Initial Environmental Examination

April 2021

Uzbekistan: Partial Credit Guarantee Facility for Uzbekistan Solar PPP Program

Appendix 3.1(b): Annex 4 Botanical Assessment

Prepared by the Ministry of Energy of the Republic of Uzbekistan for the Asian Development Bank.

INFORMATION REPORT
Evaluation of the current state of the flora and vegetation in the Sherabad Solar IPP project territory (Surkhandarya Province, Uzbekistan)

Accomplished by: **N. Yu. Beshko,**
PhD in biology

The survey of the project territory Sherabad Solar IPP (Surkhandarya Province) was carried by botanist N. Yu. Beshko, PhD in biology, in March 2020, as part of comprehensive biological research, to evaluate the current state of the flora and identify rare, endemic and invasive plant species.

General specifications of the study area

The project territory encompasses a site 600 ha in area designated for the construction of a solar power station, transformer substation (15.3 ha) and power transmission line (49.2 km). The study area is located in Surkhandarya Province of Uzbekistan, in the Surkhandarya intermountain depression (Surkhan-Sherabad valley) enclosed by the ranges of Pamir-Alai from the north, west and east and bordered by the Amudarya from the south.

The climate of the Surkhan-Sherabad valley is conditioned by orography and the situation in the southernmost part of Uzbekistan. The mountains protect the area from cold northern air masses, while hot and dry air can easily penetrate into the region through the open south side. According to Köppen-Geiger climate classification (http://koeppen-geiger.vu-wien.ac.at/alps.htm), the region is located in the cold semi-arid zone (BSk). Average annual temperatures range between 16.6°C and 17.5°C, average temperatures in January – 3.6—3.9°C, in July – 29.3—29.9°C, average annual precipitation – 196—155 mm (all based on the observations of weather stations in Sherabad and Termez), absolute temperature minimum – 23.9°C, absolute maximum +47.0°C.

Due to high temperatures and low humidity, intense chemical and physical weathering plays a significant part in the formation of the region's landscape. According to the altitudinal zonation used in Uzbekistan (Geographic Atlas of Uzbekistan, 2012), the study area belongs to the *chul* (plains) and *adyr* (foothills) zones. The true altitudes of the terrain in the study area range from 297 m above sea level in the Sherabad valley to 595 m a. s. l.

The site on which the construction of the Sherabad Solar IPP solar power station (600 ha) is planned is located in Sherabad District of Surkhandarya Province, on the Karakyr Upland (369 m above sea level) between the villages of Talashkan and Baikishlak, at the foot of the Kelif-Sherabad Ridge. The landscape is a gentle piedmont composed of Quaternary proluvial deposits. The soil consists of virgin and fallow sandy and loamy sierozems, in places mixed with stones, salt or gypsum. Aridity and severe water scarcity hinder the development of both irrigation- and rain-based farming. However, in the Soviet period, an unsuccessful attempt was made to develop agriculture in this territory. Currently, this site is used to pasture livestock and uncontrollably dump household and construction waste.

The territory designated for the construction of a power transmission line 49.2 km long is located in the lower reaches of the Surkhandarya River, on the right side of the valley. The power transmission line goes from west to east, crossing an extensive area of irrigated agricultural land

in the Sherabad valley, the Karasu River (a branch of the Sherabad River), the Khaudag Ridge with a maximum altitude of 553 m above sea level and the Kattakum sands, and reaching the existing transformer substations north of the city of Jarkurgan.

According to the current phytogeographical zonation in Uzbekistan (Tojibaev et al., 2016; Tojibaev et al., 2017), the study area belongs to the Surkhan-Sherabad region, Western Hissar district, Mountain Central Asian province. This phytogeographical region encompasses the Surkhan-Sherabad valley broadening from north to south and the foothills of the Hissar, Kugitang and Babatag Ranges surrounding it.

Like other intermountain valleys in Central Asia, the Surkhan-Sherabad valley is an ancient agricultural oasis that has been used by man for many centuries, with a number of human settlements (mainly villages) located in the area. All areas suitable for farming are used to cultivate crops or as gardens. Thus, most of the study area consists of anthropogenic landscapes (agrolandscape, residential and industrial landscape), which means that, according to GOST 17.8.1.02-88 'Nature protection. Landscapes. Classification,' it can be classified as a strongly impacted landscape. All virgin and fallow lands are used actively by the local population for pasturing, including the territory designated for the construction of the solar power station and power transmission lines. In fact, the entire Surkhan-Sherabad valley is largely impacted by human activities. Some natural landscapes, degraded by grazing, still exist in the Kattakum sands, in the Khaudag Ridge, in the strip of foothills and, fragmentarily, in the floodplain of the Karasu River. According to GOST 17.8.1.02-88 'Nature Protection. Landscapes. Classification,' they can be classified as slightly or moderately impacted landscapes.

