

1.22.

| 1  | 2   |
|----|---|
| 75 | <i>Cephalopodium badachschanicum</i> Korov. |
| 76 | <i>Ferula eugenii</i> R. Kam.               |
| 77 | <i>Ferula latiloba</i> Korov.               |
| 78 | <i>Mogoltavia sewertzowii</i> Regel Korov.  |
| 79 | <i>Peucedanum hissaricum</i> Korov.         |

1.22.

| 1  | 2  |
|----|--|
| 80 | <i>Zeravschania regeliana</i> Korov.               |
| 81 | <i>Valerianella anodon</i> Lincz.                  |
| 82 | <i>Valerianella kulabensis</i> Lipsky. Ex Lincz.   |
| 83 | <i>Malacocarpus crithmifolius</i> Retz. C. A. Mey. |
| 84 | <i>Zygophyllum darvasicum</i> Boriss.              |

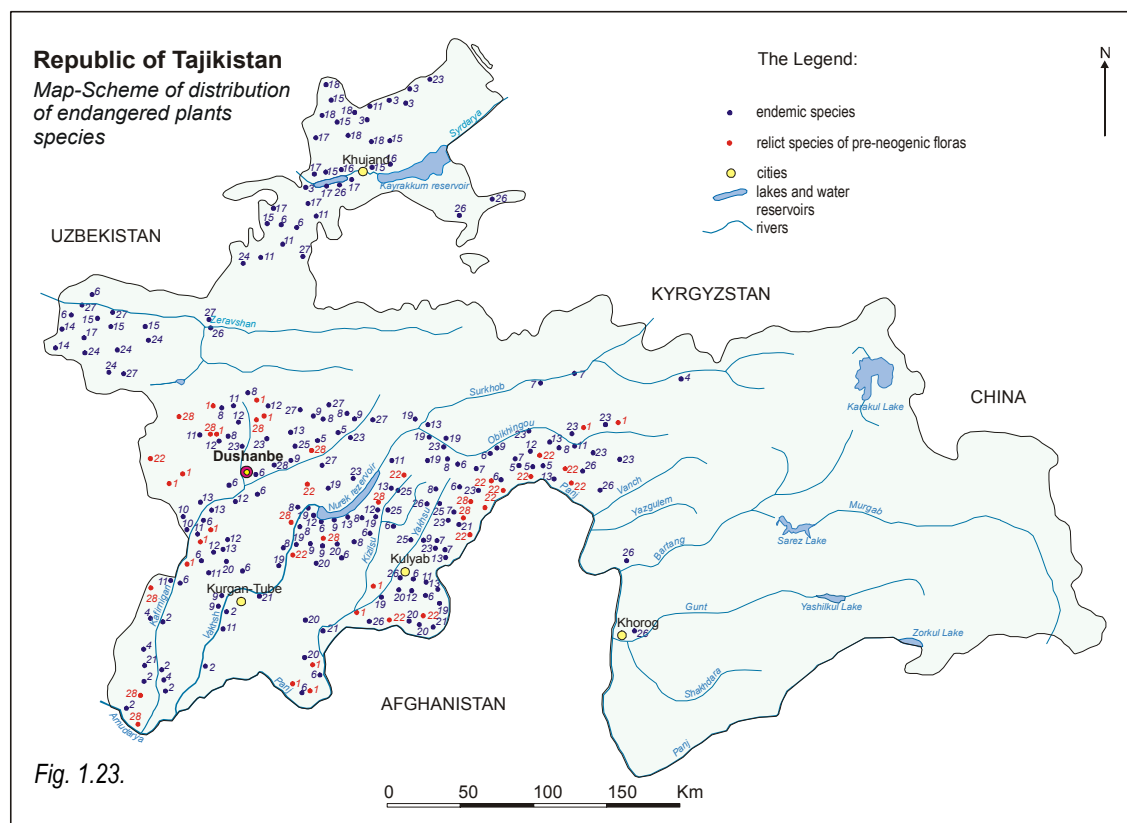
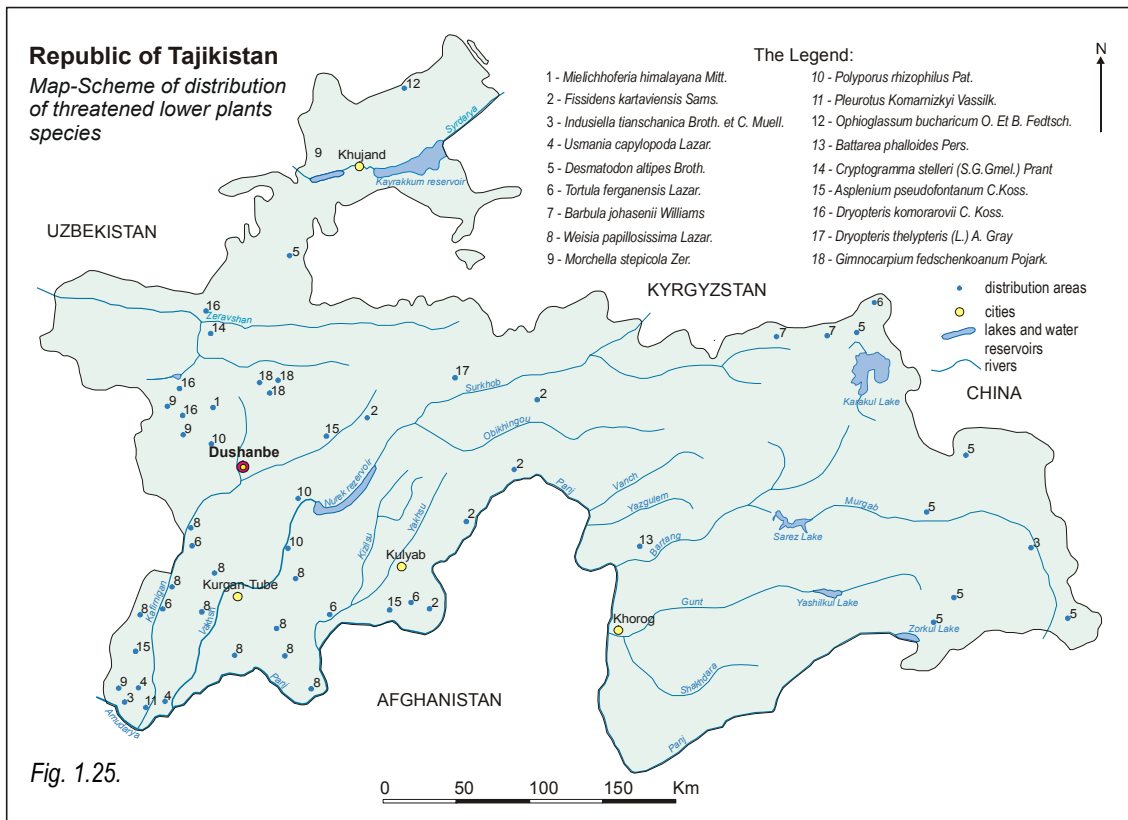
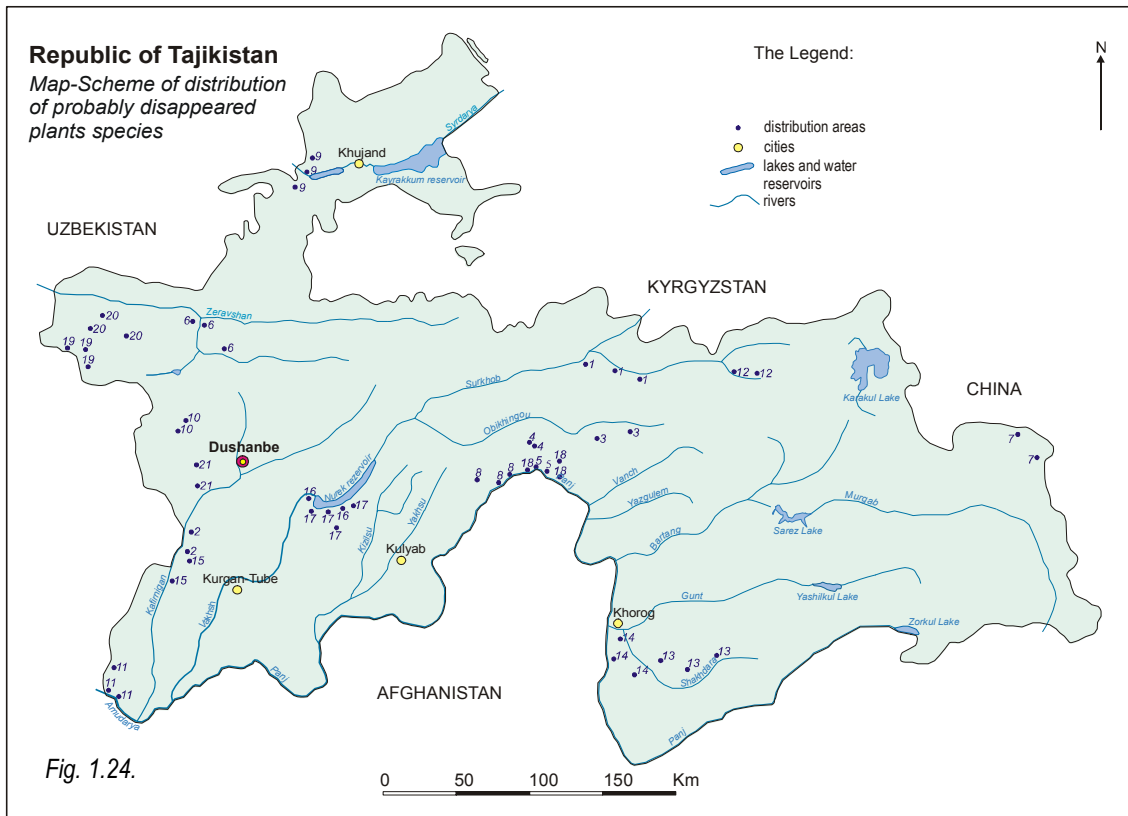


Fig. 1.23. Legend to Map-scheme of Distribution of Endangered Plants Species

| No. | Latin Names   |
|-----|---|
| 1   | <i>Ostrowskia magnifica</i> Regel.)                           |
| 2   | <i>Seidlitzia rosmarinus</i> Bunge                            |
| 3   | <i>Artemisia cina</i> Berg ex Pojark. var. <i>Mogoltavica</i> |
| 4   | <i>Carex bucharica</i> Kük.                                   |
| 5   | <i>Diospyros lotus</i> L.                                     |
| 6   | <i>Crocus korolkovii</i> Regel et Maw                         |
| 7   | <i>Iris darvasica</i> Regel                                   |
| 8   | <i>Iris hoogiana</i> Dykes                                    |
| 9   | <i>Juno nicolai</i> Vved.                                     |
| 10  | <i>Salvia insignis</i> Kudr.                                  |
| 11  | <i>Allium suworowii</i> Regel                                 |
| 12  | <i>Eremurus aitchisonii</i> Baker                             |
| 13  | <i>Petilium eduardii</i> Regel Vved.                          |
| 14  | <i>Tulipa fosteriana</i> Irv.                                 |

1.23.

| 1  | 2   |
|----|---|
| 15 | <i>Tulipa korolkovii</i> Regel              |
| 16 | <i>Tulipa lehmanniana</i> Merckl.           |
| 17 | <i>Tulipa micheliana</i> Hoog               |
| 18 | <i>Tulipa mogoltavica</i> M. Pop.et Vved.   |
| 19 | <i>Tulipa praestans</i> Hoog                |
| 20 | <i>Vassilczenkoa sogdiana</i> Lincz. Lincz. |
| 21 | <i>Ficus afghanistanica</i> Warb.           |
| 22 | <i>Ficus carica</i> L.                      |
| 23 | <i>Paeonia intermedia</i> C.A. Mey.         |
| 24 | <i>Aconitum talassicum</i> M. Pop.          |
| 25 | <i>Amygdalus vavilovii</i> M. Pop.          |
| 26 | <i>Bunium persicum</i> Boriss. B. Fed.      |
| 27 | <i>Ferula sumbul</i> Kauffm. Hook. F.       |
| 28 | <i>Vitex agnus-castus</i> L.                |



