

# High-altitude ecosystems and Biodiversity of Tajikistan: Conservation and Management

Victor R Squires<sup>1\*</sup> and Neymatolla Safarov<sup>2</sup>

<sup>1</sup> Ecology and Resources Group, Gansu Agricultural University, Lanzhou, China

<sup>2</sup> National Centre for Biodiversity and Bio-safety, Dushanbe, Tajikistan

\* yourman1812@yahoo.com

**T**ajikistan is uniquely placed in Central Asia due to its biogeographic location and rich assemblage of flora and fauna. It is located at the confluence of northeastern Europe, Central Asia, Middle East, and North Africa exhibiting affinities with these regions. At the same time the country has many relic and endemic species of its own, especially the cultivars, and several highly threatened species wildlife which are facing threats due to anthropogenic pressures such as poaching, overfishing, illegal logging, and overgrazing by domestic livestock. These factors stem from socioeconomic conditions of local communities, lack of environmental awareness, poor management capabilities of concerned departments, and lack of transboundary cooperation. Conversion of mixed-farming into mono-crop agriculture has also reduced biodiversity. This paper deals with the present status of conservation in Tajikistan, constraints, and the way forward.

**Keywords:** biodiversity; habitat fragmentation; hot spot; land degradation; mono crop agriculture; poverty; transboundary issues

## Introduction

Tajikistan, the smallest of the Central Asian countries, is landlocked yet uniquely placed in the region at the confluence of several biogeographic regions. At the same time it represents an important centre of origin of cultivated plants. Tajikistan shares its boundaries with Uzbekistan and Kyrgyzstan to the west and north, Afghanistan to the south, and China to the east and is characterized by the prominence of mountains and rivers. Mountains include the towering ranges of the Pamir and Tien Shan containing peaks ranging from 1,300 to 7,495 masl. The Pamirs are the source of several torrential rivers that have carved out gorges and canyons. There are 947 rivers longer than 10 km. The longest among these are the Amu Darya, the Syr Darya, the Zeravshan, the Vakhsh, and the Panj. Tajikistan also contains numerous lakes, among which the biggest is the saline Lake Karakul (in the eastern Pamirs) with a total area of 380 km<sup>2</sup>. The freshwater Lake Sarez (in the western pamir) is the deepest (490 metres) and has an area of 86.5 km<sup>2</sup>. The Hissar-Alay (Southern Tien Shan) ridges are central to Tajikistan

geography, with numerous mountains exceeding 5,000 masl in altitude. Dushanbe, the capital city, is situated in the Hissar Valley at the foothills of the Hissar Mountains. The Tajikistan mountains are noted for their glaciers, probably the largest in Asia. The Fedchenko Glacier is the largest in the Pamir (77 km long and 1,700–3,100 m wide); the Zeravshan Glacier is also noteworthy. The topography is heavily dissected, which makes it difficult to accurately map the fragmented vegetation types. There are no extensive unfragmented areas of rangeland, unlike the extensive steppes in China, Kazakhstan, and the Russian Federation.

The high levels of landscape diversity in the uplands are largely the result of the temporal-spatial variability in the region. The unique geology and terrain, consisting of three major mountain chains separated by valleys and plains, permit a variety of different microclimate, soil, and vegetative conditions, resulting in a broad range of landscapes and unusually high levels of species diversity for the Temperate Zone. Climatic conditions are very diverse, with precipitation ranging from more than 1,200 mm per annum in the wettest areas, to less than 200 mm per annum in the Zeravshan and Pyanj deserts. The Fergana Valley and other lowlands are shielded by mountains from Arctic air masses, but temperature in that region still drops below zero degrees for more than 100 days a year. In the subtropical southwestern lowlands, which have the highest average temperatures, the climate is more arid, although some sections are now irrigated for farming. At Tajikistan's lower elevations, the average temperature range is 23 to 30°C in July and -1 to 3°C in January. In the eastern Pamirs, the average July temperature is 5 to 10°C, and the average January temperature is -15 to -20°C. The average annual precipitation ranges between 700 and 1,600 mm for most of the country. The heaviest precipitation is at the Fedchenko Glacier, which averages 2,236 mm per annum, and the lightest in the eastern Pamirs, which averages less than 100 mm per annum. Most precipitation occurs in winter and spring. Summers are hot and dry in many places, which limits water supply in some upland regions that might otherwise be used for transhumance.

