae Lipsky Pojark.*
29	*Astragalus badachschanicus Boriss.*
30	*Astragalus insignis Gontsch.*
31	*Astragalus leptophysus Vved.*
32	*Astragalus taschkutanus V. Nikit.*
33	*Calophaca sericea B. Fedtsch.*
34	*Chesneya tadzhikistana Boriss.*
35	*Cicer chorassanicum Bunge M.Pop.*
36	*Hedysarum mogianicum B. Fedtsch.*
37	*Onobrychis gontscharovii Vass.*
38	*Oxytropis siomensis Abduss.*

1.22.

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39	*Tragacantha alekxeenkoana B. Fedtsch. et Ivanova Boriss.*
40	*Allium flavellum Vved.*
41	*Allium lipskyanum Vved.*
42	*Allium ophiophylum Vved.*
43	*Allium rosenbachianum Regel*
44	*Allium stipitatum Regel*
45	*Eremurus roseolus Vved.*
46	*Eremurus tadshikorum Vved.*
47	*Gagea holochiton M. Pop.et Czug.*
48	*Gagea villosula Vved.*
49	*Scilla raevskiana Regel*
50	*Tulipa affinis Z. Botsch.*
51	*Tulipa bifloriformis Vved.*
52	*Tulipa greigii Regel*
53	*Tulipa lanata Regel*
54	*Tulipa linifolia Regel*
55	*Tulipa maximowiczii Regel*
56	*Tulipa rosea Vved.*
57	*Tulipa subquinquefolia Vved.*
58	*Tulipa subpraestans Vved.*
59	*Tulipa tubergeniana Hoog*
60	*Neogontscharovia miranda Lincz. Lincz.*
61	*Polygonum ovczinnikovii Czuk.*
62	*Dionysia involucrata Zapr.*
63	*Primula lactiflora Turkev.*
64	*Punica granatum L.*
65	*Delphinium decoloratum Ovcz.et Koczk.*
66	*Delphinium ovczinnikovii Kam.et Pissjauk.ex Kam*
67	*Pulsatilla kostyczewii Korsh. Juz.*
68	*Fragaria bucharica Losinsk.*
69	*Prunus darvasica Temberg*
70	*Prunus tadshikistanica Zapr.*
71	*Pyrus cajon Zapr.*
72	*Rosa longisepala Koczk.*
73	*Tylosperma lignosa Willd. Botsch.*
74	*Myrtama elegans Royle Ovcz. et Kinz*