According to the vegetation typology used in Uzbekistan (The Vegetation of Uzbekistan and Rational Ways to Use It, 1971–1984; Geographical atlas of Uzbekistan, 2012), the following vegetation types can be recorded on the project territory: psammophilous plants in sand deserts (Psammophyta); gypsophilic plants (Gypsophyta) and cultivated plants on irrigated lands; small areas with halophytic plants (Halophyta) in solonchaks, *tugai* vegetation in river valleys (Potamophyta) and secondary weed associations. The basic psammophilous associations in the Kattakum sands consist of saxaul and Calligonum (*Calligonum microcarpum*, *Haloxylon persicum*, *H. ammodendron*) and ephemeral plants and bindweeds (*Convolvulus hamadae, Poa bulbosa, Carex physodes, Bromus tectorum*). Ephemeroid-saltwort (*Salsola orientalis, Poa bulbosa, Carex pachystylis*) and ephemeroid-wormwood (*Artemisia diffusa*, *A. sogdiana, Poa bulbosa, Carex pachystylis*) associations typical of gypsum deserts predominate in the Kelif-Sherabad Ridge.

Despite the harsh environmental conditions and strong anthropogenic pressure, the flora of this region is quite rich and has a high level of endemism. The current (unpublished) list of plants inhabiting the Surkhan-Sherabad phytogeographical region includes 790 species of vascular plants from 352 genera and 73 families. This region is characterised by a number of extremely rare endemic and subendemic species associated with the outcrops of variegated rocks in the Kelif-Sherabad Ridge, the Khaudag Ridge and the Kattakum sands. In total, 91 species listed in the Red Data Book of Uzbekistan grow in Surkhandarya Province, 19 of which were recorded in the study area, according to literary sources and herbarium materials (Appendix 1). Some of these species have been recorded only on few occasions (or even single individuals have been found), and no records have been made over the past few decades, despite numerous purposeful attempts to find them. These include *Allium rhodanthum* Vved. and *Dipcadi turkestanicum* Vved. – two strictly local endemics found in fixed sands at the foot of Khaudag, which are, probably, currently extinct and referred to category 0 in the Red Data Book of Uzbekistan (2009, 2019). The Red Data Book of Uzbekistan also includes some rare species

found in the Kelif-Sherabad Ridge, such as *Astragalus rubri-galli* Popov, *Phlomoides baburi* Adylov, *Zygophyllum bucharicum* B. Fedtsch. and others. The last species is also present in the IUCN Red List as CR B1ab(iii)+2ab(iii) (https://www.iucnredlist.org/species/63490/12668615). The list of rare species in the study area compiled on the basis of archival material is available in Appendix 1.

According to the applicable legislation of the Republic of Uzbekistan, special permits are required to use species listed in the Red Data Book of Uzbekistan, increased fees for their removal from their natural environment and special increased fines for damaging the Red Book species (depending on their status in the Red Data Book of Uzbekistan) are imposed (Resolution of the Cabinet of Ministers of the Republic of Uzbekistan issued on 20 October, 2014, No. PP-290 'On the regulation of the use of biological resources and permit issuing procedures in nature management' (as amended on December 15, 2017) (Appendix 2). There is no special procedure to obtainment permits for plant species present in the IUCN Red List but not listed in the Red Data Book of the Republic of Uzbekistan, while fees and penalties are the same as those for ordinary species that are not listed in the Red Data Book.

State of knowledge of the plant world of the territory [in Russian]

Начальной точкой в изучении растительного района исследований является 1881 год, когда экспедиция знаменитого российского ботаника немецкого происхождения Альберта Регеля прошла по маршруту Термез–Шерабад–Гузар. В этом же году район Шерабада посетили французские ботаники Капю (Capus) и Бонвало (Bonvalot). В 1884–1886 г.г. Регель со своим ассистентом Мусой Махмудом Рузи вновь проводили исследования на территории современной Сурхандарьинской области Узбекистана. Регель, Капю и Бонвало собрали большой гербарный материал, на основе которого было описано множество новых для науки видов растений, в том числе и представители флоры изучаемой территории. Основным местом хранения сборов Регеля является Гербарий Ботанического института им. Л.В. Комарова РАН в Санкт-Петербурге (LE). Сборы Капю и Бонвало хранятся в крупнейшей гербарной коллекции мира – Гербарии Национального музея естественной истории в Париже (P).