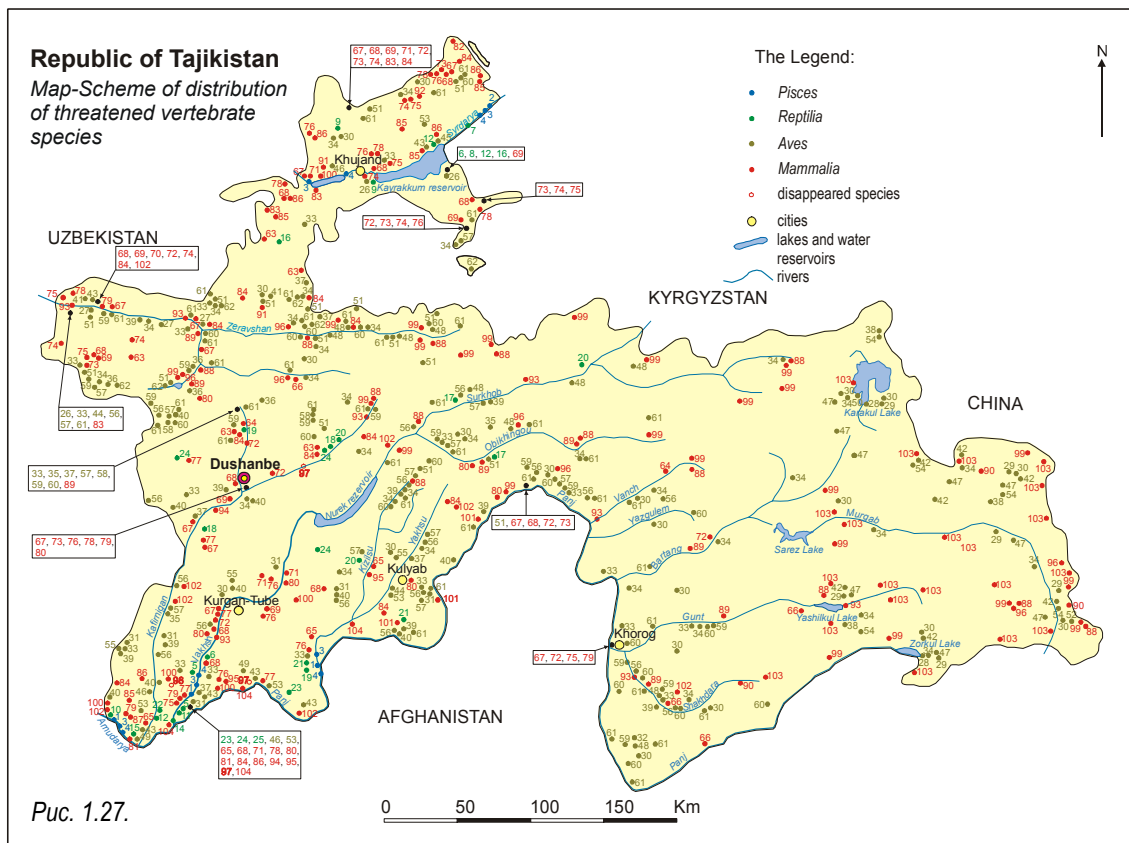
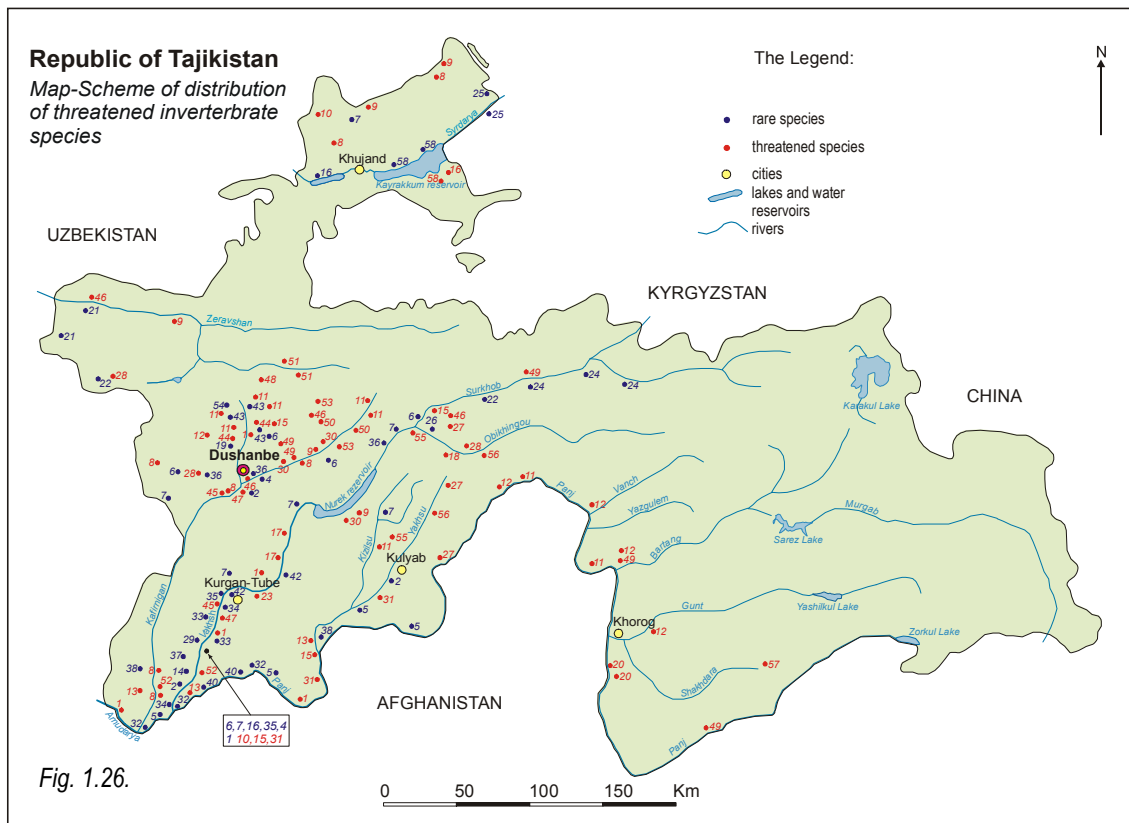


Fig. 1.24. Legend to Map-scheme of Distribution of Probably Disappeared Plants Species

| No. | Latin Names                                 | 1  | 2                                   |
|-----|---|----|-------------------------------------|
| 1   | <i>Silene caudata</i> Ovcz.                 | 11 | <i>Allium incrustatum</i> Vved.     |
| 2   | <i>Andrachne pusilla</i> Pojark.            | 12 | <i>Allium minutum</i> Vved.         |
| 3   | <i>Juno popovii</i> Vved.                   | 13 | <i>Allium paulii</i> Vved.          |
| 4   | <i>Juno tadshikorum</i> Vved.               | 14 | <i>Allium schugnanicum</i> Vved.    |
| 5   | <i>Astragalus darvasicus</i> N. Basil.      | 15 | <i>Bellevalia inconspicua</i> Vved. |
| 6   | <i>Hedysarum korshinskyanum</i> B. Fedtsch. | 16 | <i>Eremurus candidus</i> Vved.      |
| 7   | <i>Oxytropis hedinii</i> Ulbrich            | 17 | <i>Eremurus micranthus</i> Vved.    |
| 8   | <i>Oxytropis mumynabadensis</i> B. Fedtsch. | 18 | <i>Tulipa anisophylla</i> Vved.     |
| 9   | <i>Allium gracillimum</i> Vved.             | 19 | <i>Delphinium nevski</i> Zak.       |
| 10  | <i>Allium hexaceras</i> Vved.               | 20 | <i>Populus cataracti</i> Kom.       |
|     |   | 21 | <i>Viola hissarica</i> Juz.         |

Fig. 1.26. Legend to Map-scheme of Threatened Invertebrates

| No. | Latin Names   | 1  | 2   |
|-----|---|----|---|
| 1   | <b>Mantoptera</b>                                     | 28 | <i>Dolbinopsis grisea</i> Hamps.                  |
| 1   | <i>Hierodula tenuidentata</i> Saussure                | 29 | <i>Amorpha philerema</i> Djak.                    |
| 2   | <i>Rivetina crassa</i> Mistshenko                     | 30 | <i>Acosmezyx naga hissarica</i> Stshetkin         |
| 3   | <i>Rivetina beybienkoi</i> Lindt                      | 31 | <i>Celerio chamyla apocyni</i> Stshetkin          |
| 4   | <i>Rivetina monticola</i> Mistshenko                  | 32 | <i>Paragluphisia oxiana</i> Djak.                 |
| 5   | <i>Amblythespis mistshenkoi</i> Lindt                 | 33 | <i>Taragama fainae</i> Geras.                     |
| 6   | <i>Mantis macrocephala</i> Lindt                      | 34 | <i>Lemonia tancrei</i> Punglr.                    |
| 7   | <i>Empusa pennicornis</i> Pallas                      | 35 | <i>Nola silvicola</i> Stshetkin                   |
|     | <b>Homoptera</b>                                      | 36 | <i>Nola elaeagni</i> Stshetkin                    |
| 8   | <i>Porphyrophora cynodontis</i> Arch.                 | 37 | <i>Pseudohadena seposita</i> Punglr.              |
| 9   | <i>Porphyrophora odorata</i> Arch.                    | 38 | <i>Catocala optima</i> Stgr.                      |
| 10  | <i>Porphyrophora sophorae</i> Arch.                   | 39 | <i>Catocala timur</i> A.B.-H.                     |
|     | <b>Heteroptera</b>                                    | 40 | <i>Lygephila lubrosa</i> Stgr.                    |
| 11  | <i>Dalpada pavlovskii</i> Kir.                        | 41 | <i>Eupithecia djakonovi</i> Stshetkin             |
| 12  | <i>Mustha baranovi</i> Kir.                           | 42 | <i>Eupithecia dominaria</i> Stshetkin             |
| 13  | <i>Cellobius abdominalis</i> Jak.                     |    | <b>Hymenoptera</b>                                |
| 14  | <i>Calisius turanicus</i> Kir.                        | 43 | <i>Prosopigastra gigantea</i> Guss.               |
| 15  | <i>Stenolemus bogdanovi</i> Osh.                      | 44 | <i>Tachysphex radiatus</i> Guss.                  |
| 16  | <i>Reduvius fedtschenkianus</i> Osh.                  | 45 | <i>Barylypa ammabilis</i> Tas.                    |
|     | <b>Coleoptera</b>                                     | 46 | <i>Ichneumon sarcitorius</i> L.                   |
| 17  | <i>Carabus tadzhikistanus</i> Kryzh.                  | 47 | <i>Diadegma velox</i> Holmg.                      |
| 18  | <i>Carabus sphinx</i> Reitt.                          | 48 | <i>Phobocampe bicingulata</i> Grov.               |
| 19  | <i>Carabus hissarianus</i> Sem.                       | 49 | <i>Netelia juscicornis</i> Holmg.                 |
| 20  | <i>Carabus klapperichianus</i> Mandl                  | 50 | <i>Ichneumon albiger</i> Wesm.                    |
| 21  | <i>Carabus arcanus</i> Sem.                           |    | <b>Mollusca</b>                                   |
|     | <b>Lepidoptera</b>                                    | 51 | <i>Pupilla anzobica</i> Izzat.                    |
| 22  | <i>Papilio alexanor</i> Esp.                          | 52 | <i>Pupoides coenopictus</i> Hutton                |
| 23  | <i>Anthocharis tomyris</i> Chr.                       | 53 | <i>Planogyra sororcula</i> Benoit                 |
| 24  | <i>Colias sieversi</i> Gr.-Gr.                        | 54 | <i>Leucozonella caria</i> Schileyko               |
| 25  | <i>Melitaea acreina</i> Stgr.                         | 55 | <i>Pseudamnicola likharevi</i> Izzat.             |
| 26  | <i>Polyommatus Lysandra avinovi</i> Ju. Ju. Stshetkin | 56 | <i>Pseudamnicola pavlovskii</i> Izzat.            |
| 27  | <i>Polyommatus Eumedonia kogistana</i> Gr.-Gr.        | 57 | <i>Melanoides shahdaraensis</i> Starob. et Izzat. |
|     |   | 58 | <i>Anodonta bactriana</i> Rolle.                  |