This paper gives an overview of major ecosystems in Tajikistan, including the status of rangelands and their interfaces, major elements of biodiversity, the protected area network and their conservation status. Major threats to conservation and future management strategies are discussed.

## Major ecosystems

The major ecosystems in Tajikistan include forests, woodlands, rangelands (steppe and grasslands), deserts and wetlands. The vegetation changes from steppe communities in the west to semi-desert and desert-like formations in the south. Towards the east, the land rises above the plains with several peaks above 5,000 masl and is enveloped by broadleaf and coniferous forests, sub-alpine and alpine meadows, glaciers and snowfields. The eastern and southern districts are characterized by open, rocky slopes having extensive woodlands dominated by juniper (*Juniperus*) and pistachio (*Pistacia*) species. Lowland forests are found on the floodplains and low river terraces, generally growing on alluvial, swampy, or moist soils. Very few lowland forests have been preserved, although some stands remain. High

mountain meadows are dominated by herbaceous species. About 1,000 vascular plant species are reported from the high mountains with high levels of endemism. Alpine habitats are dominated by dense low-lying perennial plants. Unique communities of cliff and rock vegetation are distributed throughout the high mountains. Approximately 80% of the plant species found in rock and scree communities on limestone ridges are endemic. Wetland ecosystems are found throughout and include river deltas, marshes, swamps, lakes, and streams in alpine regions. A variety of lakes are scattered throughout Tajikistan, from small alpine lakes to significant bodies of water with highly specific fish fauna which attract a variety of waterfowl.

A considerable area in Tajikistan falls under high-altitude rangelands which include alpine meadows and grasslands, largely used for livestock grazing. Other areas such as woodlands and wetlands are also used extensively for seasonal grazing (Strong and Squires 2012). The total area of rangelands and pasturelands in the country is 3.9 million hectares. The largest area under rangelands (60% of the total rangelands in the country) falls in Khatlon and Dushanbe. Most of the rangelands are in hilly and mountainous areas above 2,000 masl. Traditionally, these rangelands have formed the basis of Tajikistan's livestock sub-sector and have been used for centuries in ways that utilize the various altitudinal belts via the system of transhumance grazing (Table 14). In recent times, much of the rangelands at lower elevations (<1,500 masl) have been used for year-round grazing by local communities whose access to more distant pasturelands has been restricted due to changes in tenure arrangements as a result of population increase in most places. There have also been changes in livestock holding patterns and most families own only two to five livestock. Because the majority of the rangelands in the country are located in remote areas, there is most hope for conserving these ecosystems.

**Table 14: Areal extent of rangelands, altitudinal distribution, and season of use in Tajikistan**

Attribute	Season of use			
	Winter	Spring-autumn	Summer	All year
Altitude (masl)	500–1,200	900–1,500	2,200–3,400	500–1,200
Use months	Nov–Mar	Mar–May, Sept–Nov	June–Aug	Jan–Dec
Use days	120–150	90–110	80–90	300–330
Total area (ha)	699,000	675,000	2,081,000	400,000+
Percentage of total rangeland area	18	18	54	10
Distance from villages (km)	0.8–1.4, 4–5	1.2–1.8, to 30	200–600*	<1

\* 6–8 weeks per year are spent travelling between winter and summer pastures

## Biodiversity

The flora and fauna of Tajikistan contain more than 23,000 species of which approximately 1,900 are endemic. Rare and endangered mammals include various gazelles (*Procapra* spp.), the argali (*Ovis ammon*), snow leopard (*Panthera unica*), peregrine falcon (*Falco peregrinus*), paradise flycatcher (*Terpsiphone paradise*), mountain goose (*Anser indicus*), Menzbier's marmot (*Marmota menzbieri*),