В 1897 году в данном регионе побывали российские ботаники В.И. Липский и С.И. Коржинский, собравшие несколько тысяч образцов гербария. В фундаментальной работе Липского «Горная Бухара» (1902–1905) приводятся сведения о географии и растительном покрове местности, а его труд «Флора Средней Азии» (1902–1905) является источником сведений обо всех ботанических исследованиях, проводившихся в данном регионе в XIX и начале XX века (включая обзор ботанических коллекций и обзор литературы того периода по флоре Средней Азии). Кроме того, В.И. Липский описал несколько новых для науки видов из данного региона.

В первой половине XX века в данном регионе работал целый ряд почвенно-геоботанических и ресурсоведческих экспедиций, в которых принимали участие ведущие ботаники того времени. Помимо описания и картирования растительного покрова и изучения запасов различных ресурсных растений, в результате этих экспедиций были сделаны богатые гербарные сборы и описано много новых для науки видов, в том числе эндемичных и включенных в настоящее время в Красную книгу Узбекистана. Собранный гербарный материал хранится в Национальном гербарии Узбекистана (TASH) в Ташкенте и в LE в Санкт-Петербурге. Важнейшие исследования того периода кратко освещены ниже.

В 1914–1916 г.г. в составе организованных Переселенческим управлением почвенно-геоботанических экспедиций в Сурхан-Шерабадской долине и юго-западных отрогах Гиссарского хребта побывали М.Г. Попов, Е.П. Коровин, М.В. Культиасов. Основной задачей этих экспедиций являлось составление почвенных карт и карт растительности изучаемого региона. Основные результаты исследовательской деятельности издавались на страницах периодической печати или в специальных изданиях Переселенческого управления (серии «Предварительных отчетов почвенно-ботанических экспедиций» и «Трудов почвенно-ботанических экспедиций»). По результатам данных экспедиций М.Г. Попов опубликовал работы «Новые и редкие растения Бухары» (1916) и «Флора пестроцветных толщ краснопесчаниковых низкогорий Бухары» (1924), в которых приводится характеристика растительного покрова пестроцветных низкогорий юга Средней Азии от Келифа и Шерабада на западе до Куляба и Бальджуана на востоке, дается перечень фоновых и эндемичных видов растений и описание целого ряда новых для науки видов, а также анализируются био-экологические особенности растений-обитателей гипсоносных пестроцветных толщ. Данные о некоторых новых видах из этой территории приводятся также в совместной статье Е.П. Коровина, М.В. Культиасова и М.Г. Попова «Описание новых видов растений, собранных в Туркестане» (1916). Материалы этих исследований также были использованы Е.П. Коровиным в его

фундаментальной монографии «Растительность Средней Азии и Южного Казахстана» (1934, 1961–1962), других работах (1927, 1928, 1941, 1947) и при составлении карты растительности Узбекистана (1949).

В 20-30-х годах XX века по заданиям землеустроительных, сельскохозяйственных и водохозяйственных организаций Институт почвоведения и геоботаники Среднеазиатского гос. университета (САГУ) развернул систематическое и детальное обследование почвенного и растительного покрова Средней Азии, основной целью этих исследований было картирование растительности и почвенного покрова, изучение ресурсов природных пастбищ как базы для развития животноводства и наиболее рациональное хозяйственное районирование территории. Одна из геоботанических экспедиций в течение нескольких лет работала в бассейне Сурхандарьи. В частности, в 1924–1928 г.г. М.Г. Попов и А.И. Введенский проводили геоботанические исследования в Сурхан-Шерабадской долине. В 1931 году в составе землеустроительной почвенно-ботанической экспедиции растительность Байсунского и Шерабадского районов изучал Н.А. Меркулович (в составе экспедиции участвовали также ботаники Т.Т. Ашурова и П.Т. Гомерова и почвовед А.И. Измайлова). В его работах «Ботанико-географический очерк южной части Гиссарского хребта с картой растительности» (1935) «Растительность Шерабадского и Байсунского районов» (1936) приводится характеристика растительного покрова данной территории и подробное описание видового состава растительных сообществ, а также геоботаническая карта. Гербарные образцы, собранные данной экспедицией (более 300) хранятся в TASH.

В 1931 г. комплексная экспедиция по изучению сорных растений Средней Азии посетила хребет Кугитанг (преимущественно его туркменистанскую часть). В данной экспедиции принимал участие С.А. Невский, опубликовавший впоследствии свою работу «Очерк растительности Кугитанг-тау и его предгорий» (1937), в которой привел список из 588 видов растений и детальную характеристику основных растительных сообществ, а также предложил схему высотной поясности и описал несколько новых видов растений. Долгое время эта работа оставалась практически единственной сводкой по флоре Кугитанга и Келиф-Шерабадской гряды.