Fig. 1.27. Legend to Map-scheme of Distribution of Vertebrates Listed in the Red Data Book of Tajikistan

| No.             | Latin Names  |                 |  |
|-----------------|--|-----------------|--|
| 1               | 2  | 1               | 2  |
| <b>Pisces</b>   |  |                 |  |
| 1               | <i>Pseudoscaphirhynchus kaufmannii</i> Bogdanow                  | 40              | <i>Ammoperdix griseogularis</i> Brandt           |
| 2               | <i>Pseudoscaphirhynchus fedtschenkoi</i> Kessler                 | 41              | <i>Perdix daurica turcomana</i> Stolz.           |
| 3               | <i>Aspiolucius esocinus</i> Kessler                              | 42              | <i>Tetraogallus tibetanus</i> Gould.             |
| 4               | <i>Barbus brachycephalus</i> Kessler                             | 43              | <i>Phasianus colchicus</i> L.                    |
| <b>Reptilia</b> |  | 44              | <i>Otis tarda tarda</i> L.                       |
| 5               | <i>Crossobamon eversmanni</i> Weigmann                           | 45              | <i>Otis undulata macqueeni</i> Gray              |
| 6               | <i>Teratoscincus scincus rustamowi</i> Szczerbak.                | 46              | <i>Burhinus oedicephalus astutus</i> Hartert     |
| 7               | <i>Gymnodactylus caspius</i> Eichwald                            | 47              | <i>Charadrius mongolus pamirensis</i> Richmond   |
| 8               | <i>Alsophylax loricatus loricatus</i> Strauch                    | 48              | <i>Ibidorhyncha struthersi</i> Vigors            |
| 9               | <i>Phrynocephalus helioscopus said-alievi</i> Szczerbak et Satt. | 49              | <i>Glareola pratincola</i> L.                    |
| 10              | <i>Phrynocephalus sogdianus</i> Cern.                            | 50              | <i>Larus brunnicephalus</i> Jerd.                |
| 11              | <i>Phrynocephalus mystaceus</i> Pallas                           | 51              | <i>Columba palumbus casiotis</i> Bp.             |
| 12              | <i>Varanus griseus</i> Daudin                                    | 52              | <i>Columba leuconota</i> Vig.                    |
| 13              | <i>Eremias scripta pherganensis</i> Szczerbak et Washenko        | 53              | <i>Pterocles orientalis arenarius</i> Pallas     |
| 14              | <i>Eremias scripta</i> Str.                                      | 54              | <i>Syrrhaptes tibetana</i> Gould.                |
| 15              | <i>Eremias grammica</i> Licht.                                   | 55              | <i>Apus affinis gallejensis</i> Antorini         |
| 16              | <i>Ablepharus deserti</i> Strauch                                | 56              | <i>Garrulax lineatus bilkevitchi</i> Zarud.      |
| 17              | <i>Ablepharus alaicus</i> Elpat.                                 | 57              | <i>Terpsiphone paradisi leucogaster</i> Swain.   |
| 18              | <i>Eumeces schneideri</i> Daudin                                 | 58              | <i>Muscicapa ruficauda</i> Swainson              |
| 19              | <i>Typhlops vermicularis</i> Merrem                              | 59              | <i>Microcichla scouleri scouleri</i> Vigors      |
| 20              | <i>Eryx tataricus</i> Lichtenstein                               | 60              | <i>Chaimarrornis leucocephala</i> Vigors         |
| 21              | <i>Lycodon striatus bicolor</i> Nicol'sky                        | 61              | <i>Myophonus coeruleus turkestanicus</i> Zarudny |
| 22              | <i>Boiga trigonatum melanocephala</i> Annan.                     | 62              | <i>Leptopoecile sophiae sophiae</i> Severtzov    |
| 23              | <i>Naja oxiana</i> Eichward                                      | <b>Mammalia</b> |  |
| 24              | <i>Vipera lebetina turanica</i> Cernow                           | 63              | <i>Paraechinus hypomelas hypomelas</i> Brandt    |
| 25              | <i>Echis carinatus</i> Schneider                                 | 64              | <i>Sorex buchariensis</i> Ognev                  |
| <b>Aves</b>     |  | 65              | <i>Suncus etruscus</i> Savi                      |
| 26              | <i>Ciconia ciconia asiatica</i> Severtzov                        | 66              | <i>Crocidura pergrisea</i> Miller                |
| 27              | <i>Ciconia nigra</i> L.  | 67              | <i>Rhinolophus hipposideros</i> Bechstein        |
| 28              | <i>Anser indicus</i> Lath.                                       | 68              | <i>Rhinolophus ferrumequinum</i> Schreber        |
| 29              | <i>Gyps himalayensis</i> Hume                                    | 69              | <i>Rhinolophus bocharicus</i> Kastch. et Ak.     |
| 30              | <i>Gypaetus barbatus hemachalanus</i> Hutt                       | 70              | <i>Nyctalus noctula</i> Schreb.                  |
| 31              | <i>Circaetus ferox heptneri</i> Dementijev                       | 71              | <i>Myotis emarginatus</i> Geoffroy               |
| 32              | <i>Pandion haliaetus</i> L.                                      | 72              | <i>Myotis mystacinus</i> Kuhl                    |
| 33              | <i>Neophron percnopterus</i> L.                                  | 73              | <i>Plecotus auritus</i> L.                       |
| 34              | <i>Aquila chrysaetus daphanea</i> Menzbier                       | 74              | <i>Barbastella darjelingensis</i> Pobson         |
| 35              | <i>Aquila pennata pennata</i> Gmelin                             | 75              | <i>Vespertilio savii</i> Bonaparte               |
| 36              | <i>Accipiter nisus melaschistos</i> Hume                         | 76              | <i>Vespertilio serotinus</i> Schreber            |
| 37              | <i>Falco cherrug coatsi</i> Dementijev                           | 77              | <i>Eptesicus ognevi</i> Bobrinskoy               |
| 38              | <i>Falco cherrug milvipes</i> Jerdon                             | 78              | <i>Eptesicus serotinus turcomanus</i> Eversmann  |
| 39              | <i>Falco peregrinus babylonicus</i> Sclat.                       | 79              | <i>Otonycteris hemprichi</i> Peters              |
|                 |  | 80              | <i>Tadarida teniotis teniotis</i> Rafinesque     |

1.27.

| 1  | 2   |
|----|---|
| 81 | <i>Spermophilopsis leptodactylus bactrianus</i> Scully                          |
| 82 | <i>Marmota menzbieri</i> Aschk.   |
| 83 | <i>Citellus fulvus oxianus</i> Thomas   |
| 84 | <i>Hystrix leucura satunini</i> Muller  |
| 85 | <i>Allactaga severtzovi</i> Vinogradov  |
| 86 | <i>Allactaga elater</i> Lichtenstein  |
| 87 | <i>Vulpes corsac turkmenica</i> Ognev   |
| 88 | <i>Ursus arctos isabellinus</i> Horsfield                                       |
| 89 | <i>Mustela nivalis pallida</i> Barrett-Hamilton; <i>M.n. heptneri</i> L. Turova |
| 90 | <i>Mustela altaica sacana</i> Thomas  |
| 91 | <i>Mustela putorius eversmanni talassica</i> Ognev.                             |
| 92 | <i>Vormela peregusna koshevníkovi</i> Satunin                                   |

(*Ovis ammon polii*) – 40-80, Siberian ibex (*Capra sibirica*) – 100-150, Tajik markhur (*Capra falconeri*) – 5-7. Commercial purchase of steppe tortoise (*Testudo horsfieldi*) considerably decreased its number.

Among the mammals and birds, the major game species are: wild boar (*Sus scrofa*), tolai hare (*Lepus tolai*), red marmot (*Marmota caudata*), nutria (*Myocastor coypus*), muskrat (*Ondatra zibethica*), pigeon (*Columbia columba*), and partridge (*Alectoris kakelik*) (table 1.24).

Numbers of many animal species, particularly snakes – Central Asian cobra (*Naja oxiana*), *Vipera lebetiana*, *Echis carinatus*, blind snake (*Typhlops vermicularis*), some lizards, snow leopard (*Uncia uncia*), Tien Shan brown bear (*Ursus arctos*), and other species keep reducing.

Table 1.24. Dynamics of Wild Animal Hunting (individuals)

| Name                                    | 1990  | 2000 |
|---|-------|------|
| Wild boar ( <i>Sus scrofa</i> )         | 390   | 30   |
| Siberian ibex ( <i>Capra sibirica</i> ) | 250   | 20   |
| Fox ( <i>Vulpes vulpes</i> )            | 750   | 388  |
| Marten ( <i>Martes foina</i> )          | 416   | 200  |
| Badger ( <i>Meles meles</i> )           | 185   | 20   |
| Tolai hare ( <i>Lepus tolai</i> )       | 830   | 51   |
| Partridge ( <i>Alectoris graeca</i> )   | 2700  | 210  |
| Pigeon ( <i>Columbia columba</i> )      | 7800  | 150  |
| Red marmot ( <i>Marmota caudata</i> )   | 2200  | 500  |
| Waterfowls                              | 11070 | 1000 |

1.27.

| 1   | 2   |
|-----|---|
| 93  | <i>Lutra lutra seistanica</i> Birula                                    |
| 94  | <i>Hyaena hyaena</i> L.   |
| 95  | <i>Felis chaus oxiana</i> Heptner                                       |
| 96  | <i>Felis lynx isabellina</i> Blyth                                      |
| 97  | <i>Panthera tigris virgata</i> Illiger                                  |
| 98  | <i>Panthera pardus ciscaucasica</i> Satunin                             |
| 99  | <i>Uncia uncia</i> Schreber   |
| 100 | <i>Gazella subgutturosa</i> Guldenstaedt                                |
| 101 | <i>Capra falconeri heptneri</i> Zalkin                                  |
| 102 | <i>Ovis vignei bochariensis</i> Nasonov; <i>O.v. severtzovi</i> Nasonov |
| 103 | <i>Ovis ammon polii</i> Blyth   |
| 104 | <i>Cervus elaphus bactrianus</i> Lydekker                               |

Many rare and endemic insects are illegally caught in great numbers for collections; their populations are rapidly reducing, especially decorative species of butterflies, beetles and some other groups of insects.

Use of pesticides gets some pests accustomed to these chemicals and causes a sharp increase in their numbers (e.g. *Tetranychus turkestanii*, *Helicoverpa armigera*, *Scotia segetum*), while some mammals, reptiles and birds, subjected to the harmful impact of pesticides, have their reproduction abilities declined.

In recent years, the tendency of sharply increasing numbers of synanthropic rodents is becoming threatening. Nearly 70% of houses in cities and rural settlements are occupied by Turkestan rats which threaten people with infectious diseases.