Siberian ibex (*Capra siberica*), and others. The Bukhara red deer (*Cervus elaphus*), the Persian gazelle (*Gazella subgutturosa*), and the markhor (*Capra falconeri*) are also listed in the Tajikistan Red Data Book as vulnerable species. A number of birds are equally endangered, including several species of waders, birds of prey, pheasants, cranes, plovers, pigeons, and swifts. Nearly half of the flora and fauna species of the mid-mountain ecosystems are considered endangered. A brief biodiversity profile of Tajikistan is given in Table 15.

**Table 15: Main components of biodiversity in Tajikistan**

Components/attributes	Number
Ecosystem types	12
Vegetation types	20
Flora	9,771 species
Wild relatives of cultivated plants	1,000 species
Endemic plants	1,132 species
Plants listed in the Red Data Book of Tajikistan	226 species
Fauna	1,353 species
Endemic animals	800 species
Animals listed in the Red Data Book of Tajikistan	162 species
Agricultural crops	500 varieties
Domestic animals	30 breeds

One of the reasons for species richness in the country is diversity of habitats ranging from foothill semi-deserts to alpine meadows combined with characteristic mountain forests. Foothills (below 1,800–2,000 masl) are occupied by ephemeroid sagebrush communities (*Artemisia diffusa*, *A. sogdiana*, *Poa bulbosa*, *Carex pachystilis*), which are replaced at higher levels by herbaceous low herb ephemeroid communities (*Poa bulbosa*, *Carex pachystilis*, *Phlomis thapsoides*, *P. bucharica*). Spectacular red tulips (*Tulipa micheliana*) form the characteristic aspect of ephemeroid spring vegetation. In the middle mountain belts, characteristic grasslands are dominated by *Prangos pabularia*, *Ferula* spp., *Inula macrophylla*, *Crambe kotschyana*, and *Paraligusticum discolor*. Grass meadows are widespread at higher elevations of the Zaravshan and Gissar ranges, and fescue (*Festuca alaica*) is a dominant bunchgrass species. Sub-alpine meadows begin at 3,100–3,400 masl, with fescue, *Poa relaxa*, *Puccinella subspicata*, *Nepeta podostachys* and *N. cocanica*.

The woodlands in the country have a variety of wild fruit and nut trees including walnut (*Juglans regia*), maple (*Acer semenovii*, *A. turkestanicum*), pistachio (*Pistacia vera*), hawthorn (*Crataegus turkestanica*, *C. pontica*), mountain ash (*Sorbus tianschanica*), pear (*Pyrus korshinskyi*, *P. regelii*), almond (*Amygdalus communis*, *A. buharensis*), apricot (*Prunus ferganica*, *P. sogdiana*), cherry (*Cerasus mahaleb*), and apple (*Malus sieversii*). Common shrubs include various species of *Rosa*, *Cotoneaster*, *Lonicera*, *Caragana*, *Colutea*, and

*Rhamnus*. Juniper forests grow at the higher altitudes of the mountain ranges dominated by three species of juniper (*Juniperus turkestanica*, *J. seravschanica*, *J. semiglobosa*). The valleys of mountain rivers house riparian forests with dominant trees such as poplars (*Populus* spp.), ash (*Fraxinus sogdiana*), willow (*Salix*), birch (*Betula*), jidda (*Elaeagnus* spp.), and *Tamarix* spp.; and shrubs such as *Hippophae rhamnoides*, *Berberis sphaerocarpa*, and *B. interregima*.