В 1934 году полевые геоботанические исследования в Байсунских горах и Сурхан-Шерабадской долине проводила Е.М. Демурина (около 200 гербарных образцов и полевые дневники хранятся в TASH). В 1940–1941 г.г. Л.И. Попова, А.П. Васильковская и Г.Ф. Протопопов изучали растительный покров пестроцветных низкогорий Байсунского и Шерабадского районов. Ими была составлена геоботаническая карта и собрано более 2 тыс. образцов гербария (хранится в TASH). В 1964–1966 г.г. в Сурхандарьинской области работала геоботаническая экспедиция Узгипрозема (А.В. Каюмов, Х.Ю. Ачилов и Х. Бойкабулов), по результатам которой была составлена карта растительности масштаба 1:200000, гербарные сборы хранятся в TASH.

Данные флористических исследований второй половины XX века представлены также в работах Джумаева (1974), Камелина и Хасанова (1987). Краткий анализ особенностей флоры изучаемой территории с оценкой показателей видового богатства и эндемизма, а также обзор истории ботанических исследований представлен в монографии Р.В. Камелина «Флорогенетический анализ естественной флоры горной Средней Азии» (1973). Общие сведения о растительности территории (в том числе геоботанические описания) приводятся в 4-томной коллективной монографии «Растительный покров Узбекистана и пути его рационального использования» (1971–1984).

В 2012–2013 г.г. Институтом генофонда растительного и животного мира АН РУз (ныне Институт ботаники и Институт зоологии) был реализован проект «Кадастр краснокнижных видов флоры и фауны Ташкентской и Сурхандарьинской областей Узбекистана» (государственный грант № И5-ФА-1-11821), в результате которого были установлены координаты и численность популяций 85 видов флоры Сурхандарьинской области, внесенных в Красную книгу Узбекистана (2009), еще 6 редких видов, известных для Сурхандарьинской области по гербарным данным, обнаружены не были. В отчете данного проекта указаны местонахождения редких видов изучаемой территории.

В 2017–2019 г.г. в ходе проектов ФЗМВ-2016-0914113123 «Систематика двудольных растений природной флоры Узбекистана» и П3-20170925347 «Сеточное картирование флоры западных отрогов Зеравшанского хребта и идентификация ключевых ботанических территорий» Институтом ботаники был составлен список флоры Сурхан-Шерабадского ботанико-географического района из 790 видов сосудистых растений из 352 родов и 73 семейств (не опубликован, содержится в отчетах указанных проектов).

Важными источниками информации по видовому составу, географическому распространению и экологии сосудистых растений Узбекистана в целом и его отдельных географических регионов (включая изучаемую территорию Сурхан-Шерабадской долины) являются две фундаментальные сводки, «Флора Узбекистана» и «Определитель растений Средней Азии».

Шеститомное первое издание «Флоры Узбекистана» вышло из печати в 1941–1962 г.г., оно включало информацию по 4148 видам растений, зарегистрированных на тот период для Узбекистана (из них 3663 – аборигенные, 485 – заносные и интродуцированные). Для каждого вида указывалось распространение по административным областям (согласно административно-территориальному устройству того периода). С 2016 года Институтом ботаники Академии наук Узбекистана была начата работа по подготовке нового, обновленного издания национальной «Флоры». К настоящему времени опубликованы три тома новой «Флоры Узбекистана», включающие обработку 15 семейств с 58 родами и 376 видами и подвидами (Сенников, 2016, 2017, 2019). Одним из главных достоинств нового издания «Флоры Узбекистана» является детальная информация о распространении видов по ботанико-географическим округам и районам страны согласно современной схеме районирования (Тожибаев и др., 2016), включая цитирование гербарных сборов по каждому виду и точечные карты распространения.

В 1968–1993 г.г. был издан 10-томный «Определитель растений Средней Азии», в работе над которым приняли участие все ведущие специалисты по флоре Средней Азии. Последний, одиннадцатый том «Определителя» был опубликован в 2015 году под редакцией проф. Ф.О. Хасанова. В нем помимо сквозного указателя ко всем томам, были приведены новые виды и новые местонахождения, описанные или ставшие известными после публикации соответствующих томов.