The Strategy criteria for assessing the tendencies of biodiversity transformation and vulnerability are based on the ecosystem approach and analysis of problem priorities. According to selected indicators and impact on ecosystems, all



Ruderal-degraded ecosystem

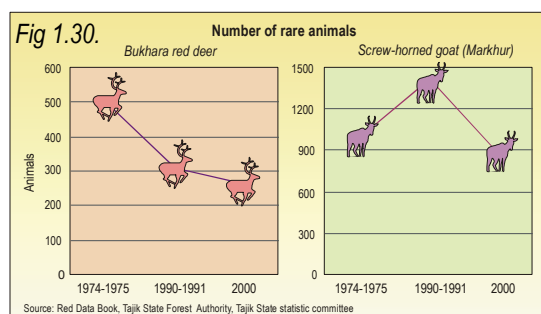
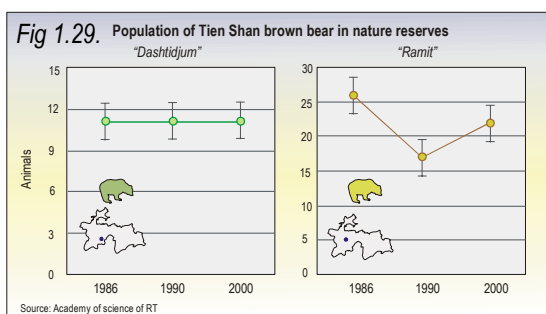
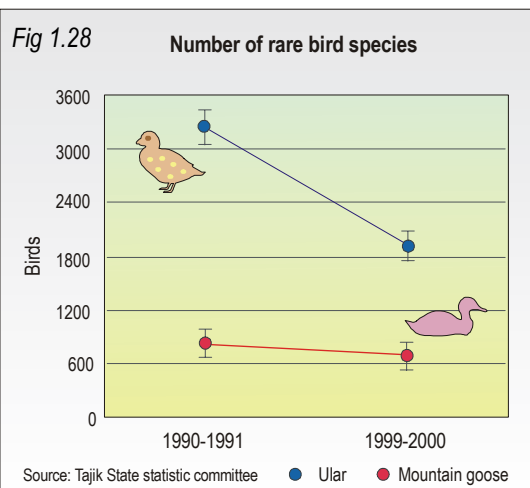
problems are systematized with regard to the methods of biodiversity conservation (*in-situ*, *ex-situ*) and activity level (global, regional, national, etc.). The main assessment criterion was a degree of biodiversity loss and worsening of ecosystem situation.

The tendency for the establishment of protected areas and the improved propaganda in mass media supported by international organizations is considered positive.

Having evaluated the situation in biodiversity conservation and the tendencies of its transformation, the following priorities have been determined:

- degradation of natural ecosystems;
- specific biodiversity reduction and biocoenosis impoverishment;
- general environmental imbalance of landscapes;
- reduction of genetic resources of wild flora, cultivated plants, as well as wild relatives of domestic animals;

- destruction of wild animal migration routes; wild plant range restriction;
- poor level of the population environmental education.



## 1.4. Biodiversity Conservation and Management

At present, nearly 70% of the population actively uses and cultivates biodiversity components and their habitats that results in decline of soil productivity, pasture and forest productivity, and worsening of living conditions of the people.

The reduction of biodiversity and destruction of the main components of biological systems leads to violation of ecological balance, degradation and impoverishment of unique mountainous geosystems. To overcome the crisis is possible only if work on sustainable management and conservation of the main biodiversity components are carried out at various levels of biodiversity existence.

The biodiversity conservation at the population-species and ecosystem levels is the most important issue of environmental sustainability:

- The population-species approach makes it possible to preserve species and its genetic resources, closely related to populations.
- The ecosystem approach considers biological diversity in association with living conditions and accommodation to environment, and promotes more sustainable conservation of various communities of living organisms in different natural-geographic conditions.

In view of these approaches, the Strategy on Biodiversity Conservation considers species, biocoenosis, ecosystems, many domestic species, cultivated plants, agroecosystems, and genetically modified organisms in the light of particular botanico-geographical and zoogeographical zones. The possibility of biodiversity conservation concludes in:

- Providing conservation of rich and unique biodiversity in natural habitats (*in-situ*), protection and sustainable use of various species of agrobiodiversity by local people, conservation of collection materials, as well as development of active long-term measures.
- Conserving biodiversity at the level of organisms, which carry the inherited information on properties and features (genes).

The biodiversity conservation at the population level is of great importance for sustainable conservation of species genetic re-

sources and species development. The attempt to preserve the populations of wild rams – argali (*Ovis ammon polii*) and urial (*Ovis vignei bochariensis*), Tajik markhur (*Capra falconeri*), Bukhara Red deer (*Cervus elaphus bactrianus*) is being taken in Tajikistan. The populations of other animals remained uncontrolled.

At the population level, *Ungernia tadshicorum*, walnut (*Juglans regia*), currants (*Ribes*) are under protection. Rare, endemic species of plants and animals have been inventoried and listed in the Red Data Book of Tajikistan.

A considerable number of plant and animal collections, seeds of wild relatives of cultivated plants are deposited at the academic institutes of the Republic and other CIS countries.

The country still lacks a Program on biodiversity conservation. To improve the biodiversity conservation, it is required:

- improve the structure of the protected areas management,
- attach investments for equipment, research and education,
- provide sufficient support for the existing botanical gardens, zoos, nurseries and farms,
- create new nurseries and farms for rare and endangered plants and animals, as well as for wild species (important for agrobiodiversity) conservation,
- to raise the public awareness on biodiversity value,
- to involve NGOs and local communities in actions on biodiversity conservation.



High-mountain meadows



## Biodiversity Conservation at the Geosystem Level

In the mountainous Tajikistan, all the biodiversity components, except for circumpolar, invasive, and weed species, are assigned to geosystems – botanico-geographic zones with typical natural conditions and vegetation belts. Here, about 90% of the regional flora and fauna specific diversity and 60% of ecosystems occur.

Southern Tajikistan area still contains tugai forests, sand-desert, and wetland ecosystems, xerophytic light forest, and low-grass semisavanna. The most vulnerable are pomegranates (*Punica granatum*), jujube forest (*Ziziphus jujuba*), fig (*Ficus carica*), persimmon (*Diopyros*), grapes (*Vitis*), and Sogd ash (*Fraxinus sogdiana*).

The Hissar-Darvaz area is represented by broad-leaf forests, mountain steppes, and savanoid. This is the most diverse in species area.

The Zeravshan area is dominated with light forest-juniper and small-leaf forests. There are about 3 thousand species of higher plants in the Zeravshan River Valley. To conserve the valuable communities of birch forests and fragmentary Turkestan maple forests is most urgent in the juniper zone. The most valuable grass communities, which need urgent protection, are mountain flood-lands meadows with *Pyrola* and *Orchis*.

The most valuable communities of the Kuramin area are juniper forests and light forests.

In the Turkestan area, solely juniper-forest ecosystems prevail, which are in comparatively stable state. Here, it is urgent to conserve the valuable communities of Turkestan and hemispheric juniper forests.



High-mountain meadow-steppe ecosystem



*Phragmites communis*

The Western Pamirs still contains mainly meadow-steppe and small-leaf, light forest-juniper ecosystems, which are at the stage of degradation. Small juniper light forests, birch forests within the Vanch, Yazgulem, Rushan, and Shugnan ranges need protection, that could help to improve the habitats of rare endemics of mammals – snow leopard (*Uncia uncia*), argali (*Ovis ammon polii*).

The Eastern Pamirs need protection of the wetlands at the Alichur Valley meadows and swamps, as well as small woodlands along Western Pshart and Kudara river valleys.

The diversity of the country ecosystems can be observed all over Central Asia and is valuable for the total region. That is why, all Central Asian states are interested in Tajikistan biodiversity conservation.

## Biodiversity Conservation at the Ecosystem Level

The mountain landscape of Tajikistan, where the natural-climatic conditions are quite variable within small areas, ecosystems have specific flora and fauna composition. A long-term sustainable conservation of species, communities, and organisms is possible only within ecosystem.

The recently occurred decline in the natural ecosystem productivity is slightly compensated by measures on ecosystem protection. Zapovedniks and zakazniks include 50% of the total area of tugai, 0.5% – juniper, 0.01% – small-leaf, 0.2% - high-mountain-meadow and steppe, and 60% - high-mountain-desert ecosystems.

The almost inaccessible ecosystems of rocky mountains, glaciers, and, partly, high-mountain deserts are in relatively stable state. More than half of valuable ecosystems are under active human impact, 25% of them are degrading.

### Biodiversity Conservation at the Species Level

The specific diversity of flora and fauna has been studied irregularly. Best studied is the specific composition of high vascular plants and vertebrate animals. Among lower plants (including fungi) and invertebrates, the specific composition of some groups is well studied.

A considerable part of species and subspecies of plants and animals are assigned to endemics. This points to the confinement of Tajikistan area to the center of world specific formation. High concentration of species per area unit is observed (table 1.25).

Numerous plant and animal species of Tajikistan appeared outside their communities, with reduced or fragmentary areas, due to the human impact and natural factors. The biodiversity conservation at the ecosystem level is one of the main forms of specific diversity preservation.



Rare Juniper forests (*Juniperus*)

In the mountain landscapes, some species live within their own communities, others adapted to other communities as associated species, thus keeping the nature diversity in relatively stable state. To preserve rare and endemic species, nurseries, serpentaries, etc. are established. Work on species breeding is carried out in botanical gardens and biological stations. Reserves and zakazniks make inventories of species listed in the Red Data Book.

Many species are used as food, raw materials for production of clothes, domestic appliances, construction, medicines, etc. As a result, a drop in numbers is observed in many species, some of them are rare or endangered.

However, at present a number of activities need support for the reason of economic crisis in the country.

Table 1.25. Specific Biodiversity and Species Concentration

| Group   | Number of species |                           |               |                           | % of the world total |
|---|-------------------|---------------------------|---------------|---------------------------|----------------------|
|   | In the world      |                           | In Tajikistan |                           |                      |
|   | Total             | Per 1 th. km <sup>2</sup> | Total         | Per 1 th. km <sup>2</sup> |                      |
| Lower plants ( <i>Tallobionta</i> )                                     | 73883             | 0.145                     | 5260          | 36.7                      | 7.1                  |
| Higher plants ( <i>Embryobionta</i> )                                   | 248428            | 1.666                     | 4511          | 31.5                      | 1.81                 |
| Viruses, bacteria, protozoans ( <i>Virus, Bacteriophyta, Protozoa</i> ) | 5760              | 0.011                     | 800           | 5.6                       | 13.9                 |
| Worms ( <i>Vermes</i> )   | 36200             | 0.071                     | 1400          | 9.8                       | 3.9                  |
| Mollusks ( <i>Mollusca</i> )  | 50000             | 0.098                     | 204           | 1.42                      | 0.4                  |
| Arthropods ( <i>Arthropoda</i> )  | ~2000000          | 13.407                    | 10715         | 75.0                      | 0.53                 |
| Fish ( <i>Pisces</i> )  | 19056             | 0.041                     | 52            | 0.36                      | 0.3                  |
| Amphibians ( <i>Amphibia</i> )  | 4184              | 0.023                     | 2             | 0.013                     | 0.05                 |
| Reptiles ( <i>Reptilia</i> )  | 6300              | 0.047                     | 47            | 0.33                      | 0.75                 |
| Birds ( <i>Aves</i> )   | 9040              | 0.062                     | 346           | 2.42                      | 3.83                 |
| Mammals ( <i>Mammalia</i> )   | 4000              | 0.027                     | 84            | 0.59                      | 2.1                  |

#### 1.4.1. Biodiversity conservation in natural habitats (*in-situ*)

Ensuring the biodiversity conservation is possible only if the specific diversity is protected within *in-situ*, as most species have limited habitats. A decline of specific diversity is being observed in all natural zones. For the last 50 years the Turan tiger (*Panthera tigris virgata*) and Menzbier's marmot (*Marmota menzbieri*) completely disappeared from Tajikistan fauna.