Tajikistan is also home to more than 1,350 species of animals, including 385 species of bird, about 800 of which are endemic to the region, including four bird species. Twenty-two of the 46 reptiles in Tajikistan are endemic to the region. Fourteen amphibian species including two endemic ones, are found in the region. More than 52 species of fish are found in the rivers and lakes, more than a third of which are found nowhere else. The most common mammals in the forested habitats of Tajikistan are wild pig (*Sus scrofa*), various species of rodents, and shrews. Indian porcupine (*Hystrix leucura*) is found at lower altitudes. Predators include wolves (*Canis lupus*), red fox (*Vulpes vulpes*), weasel (*Mustela nivalis*), ermine (*M. erminea*), marten (*Martes foina*), badger (*Meles meles*), otter (*Lutra lutra*), Turkestan lynx (*Lynx lynx*), and Tien Shan bear (*Ursus arctos*). Species more common to the juniper forests and higher altitudes include marmots (*Marmota*), tolai hares (*Lepus tolai*), Turkestan red pikas (*Ochotona rufescens*), juniper voles (*Microtus juldaschi*), and Siberian roe deer (*Capreolus capreolus*).

## Protected areas

Almost 3 million hectares of the country's territory have been designated as natural reserves, national parks, site management areas, tourist and recreation zones, botanical gardens, or stations. The nature reserve Tigrovaya Balka lies along the Vakhsh River delta in southern Tajikistan and is characterized by tugai forests along the Vakhsh and Panj rivers; populations of markhor and Bukhara red deer are conserved in Dashtijum Reserve; and the argali is found and the bar-headed goose nests in Zorkul in southeastern Tajikistan, which includes the protected areas of Zorkul lake islands. The Romit Nature Reserve has practically lost its status as a valuable biodiversity refuge (Box 1).

Around 10% of the unique ecosystems of Tajikistan are situated outside the protected areas. Poor ecological education contributes to irregular use of biological resources. For example, more than 60 species of wild medicinal herbs are used by the population who have no idea that some of them are about to become extinct. New protected areas need to be created in regions where there are none, and corridors need to be created between existing protected areas. The protected status of sanctuaries, which have low levels of protection, needs to be increased in areas that are important for the conservation of biodiversity and which have endangered species and ecosystems. Management and planning in nature reserves needs to be improved by increasing the qualifications of nature reserve staff and elaborating and implementing management plans.

Protecting sites alone will not be sufficient to conserve biodiversity in the long term; conservation of landscapes large enough to allow the persistence of biodiversity must be

### Box 1: Romit: A protected area in Varzob Raion

Romit Reserve is a mountain-landscape nature conservation area of 16,000 ha in the highest protection category. Romit was recognized by the IUCN as a major biodiversity site and is a declared zone of international tourism. The main purpose of the reserve is to study and preserve mesophyllic forest, mountain-steppe, meadow ecosystems, and rare endemic species, including fauna and flora listed in the Red Data Book of Tajikistan. Despite the limited territory of the reserve, it is rich in diversity of species of flora and fauna. The Reserve has about 1,500 higher flowering plants. The vegetation cover is quite diverse and consists mainly of shiblyak, deciduous forest, tall-grass (shroud) semi-savanna, mountain steppe, and alpine and sub-alpine meadows at some places along the upper boundary. Maple and juniper are the main forest-forming species. In addition, there are walnut (*Juglans regia*), Bokhara almonds (*Amygdalus bucharica*), Turkestan birch (*Betula turkestanica*), and many species of plants such as *Allium rosenbachianum*, *Petilium Eduardii*, and *Allium suworowii*. The highlands of the Varzob River basin are mainly savanna type steppe, with small areas of meadow pasture, and the alpine pastures of the Romit River basin are mainly sub-alpine meadows with steppe type tall-grass. Only 500 plant species, including 130 forage plants, have been recorded in the mountainous territory of the Varzob valley (Romit river basin or Kofarnihan) and in Varzob gorge, where there is regular intensive summer grazing. Unfortunately, due to intensive and unregulated grazing, the pastures are heavily contaminated with buzulnik, Rumehs, kotovnik tarragon, and wormwood (*Artemisia* spp.). This type of biodiversity is typical for the river basin of Varzob, the only difference is that in the river basin in the middle of Varzob, the large areas of floodplain are occupied by chinar (*Pinus* spp.) plantations, and willows (*Salix* spp) grow in large areas of the floodplains. Romit home to partridge (*Alectorica kakelik*), quail (*Coturnix coturnix*), a large dove (*Streptopelia orientalis*), ringdove (*Solimba palumbus*), kestrel (*Falco tinnunculus*), golden eagle (*Aquila chrysaetus*), owl (*Bubo vito*), splyushka (*Otus scops*), ordinary starling (*Sturnus vulgaris*), Himalayan snow cock (*Tetraogallus himalayensis*), Himalayan merganser (*Mergus merganser*), and other birds. The mammals include a stone marten (*Martes foina*), ermine (*Mustel erminea*), weasel (*Mustela nivallis*), badger (*Meles meles*), wolf (*Canis lupus*), fox (*Vulpes vulpes*), lynx (*Felix lynx isabellina*), wild boar (*Sus scrofa*), Siberian ibex (*Sarica sibirica*), tolai rabbit (*Lepus tolai*), and long-tailed marmot (*Marmota caudata*). Reptiles include the viper (*Vipera lebetina*), copperhead (*Ancistrodon halys caraganus*), non-venomous spotted whip snake (*Hemorrhoids ravergieri*), patterned snake (*Elaphe diene*), and sand boa (*Ehuh* sp.). The rivers are home to fish such as the marinka (*Schizothorax intermedius*), trout (*Salmo trutta oxianus*), and Turkestan catfish (*Glyptosternon reticulatum*). Sadly, the value of the Reserve has been compromised by unregulated grazing, wood gathering, and illegal hunting.