Survey methods

The survey of the vegetation cover was carried out using generally accepted transect field geobotanical and floristic methods, which are widely utilised in the mapping of vegetation, the studying and monitoring of pastures, in environmental and engineering surveys, as well as in the monitoring of the flora of protected areas (Field Geobotany, 1959–1976; Guidelines, 1980; СП 11-102-97, 1997). Areas where the composition and structure of phytocoenoses were described include the Karakyr Upland, a strip along the prospect and existing power transmission lines in the Sherabad Valley, the Khaudag Ridge, the Kattakum Sands and the Kelif-Sherabad Ridge (secondary areas where the vegetation is not going be affected during the construction). A standard botanist's range of field tools and instruments was used in the field survey: herbarium sheets, a plant press, a reflex camera (Canon EOS 550D), a tool to dig up plants, a 50-metre tape measure and standard geobotanical description blanks. A Xiaomi Mi8 SE smartphone with free applications MapsMe and GPS Status was used to navigate and take digital geotagged photos. A binocular optical microscope (Bresser stereo microscope Advance ICD 10-160x, made in Germany), dissecting needles, specialist literature (including «Определитель растений Средней Азии» - A Guide to the Plants of Central Asia, «Флора Узбекистана» - The Flora of Uzbekistan and others) and the collections of the National Herbarium of Uzbekistan TASH (including digital ones) were used to process material and identify the species of collected herbaria in a laboratory.

The identification of plant associations was based on the identification of predominating species. The general plant cover (in %) was established visually. Sites were photographed and all plant species were recorded, their abundance was established visually using the Braun-Blanquet vegetation cover scale. Also their phenological stage and condition (normal or depressed) were identified. In case of rare plant species, their coordinates were recorded, the area occupied by a population was established and all specimens were counted.

Currently, the classical Braun-Blanquet scale (Braun-Blanquet, 1951) is the commonest instrument used to estimate species abundance. This method, which allows for a quick and sufficiently precise evaluation of the role of this or that species in a plant community, divides plants into several groups based on their abundance and occurrence:

+ – low number of individual plants, cover area 1%;
1 – high number of individual plants, cover area 1–5%;
2 – high number of individual plants, cover area 5–25%;
3 – any number of individual plants, cover area 25–50%;
4 – any number of individual plants, cover area 50–75%;
5 – any number of individual plants, cover area 75% and higher.

Usually, three degrees of degradation (anthropogenic impact) – weak, moderate and strong – are identified when evaluating plants' ecological condition. This evaluation is carried out by experts as part of a field survey. Direct and indirect signs of anthropogenic impact on vegetation and soil (such as the ploughing of soil, traces of the use of heavy machinery, livestock grazing, haymowing, high proportion of weeds and adventitious plants and others) are taken into account. Plants are classified as weedy and adventitious based on available published data (Nikitin, 1983; CABI: Invasive Species Compendium, 2017; Sennikov et al., 2018).

Weak degradation is characterised by slight worsening of vegetation's state, including the presence of individual synanthropic (weedy) plant species, slight worsening of the plants' state and decrease in the abundance of some species sensitive to anthropogenic impacts, a slight decrease in the projective cover and productivity of pasture vegetation. Plant communities are

represented by aboriginal plant associations and are quite complete in structure and composition, where most species are in good living conditions and reproduce themselves properly. They retain the ability to self-restore under existing pressures.

In moderate degradation negative changes in the structure and composition of plant communities are quite noticeable. The proportion of xerophytic, ephemeral and weedy plants grows, some of them becoming subdominants or co-dominants; the state of natural dominants worsens, their reproduction drops; the projective cover and productivity of pasture vegetation decreases noticeably. Self-restoration is possible if the anthropogenic pressure is reduced.

In strong degradation the structure and composition of a community are heavily changed, so that even in some communities aboriginal plants are completely replaced by secondary ones. Natural dominants are crowded out by ephemeral, inedible and weedy species. All plants (except weeds) are in a depressed state. The projective cover and productivity of pasture vegetation are low. Self-restoration is possible only if anthropogenic pressure is stopped for a long period of time; special steps to revegetate the area are required.

Currently, there are no legal guidelines or standards in Uzbekistan to evaluate the ecological condition of vegetation (similar to the 'Estimation criteria for an environmental situation in a territory to identify environmental emergency areas and environmental calamity areas' in the Russian Federation and an identical regulatory document in the Republic of Kazakhstan providing quantitative criteria to evaluate the condition of vegetation). These criteria can be found in Appendix 3.