A considerable drop in numbers of 5 ungulate species, which became rare: Tajik mark-hur (*Capra falconeri*), Bukhara Red deer (*Cervus elaphus*), Pamir wild sheep (argali) (*Ovis ammon polii*), Persian gazelle (*Gazella subgutturosa*), Bukhara wild ram (urial) (*Ovis vignei bochariensis*); and 6 species of predatory mammals: snow leopard (*Uncia uncia*), *Mustela altaica*, jungle cat (*Felis chaus oxiana*), otter (*Lutra lutra*), striped hyena (*Hyaena hyaena*), leopard (*Panthera pardus ciscaucasica*), is observed. Most critical of 37 species of rare birds are: saker falcon (*Falco cherrug*), peregrine falcon (*Falco peregrinus*), bustard (*Otis tarda*), *Ibidoruncha struthersi*, brown-headed gull (*Larus*



*Tulipa turkestanica*

*brunnicephalus*), *Syrhaptus tibetanus*, *Terpsiphone paradisi leucogaster*, *Miophonus caeruleus*, and bar-headed goose (*Anser indicus*).

The habitats of rare plants species – *Eremurus candidus* and *Salvia gontscharovii* – are hidden under the waters of the Nurek Reservoir.

Commercial collecting is one of the reasons for the drop in numbers of particular invertebrate species.

The Red Data Book of Tajikistan includes 226 plant and 162 animal species, which are rare or endangered (table 1.26, 1.27).

Table 1.26. Dynamics of Rare and Dangerous Species of Plants (by categories)

| Name  | 1978     |           |           |           |           | 1988      |           |           |           |            | 1998      |            |            |           |           |          | 2002       |           |            |            |           |           |           |            |
|---|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|-----------|------------|------------|-----------|-----------|----------|------------|-----------|------------|------------|-----------|-----------|-----------|------------|
|   | Category |           |           |           | Total     | Category  |           |           |           | Total      | Category  |            |            |           |           | Total    | Category   |           |            |            |           | Total     |           |            |
|   | 0        | 1         | 2         | 3         |           | 0         | 1         | 2         | 3         |            | 0         | 1          | 2          | 3         | 4         |          | 5          | 0         | 1          | 2          | 3         |           | 4         | 5          |
| Fungi<br>(Fungi)                              | -        | -         | 1         | -         | 1         | -         | -         | 4         | -         | 4          | -         | -          | 4          | -         | -         | -        | 4          | -         | -          | 4          | -         | -         | -         | 4          |
| Bryophytes<br>(Bryophyta)                     | -        | 4         | 2         | 2         | 8         | -         | 4         | 2         | 2         | 8          | -         | 4          | 2          | 2         | -         | -        | 8          | -         | 4          | 2          | 2         | -         | -         | 8          |
| Filices<br>(Pteridophyta)                     | -        | -         | -         | -         | -         | 1         | 3         | 2         | -         | 6          | 1         | 3          | 2          | -         | -         | -        | 6          | 1         | 3          | 4          | -         | -         | -         | 8          |
| Gymnosperms<br>(Gymnospermae)                 | -        | -         | 1         | -         | 1         | -         | 1         | -         | -         | 1          | -         | 1          | -          | -         | -         | -        | 1          | -         | 1          | -          | 3         | -         | -         | 4          |
| Angiosperms<br>(Angiospermae),<br>including.: | -        | 14        | 43        | 12        | 69        | 19        | 73        | 87        | 28        | 207        | 22        | 92         | 102        | 38        | 19        | -        | 273        | 25        | 111        | 118        | 48        | 26        | 11        | 339        |
| Trees   | -        | 1         | 2         | 3         | 6         | 1         | 2         | 1         | 4         | 8          | 1         | 2          | 3          | 4         | 2         | -        | 12         | 1         | -          | 4          | 4         | 2         | 3         | 14         |
| Shrubs  | -        | -         | 7         | 3         | 10        | -         | 8         | 9         | 1         | 18         | -         | 10         | 17         | -         | 1         | -        | 28         | -         | 5          | 18         | 11        | 1         | 3         | 38         |
| Grass, sub-shrubs,<br>dwarf sub-shrubs        | -        | 13        | 34        | 6         | 53        | 18        | 63        | 77        | 23        | 181        | 21        | 80         | 82         | 34        | 16        | -        | 233        | 24        | 106        | 96         | 33        | 23        | 5         | 287        |
| <b>Total:</b>                                 | <b>-</b> | <b>18</b> | <b>47</b> | <b>14</b> | <b>79</b> | <b>20</b> | <b>81</b> | <b>95</b> | <b>30</b> | <b>226</b> | <b>23</b> | <b>100</b> | <b>110</b> | <b>40</b> | <b>19</b> | <b>-</b> | <b>292</b> | <b>26</b> | <b>119</b> | <b>128</b> | <b>53</b> | <b>26</b> | <b>11</b> | <b>363</b> |

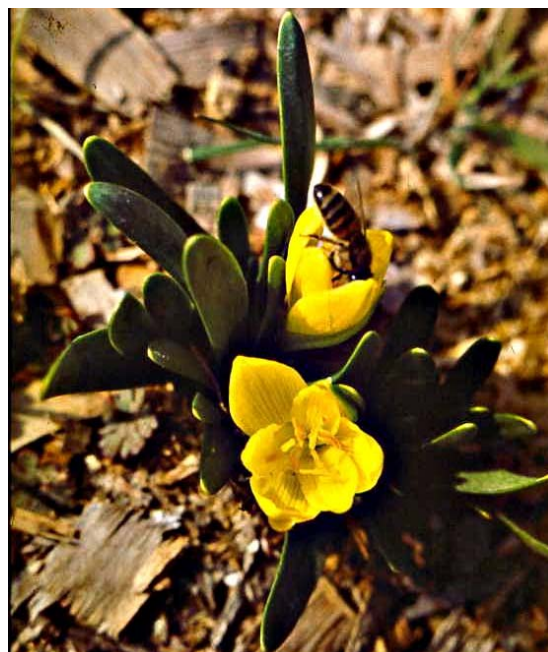
Table 1.27. Plants and Animals, Listed in the Red Data Book of Tajikistan (by IUCN categories)

| Name  | Category  |           |            |           |           |           | Total      |
|---|-----------|-----------|------------|-----------|-----------|-----------|------------|
|   | 0         | 1         | 2          | 3         | 4         | 5         |            |
| <b>PLANTS</b>                                 |           |           |            |           |           |           |            |
| Fungi ( <i>Fungi</i> )                        | –         | –         | 4          | –         | –         | –         | 4          |
| Bryophytes ( <i>Bryophyta</i> )               | –         | 4         | 2          | 2         | –         | –         | 8          |
| Filices ( <i>Pteridophita</i> )               | 1         | 3         | 2          | –         | 1         | –         | 7          |
| Gymnosperms ( <i>Gymnospermae</i> )           | –         | 1         | –          | –         | –         | –         | 1          |
| Angiosperms ( <i>Angiospermae</i> )           | 16        | 68        | 75         | 25        | 7         | 15        | 206        |
| <b>Total of plants:</b>                       | <b>17</b> | <b>76</b> | <b>83</b>  | <b>27</b> | <b>8</b>  | <b>15</b> | <b>226</b> |
| <b>VERTEBRATES</b>                            |           |           |            |           |           |           |            |
| Fish ( <i>Pisces</i> )                        | 1         | –         | 2          | 1         | –         | –         | 4          |
| Reptiles ( <i>Reptilia</i> )                  | –         | 5         | 12         | 4         | –         | –         | 21         |
| Birds ( <i>Aves</i> )                         | –         | 9         | 10         | 11        | 7         | –         | 37         |
| Mammals ( <i>Mammalia</i> )                   | 2         | 12        | 21         | 2         | 5         | –         | 42         |
| <b>Total of vertebrates:</b>                  | <b>3</b>  | <b>26</b> | <b>45</b>  | <b>18</b> | <b>12</b> | <b>–</b>  | <b>104</b> |
| <b>INVERTEBRATES</b>                          |           |           |            |           |           |           |            |
| Mantis ( <i>Mantoptera</i> )                  | –         | 6         | 1          | –         | –         | –         | 7          |
| Proboscidea ( <i>Homoptera</i> )              | –         | –         | 3          | –         | –         | –         | 3          |
| Bugs ( <i>Heteroptera</i> )                   | –         | 2         | 4          | –         | –         | –         | 6          |
| Coleopterous or beetles ( <i>Coleoptera</i> ) | 1         | –         | 4          | –         | –         | –         | 5          |
| Lepidopterous ( <i>Lepidoptera</i> )          | –         | 8         | 9          | –         | 4         | –         | 21         |
| Hymenopterous ( <i>Hymenoptera</i> )          | –         | –         | 4          | 4         | –         | –         | 8          |
| Mollusks ( <i>Mollusca</i> )                  | –         | 2         | 5          | 1         | –         | –         | 8          |
| <b>Total of invertebrates:</b>                | <b>1</b>  | <b>18</b> | <b>30</b>  | <b>5</b>  | <b>4</b>  | <b>–</b>  | <b>58</b>  |
| <b>Total of animals:</b>                      | <b>4</b>  | <b>44</b> | <b>103</b> | <b>7</b>  | <b>16</b> | <b>–</b>  | <b>162</b> |

Note: 0 – extinct; 1 – endangered; 2 – rare; 3 – declining; 4 – undetermined; 5 – restored.

The Red Data Book of the IUCN includes 10 species of animals.

One of the primary tasks in conserving rare and endangered animal species *in-situ* is a regular inventory aimed at estimating species populations. Unfortunately, for the recent decade, there have been no valid data on the numbers of plants and animals, including those listed in the Red Data Book, which makes the assessment of the present state of populations difficult. The risk of taxa, various plant and animal systematic groups disappearance is also relatively estimated. In view of the species category systems, renewed by IUCN, there is a need in reediting of the Tajik Red Data Book. Renewed systematization and risk assessment of rare and endangered species will make it possible to identify ecosystems by their vulnerability.



*Sternbergia lutea*

**Animals the Red Data Book of the IUCN include**

*Reptiles:*

- Gray monitor lizard (*Varanus griseus*)
- Central Asian cobra (*Naja oxiana*)

*Aves:*

- Red Naped Shahin (*Falco peregrinus babylonicus*)

*Mammals:*

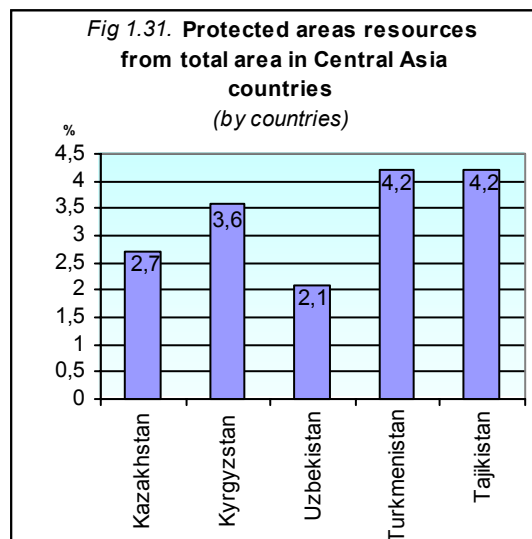
- Menzbier's marmot (*Marmota menzbieri*)
- Central Asian otter (*Lutra lutra*)
- Turan tiger (*Panthera tigris virgata*)
- Leopard (*Panthera pardus*)
- Snow leopard (*Uncia uncia*)
- Persian gazelle (*Gazella subgutturosa*)
- Tajik markhur (*Capra falconeri*)
- Bukhara wild ram (urial) (*Ovis vignei bochariensis*)

To improve the rare and endangered species conservation, the Tajik Government approved the legislation regulating flora and fauna (game animals, medicinal plants, etc.) management.