anchored on core areas, embedded in a matrix of other natural habitat and anthropogenic land uses. A preliminary assessment of such landscapes within Tajikistan should be carried out to identify and delineate suitable sites based on the following criteria: coverage of representative sites, existence of large-scale intact biotic assemblages (all the living things within an environment: plants, animals, invertebrates, birds, and micro-flora and fauna), needs of wide-ranging (landscape) species, connectivity of habitats, and opportunities for maintaining ecological and evolutionary processes. Areas that should be considered include intact rivers and landscapes, natural mountain passes, known migratory corridors, and areas

with spatial heterogeneity that could serve as stepping stones for many species. Other factors to be considered are the range of habitats represented, resilience to anthropogenic development scenarios, and the need to safeguard as yet unstudied areas that might harbour high levels of biodiversity or endemism. Remote sensing and GIS are important tools and the results of the initial studies in Tajikistan (and elsewhere) illustrate the value of such an approach (Akhmodov 2008).

Most species are best conserved through the protection of the sites in which they occur. Sites are physically and/or socioeconomically discrete areas of land that need to be protected to conserve the target species. Sites are scale-independent, which means they can be very small or very large. The defining characteristic of a site is that it is an area that can be managed as a single unit. Sites can be any category of protected area, government land, or private farm. The main objective of defining important sites for conservation of threatened species is to identify areas where investments can be made to create protected areas or special conservation regimes, expand existing protected areas, and/or improve protected area management, all of which will help to prevent species extinctions and biodiversity loss.

International hunting is organized for argali (*Ovis ammon*), Siberian ibex (*Capra sibirica*), urial (*Ovis vignei*), and Tajik markhur (*Capra falconeri*). Overhunting of legal game species and poaching of rare species is widespread, especially in the mountain regions. Government agencies set quotas for game species without carrying out appropriate research on game numbers or population dynamics. Thus quotas are often too high to ensure that viable populations of game animals (mostly ungulates like argali and Siberian ibex) are maintained. In the last ten years, poaching alone caused a drop in numbers of argali and Siberian ibex by 50%.