According to the abovementioned documents, moderate degradation criteria are characterised by changes in the population density of species – indicators of anthropogenic pressure – by up to 20% in relation to the background conditions, strong degradation criteria – changes by 20—50% in relation to the background conditions. In the study area degradation indicators are the following pastoral, segetal and ruderal weeds: species from the genera *Aegilops*, *Amaranthus, Atriplex, Carthamus, Centaurea, Ceratocephala, Chenopodium, Cirsium, Cuscuta, Heliotropium, Hypecoum, Onopordum, Xanthium;* species *Artemisia scoparia, Bromus tectorum, Capparis spinosa, Ceratocarpus arenarius, Diarthron vesiculosum, Erodium cicutarium, Hordeum murinum* subsp. *leporinum, Hulthemia persica, Lagonychium farctum, Papaver pavoninum, Peganum garmala, Picnomon acarna, Roemeria refracta, Salsola paulsenii, Taeniatherum caput-medusae (T. crinitum).*

After the field research material was processed in a laboratory, lists of plants recorded in each of the studied sites were compiled. Since the research was carried out in early spring, these lists are far from being complete. To make a complete list of plants growing in the study area, more research is needed to be carried out in late spring—early summer and in early autumn.

The names of plant species are given in Russian and Latin. The Latin names are arranged in the alphabetical order, in accordance with the international taxonomic databases The Plant List (www.theplantlist.org), International Plant Names Index (www.ipni.org), Catalogue of Life (www.catalogueoflife.org). Given in brackets are their synonyms, according to «Определитель растений Средней Азии» (A Guide to the Plants of Central Asia) (1968–1993) (optional).

Each species in the list is provided with additional information, such as life form (tree, shrub, subshrub, pnl herb, biennial or annual), phenological stage, living state (normal or depressed), biotope and status. The status column indicates species listed as threatened in the Red Data Book of Uzbekistan or IUCN Red List, those planted by man, as well as adventitious

and weedy species, including quarantine weeds listed as quarantine objects in Uzbekistan. The statuses of adventitious (brought to the country by chance) and weedy species are based on available sources (Nikitin, 1983; IUCN/ISSG, 2014; CABI, 2017; Sennikov et al., 2018).

The following abbreviations are used in the tables to indicate life forms: tree – tree, shb – shrub, sshb – subshrub, pnl – pnl, bnl – biennial, anl – annual. Phenological stages are designated by the following abbreviations: veg – vegetation, growth; bud – budding; bsm – blossoming, frt – fruiting; ddpl – dead plants. The following abbreviations refer to a living state: nml – normal; dprd – depressed. The status is specified using the following abbreviations: RDB RUz – the species is listed in the Red Data Book of the Republic of Uzbekistan; IUCN – the species is included in the IUCN Red List. NE (not evaluated) is used for species whose status has never been estimated in conformity with IUCN international criteria.

The IUCN Red List does not reflect the actual state of affairs for rare species in Uzbekistan and in the study area, in particular, since no adequate estimation of the country's floral diversity has been made in conformity with IUCN Red List Categories and Criteria. The IUCN Red List proposes 9 species categories (statuses) reflecting the amount of threat to plants, and these categories form the following groups. Group 1 includes two types of species: EX (Extinct) and EW (Extinct in the Wild). Threatened species are divided into 3 categories: CR (Critically Endangered), EN (Endangered) and VU (Vulnerable). The least threatened species form 2 categories: NT (Near Threatened) and LC (Least Concern). And the last group of species is also divided into 2 categories: DD (Data Deficient) and NE (Not Evaluated). As of now, only 220 of around 4,380 floral species inhabiting Uzbekistan have been evaluated following IUCN criteria (5%), with 17 of them included in the IUCN Red List as threatened (categories CR, EN, VU) and only 5 included in the Red Data Book of Uzbekistan. All the other plant species are listed as NE (Not Evaluated), which means their status has never been evaluated in conformity with the IUCN international criteria.

According to the applicable legislation of the Republic of Uzbekistan, special permits are required to use species listed in the Red Data Book of Uzbekistan, while increased fees are imposed for their removal from their natural environment and special increased fines for damaging the Red Book species (depending on their status in the Red Data Book of Uzbekistan) (Resolution of the Cabinet of Ministers of the Republic of Uzbekistan issued on 20 October, 2014, No. PP-290 'On the regulation of the use of biological resources and permit issuing procedures in nature management' (as amended on December 15, 2017) (Appendix 2). No special permit need be obtained to use plant species present in the IUCN Red List but not listed in the Red Data Book of the Republic of Uzbekistan, while fees and penalties are the same as those for ordinary species that are not listed in the Red Data Book.