Protected area resources, including some nature-landscape zones and ecosystems, has been created in Tajikistan (table 1.28).

13 state zakazniks, 4 reserves and 1 micro-zakaznik are registered in Tajikistan by 01.01.2001. According to the data available by , the total area of zakazniks is 487 th. ha, or 3,4% of the country area (fig. 1.31, 1.32).

The total area of Tajik state reserves (according to the data available by 01.01.2002) is 173,4 ths hectares. Over 35% of animals' species diversity is protected in reserve areas. They contain valuable breeding materials for growing stable varieties of forage, food, and medicinal plants.



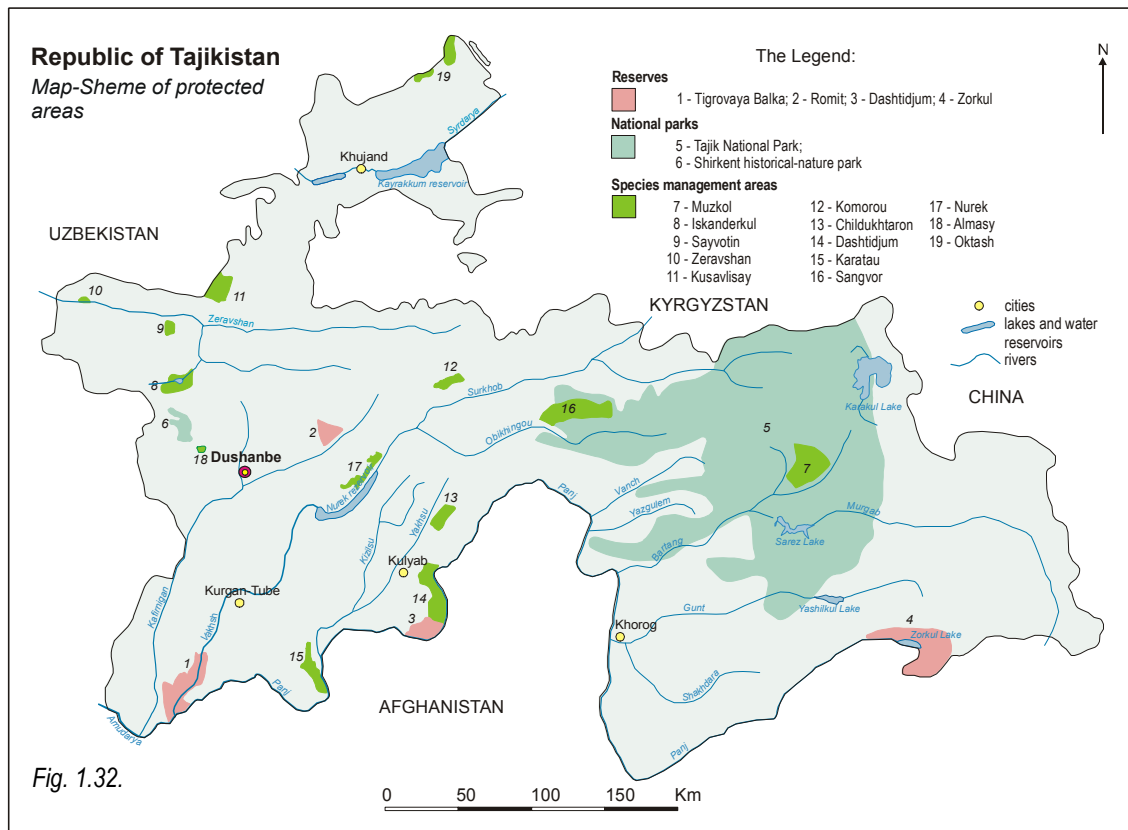
Due to the measures taken, the unique wetland forests of the dry subtropics zone is preserved in Tigrovaya Balka Reserve. The most favorable area of 21 th. ha of tugai is the left bank of the Vakhsh River. Tugai forests contain rare animal species: pheasant (*Phasianus colchicus*), jungle cat (*Felis chaus oxiana*), Bukhara Red deer (*Cervus elaphus*) and hyena (*Hyaena hyaena*).

Dashti-Jum Reserve preserves the last Central Asian valuable and viable populations of Tajik markhur (*Capra falconeri heptneri*). Its habitats – medium-mountainous xerophytic light forests – are also protected.

The resources of fish in high-mountainous lakes are of great commercial importance. The protected areas of Zorkul Lake islands still contain bar-headed goose (*Anser indicus*), totaling in 600 birds. The argali (*Ovis ammon*) is also preserved here.

Table 1.28. Protected Area Resources (01.01.02)

| No.           | Protected area category                            | IUCN category | Number    | Area / ths ha   |
|---------------|--|---------------|-----------|-----------------|
| 1.            | Reserves   | I             | 4         | 173.418         |
| 2.            | National parks                                     | II            | 2         | 2603.6          |
| 3.            | Nature monuments                                   | III           | 26        | –               |
| 4.            | Zakazniks  | IV            | 14        | 313.390         |
| 5.            | Tourism and recreation zone                        | –             | 3         | 15.3            |
| 6.            | Botanical gardens                                  | –             | 5         | 0.731           |
| 7.            | Botanical stations, temporary and permanent points | –             | 13        | 10.0            |
| <b>Total:</b> |  |               | <b>67</b> | <b>3116.439</b> |



In recent years, the Romit Reserve has been developed as economic unit and does not have its conserving function any more.

13 state zakazniks provide conservation of valuable animal and plant species almost in all nature-landscape zones of Tajikistan (table 1.30).

The protected areas of Tajikistan include 3 tourism and recreation zones, with the total area of 15.3 th. hectares. To preserve the landscapes, unique ecosystem elements and natural monuments, the national and nature parks are established in Tajikistan.

Table 1.29. Staff of reserves and zakazniks, with positions indicated

| Position              | Reserves        |           |            |           | Zakazniks   |           |          |              |            |          |          |          |            |          |           |          |          |
|-----------------------|-----------------|-----------|------------|-----------|-------------|-----------|----------|--------------|------------|----------|----------|----------|------------|----------|-----------|----------|----------|
|                       | Tigrovaya Balka | Rasht     | Dashti-Jum | Zorkul    | Iskanderkul | Saivotnin | Kamarov  | Chidukhatron | Dashti-Jum | Karato   | Sangvor  | Muzkul   | Kusavlisai | Oktash   | Zeravshan | Almasi   | Nurek    |
| Director              | 1               | 1         | 1          | 1         | 1           | 1         | 1        | 1            | 1          | 1        | 1        | 1        | 1          | 1        | 1         | 1        | 1        |
| Chief Forester        | 1               | 1         | 1          | 1         | 1           | 1         | 1        | 1            | 1          | 1        | 1        | 1        | 1          | 1        | 1         | 1        | 1        |
| Forest-Guard Engineer | 1               | 1         | 1          | 1         | 1           | 1         | -        | 1            | 1          | 1        | 1        | 1        | -          | -        | 1         | -        | 1        |
| Research worker       | 2               | 2         | 2          | 2         | -           | -         | -        | -            | -          | -        | -        | -        | -          | -        | -         | -        | -        |
| Senior ranger         | 2               | 2         | 2          | 4         | 1           | 1         | -        | 1            | 1          | 1        | 1        | 1        | 1          | -        | 1         | -        | 1        |
| Ranger                | 29              | 18        | 13         | 17        | 1           | -         | -        | -            | 2          | -        | -        | -        | -          | -        | -         | -        | 1        |
| Fireman-Guard         | 3               | 2         | 2          | 0         | -           | -         | -        | -            | -          | -        | -        | -        | -          | -        | -         | -        | -        |
| <b>Total:</b>         | <b>39</b>       | <b>27</b> | <b>22</b>  | <b>26</b> | <b>5</b>    | <b>4</b>  | <b>2</b> | <b>4</b>     | <b>6</b>   | <b>4</b> | <b>4</b> | <b>4</b> | <b>3</b>   | <b>2</b> | <b>4</b>  | <b>2</b> | <b>5</b> |

Table 1.30. Types of protected areas and valuable animal and plant species conservation

| No.              | Name                        | Type                                      | Species requiring protection  |
|------------------|-----------------------------|---|---|
| <b>Reserves</b>  |                             |   |   |
| 1.               | Tigrovaya Balka             | Tugai                                     | Pheasant ( <i>Phasianus colchicus</i> ), hyena ( <i>Hyaena hyaena</i> ), Persian gazelle ( <i>Gazella subgutturosa</i> ), Bukhara Red deer ( <i>Cervus elaphus</i> ), gray monitor lizard ( <i>Varanus griseus</i> ) and waterfowls |
| 2.               | Romit                       | Complex                                   | Golden eagle ( <i>Aquila chrysaetus laphanea</i> ), brown bear ( <i>Ursus arctos</i> ), snow leopard ( <i>Uncia uncia</i> ), Siberian ibex ( <i>Capra sibirica</i> )  |
| 3.               | Dashti-Jum                  | Complex, Mountain-forest                  | Brown bear ( <i>Ursus arctos</i> ), Bukhara wild sheep (urial) ( <i>Ovis vignei bochariensis</i> ), Tajik markhur ( <i>Capra falconeri</i> ), partridge ( <i>Alectorius kakelik</i> ), snow leopard ( <i>Uncia uncia</i> )          |
| 4.               | Zorkul                      | Zoological                                | Bar-headed goose ( <i>Anser indicus</i> ), Pamir wild ram (argali) ( <i>Ovis ammon polii</i> ), Siberian ibex ( <i>Capra sibirica</i> ), snow leopard ( <i>Uncia uncia</i> ), red wolf ( <i>Canis lupus</i> )                       |
| <b>Zakazniks</b> |                             |   |   |
| 1.               | Iskanderkul                 | Landscape, mountain-forest                | Snow leopard ( <i>Uncia uncia</i> ), Bukhara wild sheep (urial) ( <i>Ovis vignei bochariensis</i> ), birch ( <i>Betula</i> )  |
| 2.               | Saivotin                    | Mountain-forest                           | Juniper forest ( <i>Juniperus</i> )   |
| 3.               | Kamarov                     | Mountain-forest                           | Brown bear ( <i>Ursus arctos</i> ), Siberian ibex ( <i>Capra sibirica</i> ), trout ( <i>Salmo trutta morfa fario</i> )  |
| 4.               | Childukhtaron               | Landscape, mountain-forest                | Juniper forest ( <i>Juniperus</i> ), brown bear ( <i>Ursus arctos</i> ), Bukhara wild ram (urial) ( <i>Ovis vignei bochariensis</i> ), partridge ( <i>Ammoperdix griseogularis</i> ), wild boar ( <i>Sus scrofa</i> )               |
| 5.               | Dashti-Jum                  | Landscape, mountain-forest                | Juniper forest ( <i>Juniperus</i> ), brown bear ( <i>Ursus arctos</i> ), Bukhara wild ram (urial) ( <i>Ovis vignei bochariensis</i> ), partridge ( <i>Ammoperdix griseogularis</i> ), wild boar ( <i>Sus scrofa</i> )               |
| 6.               | Karatav                     | Zoological                                | Bukhara wild ram (urial) ( <i>Ovis vignei bochariensis</i> ), partridge ( <i>Alectoris graeca</i> ), Bukhara Red deer ( <i>Cervus elaphus</i> )   |
| 7.               | Sangvor                     | High-mountainous                          | Pamir wild ram (argali) ( <i>Ovis ammon polii</i> ), Tibetan snow partridge ( <i>Tetraogallus tibetanus tibetanus</i> )   |
| 8.               | Muzkul                      | Zoological                                | Bar-headed goose ( <i>Anser indicus</i> ), Pamir wild ram (argali) ( <i>Ovis ammon polii</i> ), Siberian ibex ( <i>Capra sibirica</i> ), snow leopard ( <i>Uncia uncia</i> )  |
| 9.               | Kusavlisai                  | Mountain-forest                           | Juniper forests ( <i>Juniperus</i> )  |
| 10.              | Oktash                      | Zoological                                | Bukhara wild ram (urial) ( <i>Ovis vignei bochariensis</i> ), <i>Vipera lebetina</i> , peregrine falcon ( <i>Falco peregrinus</i> ), saker falcon ( <i>Falco cherrug</i> )  |
| 11.              | Zeravshan                   | Complex, tugai forest                     | Pheasant ( <i>Phasianus colchicus</i> ), Bukhara Red deer ( <i>Cervus elaphus bactrianus</i> )  |
| 12.              | Almasi                      | Botanical                                 | <i>Ungernia victoris</i>  |
| 13.              | Nurek                       | Complex, mountain-forest                  | Bukhara wild ram (urial) ( <i>Ovis vignei</i> ), brown bear ( <i>Ursus arctos</i> ), partridge ( <i>Ammoperdix griseogularis</i> ), snow leopard ( <i>Uncia uncia</i> )   |
| <b>Parks</b>     |                             |   |   |
| 14.              | National                    | Complex, landscape, botanical, zoological | High-mountain, meadow-steppe, desert ecosystems, tugai, Pamir wild ram (argali) ( <i>Ovis ammon polii</i> ), Siberian ibex ( <i>Capra sibirica</i> ), Snow leopard ( <i>Uncia uncia</i> ), red wolf ( <i>Canis lupus</i> )          |
| 15.              | Shirkent historical natural | Mountain-forest, landscape biodiversity   | Bukhara wild ram (urial) ( <i>Ovis vignei bochariensis</i> ), Juniper forest ( <i>Juniperus</i> ), <i>Ungernia</i>  |