Nature reserves are neither equipped nor authorized to control poaching outside of protected areas. The limitations of enforcement capabilities also lead to uncontrolled hunting, for example of snow leopards (*Uncia uncia*), within so-called protected areas (Jackson 2012). Measures to reduce poaching include building capacity (training, equipment, transportation) of existing services, inspection agencies, and NGO groups to patrol areas where poaching is prevalent. Harvesting of animal parts, such as horns and antlers for oriental medicines and snow leopard (*Uncia uncia*) skins for decoration, threatens several endangered species. Poaching and unsustainable hunting are rampant in nearly all areas. Vipers (*Vipera lebetina*) have long been exploited for their venom, but have been hunted almost to extinction in the first decade of the twenty-first century. The mountain forests of Gissaro-Alai play a crucial role in preventing wind and water erosion. During the past two centuries, much of the natural woodland in this ecoregion has been cleared for fuelwood and overgrazed by an increasing number of domestic cattle, causing soil erosion (Akhmadov 2008). Agriculture, grazing, forestry, extractive industries, building construction, and recreation have caused the greatest impact on these mountain ecosystems. Many foothill ecosystems have shown a marked decline in biodiversity.

The ungulates, wild sheep and goats, are the most affected by human influence in this ecoregion. Wild goats are threatened primarily from traditional hunting by the local population, but they are also prized trophies for foreign hunters. In addition, the urial faces threats from loss of habitat and grazing land due to competition from flocks of domestic livestock, as the majority of land in the ecoregion is used for sheep pasture, in some areas year round.

## Threats to biodiversity

The biodiversity of Tajikistan is being lost at an alarming rate. On average, nearly half of the lands in the major biodiversity sites have been transformed by human activities. The plains, foothills, and sub-alpine belts have been the most heavily impacted. Native floodplain vegetation remains on only half of its original area, and only 2-3% of original riparian forests remain. Most natural old growth forests have been fragmented into small sections, divided by areas of commercial forests or plantations as well as agricultural and developed lands. For Tajikistan as a whole, less than a quarter of the region remains in reasonable condition, while less than 10% of the original vegetation, including forests, can be considered pristine. Numbers of large native herbivores such as wild sheep, camels, and asses have dropped dramatically over the past century as have carnivores such as red marmot (*Marmota caudata*), muskrat (*Ondatra zibethica*), fox (*Vulpes vulpes*), badger (*Meles meles*), snow leopard (*Uncia uncia*), and wolf (*Canis lupus*), which is being over hunted and placed at risk. Data on reptiles, birds, and fish are not easy to obtain, but doubtless many species have been lost or are in danger of extinction (at least locally).

**Illegal logging, harvesting of fuelwood, and the timber trade** threaten biodiversity in the region's forests and lead to habitat degradation. While officially-sanctioned logging has actually decreased in some areas over the past few years, illegal logging persists. Illegal logging leads to a decline in species composition, forest degradation, and overall habitat loss, impacting a number of plant and animal species. Rural populations are largely dependent on fuelwood for heating and cooking. Harvesting of fuelwood has increased nearly three times in some areas compared to even a decade ago as a result of energy shortages and the economic crisis, which leads to forest degradation and the disappearance of certain species.

**Overgrazing** is causing environmental damage over much of the Tajikstan rangelands. The number of sheep grazing on the winter ranges and steppes and semi-deserts has nearly tripled over the past two decades. Intensive grazing has resulted in reduced species diversity and habitat degradation. A large portion of the pasturelands in Tajikstan are subject to erosion. Secondary plant communities now occupy 80% of the rangelands in the sub-alpine belt. Grazing of cattle in forested areas disturbs the undergrowth and creates competition for wild ungulates.

## Strategies for management

**Developing new models for sustainable resource uses:** Measures to prevent overgrazing include developing sustainable rangeland management plans, enforcing restrictions on grazing in protected areas, and prohibiting grazing in damaged fields near rivers and on steep slopes. Developing opportunities for alternative sources of income would reduce the need to keep large numbers of livestock in some rural communities (Strong and Squires 2012; Lerman 2012). Examples of alternative income generation include ecotourism, sustainable collection and sale of medicinal plants and other non-timber forest products, and sustainable hunting and fishing.