The current edition of the Red Data Book of Uzbekistan (2019) includes 314 vascular plant species. Threatened species in the Red Book are grouped into the following categories (have the following statuses):

0 (Вероятно исчезнувшие – probably extinct) – roughly corresponds with the EX and EW IUCN Red List categories,

1 (Находящиеся под угрозой исчезновения – near-extinct) – roughly corresponds with the CR IUCN Red List category,

2 (Редкие – rare) – roughly corresponds with the EN IUCN Red List category,

3 (Сокращающиеся - declining) – roughly corresponds with the VU and NT IUCN Red List categories.

Research results

Karakyr Upland

The site designated for the construction of Sherabad Solar IPP is situated between the villages of Talashkan and Baikishlak, at the foot of the Kelif-Sherabad Ridge, between 37°32’13” N 66°52’58” E in the north-east and 37°31’48” N 66°50’49” E in the north-west, 37°30’23” N 66°51’28” E in the south-west and 37°31’08” N 66°52’49” E in the south-east. The landscape is a gentle piedmont composed of Quaternary proluvial deposits and intersected with a few shallow gullies made by erosion. From the north, south and east the site is bordered by a network of canals which separate the Karakyr Upland from irrigated agricultural lands; from the west the territory is bordered by a shallow gully. The soil consists of virgin and fallow sandy and loamy sierozems, in places mixed with stones, salt or gypsum. Aridity and severe water scarcity hinder the development of both irrigation- and rain-based farming. However, in the Soviet period, an unsuccessful attempt was made to develop agriculture in this territory, which can be seen from furrows and remains of a network of canals covering over 50% of the site area (Photo 1). Since the last time the territory was worked more than 20—25 years ago, the vegetation on the fallow piece of land has recovered and currently the territory is covered with ephemeral plants and saltworts (*Salsola orientalis, Carex pachystylis, Poa bulbosa*). The dominating species is *Salsola orientalis* – subshrub 20–40 cm high forming the upper storey of herbage; the lower storey, up to 10—15 cm from the ground, is composed of ephemeral and ephemeroid plants, the commonest of which are *Poa bulbosa* and *Carex pachystylis*. The virgin areas of the site, which has never been ploughed or worked in any other way, are dominated by the same plants, but the leading position is taken by ephemeroid plants, mainly *Poa bulbosa* (Photo 2). Aridity and strong grazing has resulted in a very low projective cover, which is not higher than 10–20%. The vegetation is more or less uniform, with poor species composition, and the only differences between various portions of the site are slightly varying levels of projective cover and the proportion of *Salsola orientalis*, and the absence or presence of some uncommon assectators, such as *Acanthophyllum pungens*. Horizontally, dominating plant species are distributed more or less evenly.

The ephemeroid-saltwort association is spread almost all across the Karakyr Upland, with the exception of a few small salinised areas in depressions occupied by the saltwort-camelthorn-tamarisk association (*Tamarix laxa, Alhagi pseudalhagi, Suaeda altissima, Climacoptera longistylosa*), which belongs to halophilous plants growing on saline soils (Photo 3). There the vegetation is composed of a shrub storey consisting of tamarisk (*Tamarix laxa*) and reaching a height of 1—1.2 m and a herbage storey of saltwort and camelthorn 40-45 cm high. The projective cover is 40–50%. The narrow strip along the canals, relatively small in area, features secondary weed associations (*Alhagi pseudalhagi, Hordeum murinum* subsp. *leporinum, Onopordum leptolepis*).

The residents of nearby villages use the Karakyr Upland widely to pasture their livestock, with uncontrollably organised dumps of domestic and construction waste recorded all along the periphery of the site (Photo 4). The overall degradation of plants on this site can be described as moderate. The phytocoenoses consist of natural dominant, subdominant and typical species. Weeds are not abundant and do not play a significant part in the vegetation cover. No rare species included in the national or international Red Data Book were recorded during the survey. A total of 35 species (Table 1) forming the ephemeroid-saltwort association (*Salsola orientalis, Carex pachystylis, Poa bulbosa*) on the studied site were recorded during the survey, with 12 species of aboriginal synanthropic weeds and no adventitious plants found. The saltwort-camelthorn-tamarisk association (*Tamarix laxa, Alhagi pseudalhagi, Suaeda altissima, Climacoptera longistylosa*) consists of 20 species, with no adventitious plants recorded among them (Table 2).