**Desert ecosystem of Tigrovaya Balka Reserve**

The protected area resources include many natural monuments – landscape, botanical, geological, hydrological. The country lacks any cadastre and recording of biodiversity, as well as legislation on its conservation that negatively impacts on protected areas in general.

Almost all protected areas have ecological imbalance; one of the reasons is the socio-economic and political crisis of the recent decade. The natural resources, primarily biodiversity, are used everywhere, any nature-use system is absent.

The protected areas, including reserves, are currently inefficient, because of their function restriction. The anthropogenic impact on the biological diversity of Tajikistan is steadily increasing, and the degradation of many nature-landscape complexes is becoming irreversible on a large scale. A National ecological network of protected areas has to be created.

#### **1.4.2. Biodiversity conservation outside natural habitats (*ex-situ*)**

Conservation *ex-situ* is aimed at preserving genetic resources, accumulated in plant, animal, and microorganism collections. The major collections are in botanical gardens, stations, museums, research institutions, and other organizations .

Tajikistan has many institutions working on plant and animal conservation. Usually, these are botanical and dendrological gardens, zoo, public parks, introduction nurseries of research institutes, etc. Due to the socio-economic instability, the collection materials are not enriched; the state of the zoo, museum, herbarium, biosta-

tions, and botanical gardens is not satisfactory. This may cause the national biodiversity loss.

The plant collections include about 5 thousand varieties, hybrids, lines, and local forms. The germ plasma collections of domestic animals include over 50 th. doses from 10 breeds. The microorganism collections consist of many bacteria, fungi, and algae species, including about 500 taxa.

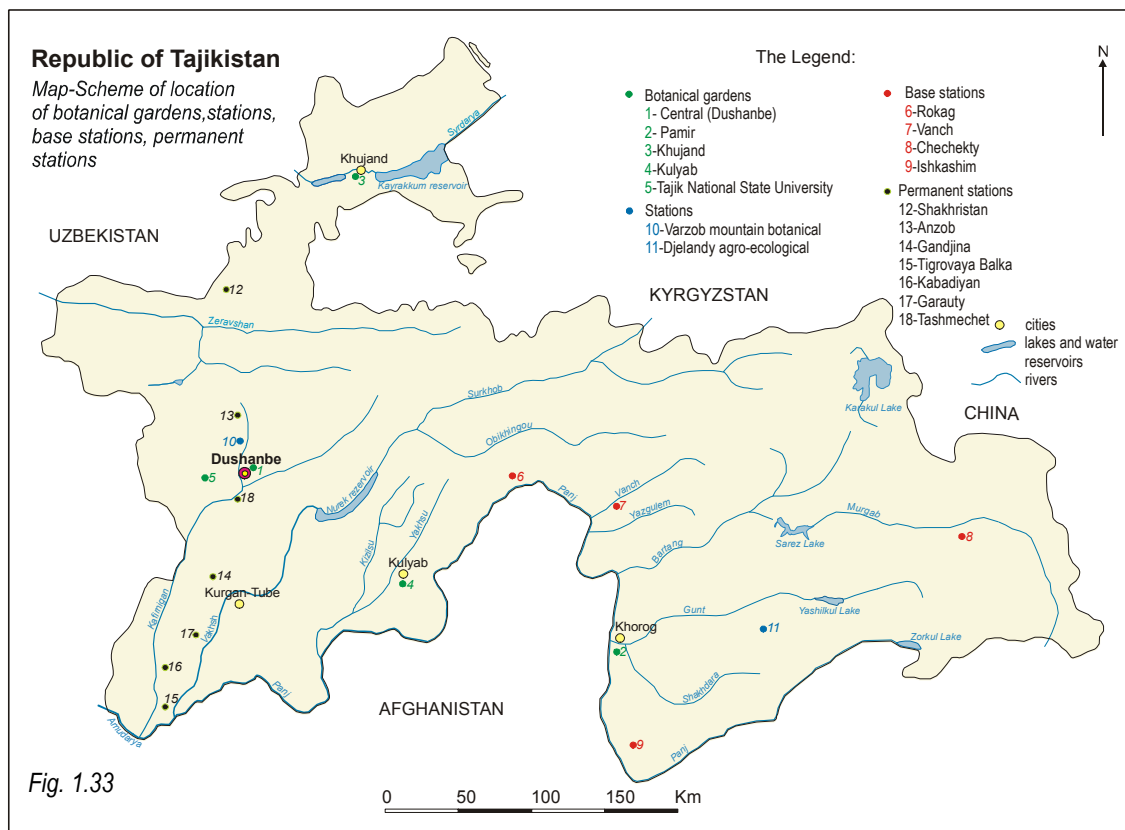
The national herbarium includes about 350-400 th. plant specimens of existing flora, zoological collections – 3.7 th. species, including 280 species and 3.5 th. specimens of birds; and about 3.3 th. species and 18.8 th. specimens of insects.

The network of botanical institutions of Tajikistan has been developed since 1930. 5 botanical gardens, 2 stations, 4 temporary and 7 permanent points (fig. 1.33) carried out active biomorphological, ecological, physiological-biochemical, anatomical, phytocoenotic, floristic and other research until 1990. At present, these works are restricted. Work on introducing woody, shrub, and grass plants of both local and alien flora is still being carried out to select valuable species, forms, and varieties.



**Tulips in Botanical Station**





More than 5 thousand species, forms, and varieties of plants from many floristic zones of the world, including about 2.3 thousand tree and shrub species, were put to introduction test at the Central Botanical Garden of the Tajik Academy of Science; 2.7 th. species of tropical and subtropical plants were tested at the hot-house complex. According to the data available by 01.01.2002, the tree and shrub collection of the Botanical Garden was 1.765 species, including 137 species of conifer breeds.

The plant resources of the Pamirs Botanical Garden (Academy of Science of the Republic of Tajikistan) are: over 4 th. species and in-



**The Pamir Botanical Garden**

traspecific taxa, including 1.1 th. woody, 1.8 th. grass, 400 fruit species, and over 80 species of indigenous flora.

The Khujand Botanical Garden preserves the area of nature tugai; over 40 plant species, listed in the Red Data Book of Tajikistan, have been tested here.

In the Kulyab Botanical Garden, introduced and reproducent nurseries are established; areas of medicinal and decorative grasses of the local flora are created. There are over 300 species of decorative-flowering and medicinal grasses.



**Botanical Garden in Dushanbe**

The Varzob Mountainous Botanical Station (Institute of Botany, Academy of Science) preserves over 1.5 th. of high flowering plant species (over 30% of the total flora specific composition of Tajikistan). Such number of plant species may ensure a sustainable conservation of natural flora communities at southern slope of Gissar Range. Among them 32 species are listed in the Red Data Book of Tajikistan.

A number of temporary and permanent stations work on selecting high-productive fruit varieties to be used in gardening. There are walnut, cereal, leguminous, and forage crops from entire Central Asia, preserved in natural conditions. The crops catalogue includes 94 specimens of soft and 33 specimens of club wheat, with 35 new specimens. The high-mountainous stations study the problems of plant's life in the extreme conditions of local environment.

#### 1.4.3. Genetic Resources and Biological Safety

The Republic of Tajikistan possesses great genetic resources of global importance. The genetic varieties of biodiversity are preserved *in-situ* and *ex-situ*. A considerable part of the wild plant and animal genetic resources occur within protected areas.

#### Main Genetic Collections of Tajikistan:

- Fruit and berries (10.000 variety specimens of apricot, apple, cherry-plum, almond, etc.). Deposited in: Scientific and Production Enterprise "Bogparvar", Tajik Academy of Agricultural Sciences.
- Cereals, leguminous, and industrial crops, potato – 1.5 ths variety specimens, deposited in the Institute of Plant Physiology and Genetics, Tajik Academy of Science, 2.2 ths – in the Scientific and Production Enterprise "Ziroat", Tajik Academy of Agricultural Sciences.
- Germ plasma of pedigree animals – over 50 ths doses of cattle breeding, deposited in the Tajik Research Institute of Cattle-Breeding, Tajik Academy of Agricultural Sciences, Ministry of Agriculture, Republic of Tajikistan.

The main genetic resources are deposited in a number of research institutes of the republic (collections of wild and cultivated plant varieties, the genetic pool of wild animals), part of these is preserved in nature reserves (table 1.31, fig. 1.34-1.37).