**Building the capacities and awareness of local communities for the sustainable use of resources:** NGOs and other civil institutions can work with local communities to develop the capacity for alternative livelihoods. Sustainable resource use also entails reducing the impacts of development on the environment and biodiversity. Civil society can play an important role in monitoring these impacts and providing objective information on pressing conservation issues. Finding ways for rural communities to benefit from nature conservation through sustainable resource use will boost local economies, helping reduce pressures on biodiversity. Involving NGOs in planning and monitoring development projects will ensure that long-term economic endeavours take into account the consequences to biodiversity. Rural populations – those with a direct link to natural resource use – are generally the least informed on conservation issues. By focusing awareness strategies in target corridors, these rural communities will gain knowledge that will last a lifetime, empowering them to make informed decisions about their environment.

**Demonstrating sustainable resource use:** Investments to demonstrate sustainable resource use might involve evaluation and implementation of models for sustainable forestry, water use, and rangeland management. It could start by identifying communities within the selected corridors that have the desire to participate in model projects. The steps are (1) build capacity in these model communities through training and technical support; and (2) elaborate guidelines for sustainable resource use and implement in model areas. International donors have provided considerable support to help resolve some of these issues. Funding opportunities exist, particularly in promoting transboundary cooperation, training conservation professionals, building environmental awareness, and demonstrating the benefits of sustainable resource use.

After the breakup of the Soviet Union in 1990, Tajikistan faced the challenge of building new governmental structures. New state institutions dealing with natural resources were created, while others were dismantled or reorganized. Various line ministries, forestry, water resources, agriculture, and other agencies also have jurisdiction over various aspects of natural resources. Ministries generally have regional divisions in each of the provinces within the country. State conservation agencies, however, often lack the funding and capacity to implement their mandates or to enforce legislation and international obligations. Conflicting

policies in legislation and overlapping jurisdictions, in addition to a general lack of communication among governing bodies, hinder effective management of environmental resources and create significant contradictions in regulation. Transboundary cooperation on environmental issues is limited. Tajikistan has signed the majority of international conventions, including the Convention on Biological Diversity, Convention on Desertification and Drought, Wetlands of International Importance, Convention on International Trade in Endangered Species (CITES), and World Cultural and Natural Heritage, but does not have the capacity and finances to fulfil its international obligations. Following accession to the UN Convention on Biological Diversity and the approval of the National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity (Government Resolution No. 392 of RT of 01.09.2003), the National Centre for Biodiversity and Bio-safety (NCBB) was established. This is the interagency coordination unit for assessing and protecting pasture biodiversity, but interagency coordination is not easy. There are severe budget constraints and a lack of properly trained staff.

Planning issues pertinent to rangeland biodiversity use, conservation, and functional activity, should be the responsibility of 'hukumats' (local government at the district level), with interagency coordination by the Ministry of Agriculture (MoA). There are units within the MoA related to grazing and biodiversity who are also assigned biotechnical activities as diverse as seed production and measures to ensure the long-term sustainable use of forest biodiversity. The Ministry of Agriculture, together with the Pasture Trust, should join the NCBB to unite efforts to improve pasture biodiversity. The Committee for Land Management Geodesy and Cartography (CLMGC) handles land transfers and should do so according to the season of use and with proper cadastral registration. Such actions by existing state institutions could do much to improve the situation in Tajikistan's rangelands and pasturelands.

Further, there is no single coordination system between departments, and no common strategy to engage with pasture users in a meaningful way. Plant biodiversity, even as it relates to valuable forage species and weedy and poisonous plants, is neglected. Training systems and university level instruction are also quite divorced from practical pasture studies, especially in the species composition aspects of rangeland biodiversity. The important issue of preserving biodiversity as a part of grazing management and assessment of the adverse effects of overgrazing on the biodiversity of rangelands, especially the impact of use on forest biodiversity, are often overlooked when short-term gains are uppermost in people's minds. Neither the forest authority who benefits from leasing out the land, nor the livestock owner who needs access to better pasture, is sufficiently concerned to monitor the situation and regulate grazing pressure or entry and exit dates if overuse is detected.

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