The genetic resources of cultivated plants and domestic animals are conserved by relevant branch research institutions of the Tajik Academy of Science, the Tajik Academy of Agricultural Sciences, and subordinate institutions of

Table 1.31. Genetic Resources of Agricultural Crops

| Crop                    | Grown     |         | Bred      |         |       | Collection available |         |       |
|-------------------------|-----------|---------|-----------|---------|-------|----------------------|---------|-------|
|                         | varieties | hybrids | varieties | hybrids | lines | varieties            | hybrids | lines |
| Fruit, including:       | 120       | –       | 42        | –       | –     | 1143                 | –       | –     |
| Stone                   | 52        | –       | –         | –       | –     | 394                  | –       | –     |
| Seed-bearing            | 31        | –       | –         | –       | –     | 224                  | –       | –     |
| Nuts                    | 13        | –       | 10        | –       | –     | 177                  | –       | –     |
| Subtropical             | 12        | –       | 21        | –       | –     | 159                  | –       | –     |
| Citrus (hot-house crop) | 6         | –       | –         | –       | –     | 47                   | –       | –     |
| Others                  | 6         | –       | 2         | –       | –     | 124                  | –       | –     |
| Berries                 | 7         | –       | –         | –       | –     | –                    | –       | –     |
| Grapes                  | 21        | –       | 11        | –       | –     | 350                  | –       | –     |
| Potato                  | 6         | –       | 1         | –       | –     | 70                   | –       | –     |
| Vegetables              | 57        | –       | 10        | –       | –     | 70                   | 4       | –     |
| Melons                  | 15        | –       | 7         | –       | –     | 51                   | –       | –     |
| Cereals                 | 48        | 2       | 29        | 82      | 2     | 2045                 | 238     | 110   |
| Leguminous plants       | 32        | –       | 20        | 302     | 4     | 921                  | –       | –     |
| Oil-bearing plants      | 28        | 2       | 23        | –       | 81    | 8218                 | –       | –     |

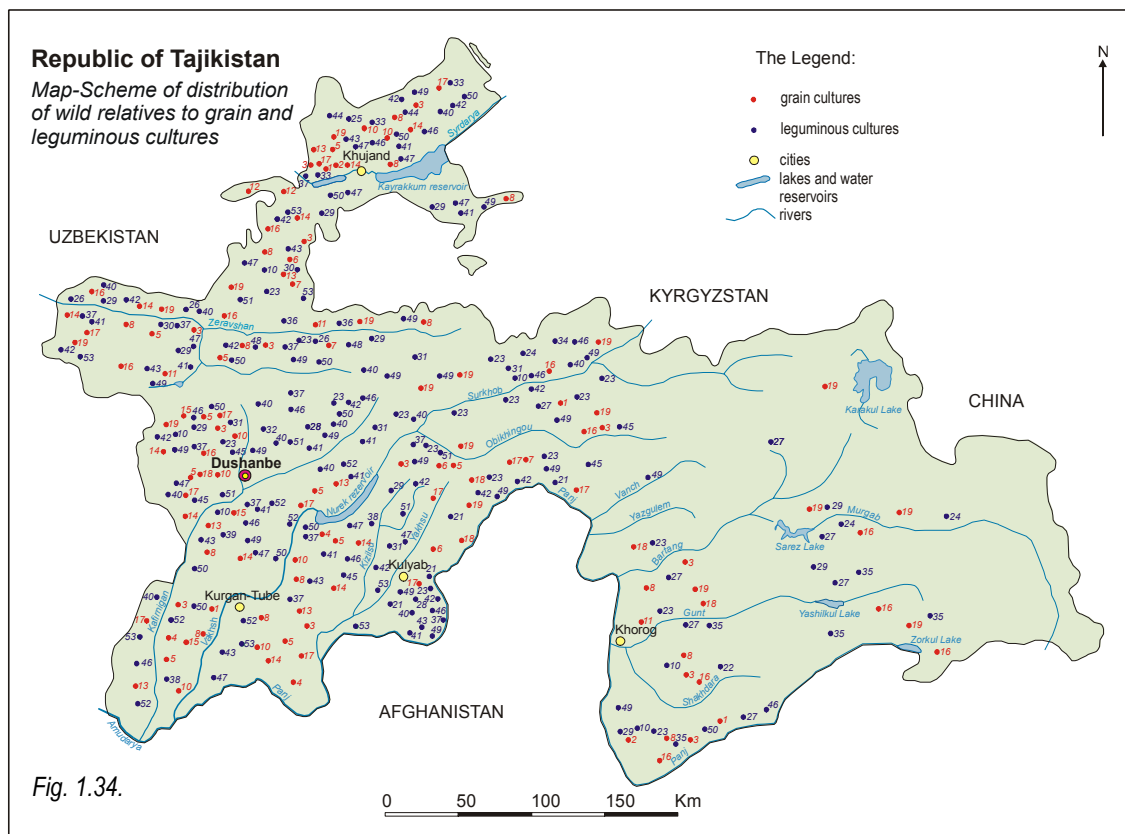


Fig. 1.34. Legend to Map-scheme of Distribution of Wild Relatives of Cereals and Leguminous Plants

| No.            | Latin Names                                     |
|----------------|---|
| 1              | 2   |
| <b>Cereals</b> |   |
| 1              | <i>Avena barbata</i> pott                       |
| 2              | <i>Avena pilosa</i> M. B.                       |
| 3              | <i>Avena latua</i> L.                           |
| 4              | <i>Avena clauda</i> Dur.                        |
| 5              | <i>Avena trichophylla</i> C. Koch.              |
| 6              | <i>Avena serpentrionalis</i> Malz.              |
| 7              | <i>Avena meridionalis</i> Malz.                 |
| 8              | <i>Secale silvestre</i> Host.                   |
| 9              | <i>Secale segetale</i> (Zhuk.) Roshev.          |
| 10             | <i>Sorghum halepense</i> (L.) Pers.             |
| 11             | <i>Hordeum bogdanii</i> Wilensky.               |
| 12             | <i>Hordeum jubatum</i> L.                       |
| 13             | <i>Hordeum spontaneum</i> C. Koch.              |
| 14             | <i>Hordeum leporinum</i> Link.                  |
| 15             | <i>Hordeum geniculatum</i> All.                 |
| 16             | <i>Hordeum brevisububatum</i> Link.             |
| 17             | <i>Hordeum bulbosum</i> L.                      |
| 18             | <i>Hordeum ischnatherum</i> (Cosson.) Koernicke |
| 19             | <i>Hordeum turkestanicum</i> Nevski             |

Fig. 1.34.

| 1                 | 2   |
|-------------------|---|
| <b>Leguminous</b> |   |
| 20                | <i>Pisum arvense</i> L.                     |
| 21                | <i>Cicer baldshuanicum</i> (M. Pop.) Lincz  |
| 22                | <i>Cicer garanicum</i> Boriss.              |
| 23                | <i>Cicer songoricum</i> Steph.              |
| 24                | <i>Cicer jacquemontii</i> jaub. et Spach.   |
| 25                | <i>Cicer flexuosum</i> lipsky.              |
| 26                | <i>Cicer spinosum</i> M. Pop.               |
| 27                | <i>Cicer acanthophyllum</i> Boriss.         |
| 28                | <i>Cicer Korshinskyi</i> Lincz.             |
| 29                | <i>Cicer macracanthum</i> M. Pop.           |
| 30                | <i>Cicer paucijugum</i> Nevski              |
| 31                | <i>Cicer microphyllum</i> Royle.            |
| 32                | <i>Cicer multijugum</i> Rassul. et Scharip. |
| 33                | <i>Cicer mogoltavicum</i> A. Korol.         |
| 34                | <i>Cicer lactum</i> Rassul. et. Scharip.    |
| 35                | <i>Cicer fedtschenkoi</i> Lincz.            |
| 36                | <i>Cicer chorossanicum</i> M. Pop.          |
| 37                | <i>Lens orientalis</i> Schmalh.             |
| 38                | <i>Vicia hirsute</i> (L.) S. F. Gray.       |
| 39                | <i>Vicia hybrida</i> L.                     |

1.34.

| 1  | 2                                      |
|----|--|
| 40 | <i>Vicia hircanica</i> Fisch. et. Mey. |
| 41 | <i>Vicia peregrina</i> L.              |
| 42 | <i>Vicia kokanica</i> Rgl. et Schmalh. |
| 43 | <i>Vicia michauxii</i> Spreng.         |
| 44 | <i>Vicia vilosa</i> Roth.              |
| 45 | <i>Vicia narbonensis</i> L.            |
| 46 | <i>Vicia sativa</i> L.                 |

1.34.

| 1  | 2                                     |
|----|---------------------------------------|
| 47 | <i>Vicia subvillosa</i> Boiss.        |
| 48 | <i>Vicia semenovii</i> B Fed.         |
| 49 | <i>Vicia tenuifolia</i> Roth.         |
| 50 | <i>Vicia angustifolia</i> L.          |
| 51 | <i>Vicia ervilia</i> (L.) Wiled.      |
| 52 | <i>Vicia tetrasperma</i> (L.) Schreb. |
| 53 | <i>Vicia calcarata</i> Desf.          |

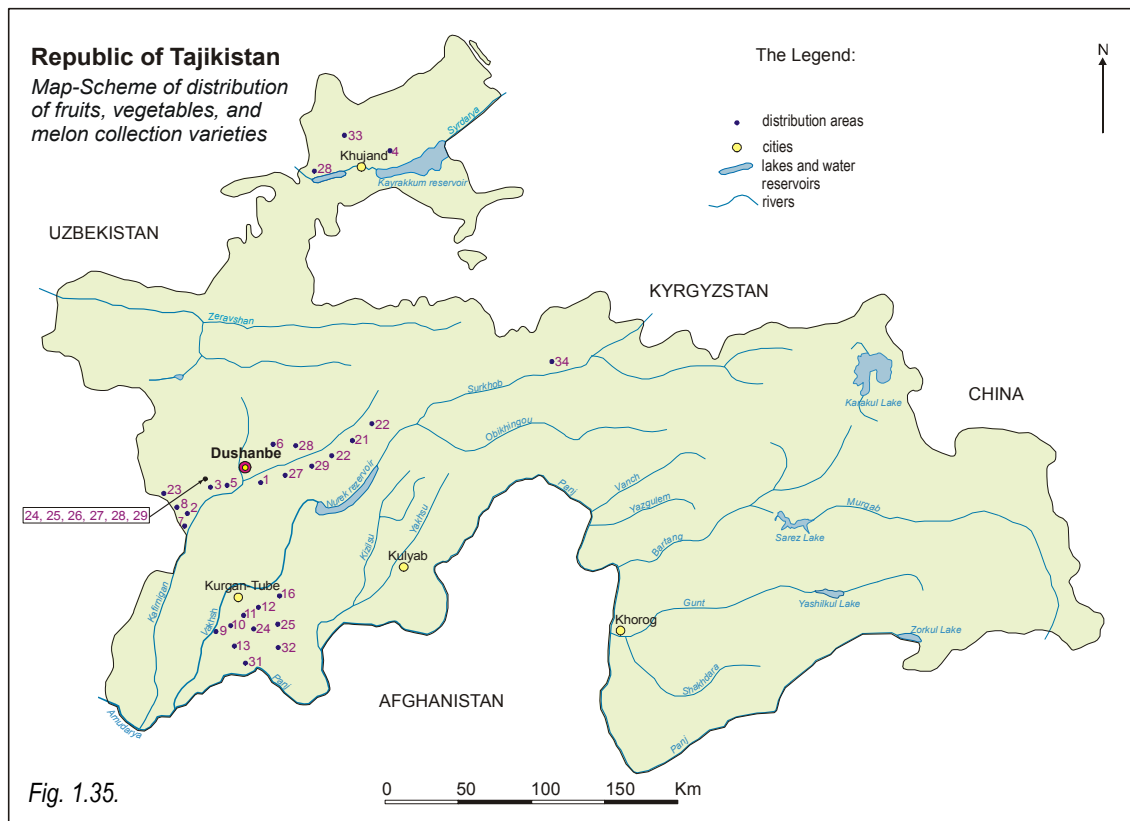


Fig. 1.35. Legend to Map-scheme of Distribution of Fruit, Vegetable and Melon Collections Varieties

| No. | Species  | Local varieties  | Introducent varieties  | Location   |
|-----|--|--|--|--|
| 1   | 2  | 3  | 4  | 5  |
| 1   | Apple-tree ( <i>Malus sieversii</i> (Ldb.) M.Roem) | Pakhtaseb, Peshpazak, Sharaf, Tiramokhi, Tiramokhi surkh, Malika, Amiri, Tobiston, Zardseb, Karsakseb, Safedseb, Kulchaseb, Dulak, Shakarseb | Aport Alexander, Borovinka Tashkent-skaya, Graphenshteinskoe krasnoe, Golden Delicious, Jonathan Delicious, Zolotoe Graim, Pervenetc of Samarkand, Perinka of Lithuania, Parmen zimny zolotoi, Renet Simirenko, white rosemarine, Khosildor, Korei | Faizabad test station of gardening SPE "Bogparvar" |