Table 1. The list of plant species observed in Karakyr Upland in ephemeroid-saltwort association (*Salsola orientalis, Carex pachystylis, Poa bulbosa*)

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
1	*Acanthophyllum pungens* (Bunge) Boiss. – колючелистник колючий	pnl	20	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
2	*Alhagi kirghisorum* Schrenk ex Fisch. & C.A. Mey. – верблюжья колючка киргизская	pnl	30-35	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
3	*Allium drepanophyllum* Vved. – лук серполистный	pnl	10-12	+	veg	dprd	IUCN (2019): Not Evaluated (NE). National status: None. Native
4	*Andrachne fedtschenkoi* Kossinsky – андрахне Федченко	sshb	10-12	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
5	*Artemisia scoparia* Waldst. & Kitag. – полынь метельчатая	bnl	10-15	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
6	*Artemisia sogdiana* Bunge – полынь согдийская	sshb	30-35	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
7	*Astragalus tribuloides* Del. – астрагал якорцевый	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
8	*Carex pachystilis* J. Gay. – осока толстостолбиковая	pnl	5-6	1	bud	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
9	*Ceratocarpus arenarius* L. – рогач песчаный	anl	12-15	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
10	*Ceratocephala falcata* (L.) Pers. – рогоглавник серповидный	anl	3-4	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
11	*Convolvulus hamadae* (Vved.) Petrov – вьюнок пустыни	sshb	20-40	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
12	*Erodium cicutarium* (L.) L'Her. – аистник обыкновенный	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
13	*Gagea graminifolia* Vved. – гусиный лук злаколистный	pnl	3-5	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
14	*Gagea olgae* Regel – гусиный лук Ольги	pnl	3-5	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
15	*Gagea stipitata* Merckl. ex Bunge – гусиный лук стебельчатый	pnl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
16	*Gamanthus gamocarpus* (Moq.) Bunge – спайнobsметник спайноплannual ый	anl	40-45	+	ddpl	dprd	IUCN (2019): Not Evaluated (NE). National status: None. Native
17	*Holosteum umbellatum* L. – костенец зонтичный	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
18	*Iris narbuti* O. Fedtsch. (*Juno narbutii* (O.Fedtsch.) Vved.) – ирис Нарbuda (юнона Нарbuda)	pnl	10-15	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
19	*Ixiolirion tataricum* (Pall.) Schult. & Schult. f. – иксиолирион татарский	pnl	10-15	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
20	*Lallemantia royleana* (Benth.) Benth. – лаллемантия Ройля	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
21	*Leptaleum filifolium* (Willd.) DC. – лепталеум нителистный	anl	3-5	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
22	*Meniocus linifolius* (Steph.) DC. – плоскоплannual ик льнолистный	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
23	*Microcephala lamellata* (Bunge) Pobed. – мелкоголовка пластинчатая	anl	10-15	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
24	*Minuartia meyeri* (Boiss.) Bornm. – минуарция Мейера	anl	5-7	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None.Native
25	*Onopordum leptolepis* DC. – татарник тонкочешуйчатый	bnl	20-30	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
26	*Peganum harmala* L. – гармала обыкновенная	pnl	15-20	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
27	*Poa bulbosa* L. – мятлик луковичный	pnl	5-6	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
28	*Salsola orientalis* S.G. Gmel. – солянка восточная, кейреук	sshb	20-40	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
29	*Sedum tetramerum* Trautv. – очиток четырехмерный	anl	1-2	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
30	*Streptoloma desertorum* Bunge – завиток пустынный	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
31	*Strigosella trichocarpa* (Boiss. & Buhse) Botsch. – стригозелла волосистоплannual ая	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
32	*Trigonella geminiflora* Bunge – пажитник парнobsметковый	anl	3-5	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
33	*Tulipa turkestanica* Regel – тюльпан туркестанский	pnl	5-7	+	veg	dprd	IUCN (2019): Not Evaluated (NE). National status: None. Native
34	*Veronica sp.* – вероника	anl	4-5	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
35	*Vulpia persica* (Boiss. & Buhse) V. Krecz. & Bobrov – вульпия персидская	anl	3-5	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
	Total 34 species						

Table 2. The list of plant species observed in Karakyr Upland in saltwort-camelthorn-tamarisk association (*Tamarix laxa, Alhagi pseudalhagi, Suaeda altissima, Climacoptera longistylosa*)

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
1	*Alhagi pseudalhagi* (M. Bieb.) Desv. – верблюжья колючка ложная	pnl	40-45	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
2	*Artemisia scoparia* Waldst. & Kitag. –	bnl	15-20	+	veg	nml	IUCN (2019): Not Evaluated

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
	полынь метельчатая						(NE). National status: None. Native. Weed
3	*Astragalus tribuloides* Del. – астрагал якорцевый	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
4	*Atriplex micrantha* C.A. Mey.	anl	10-15	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
5	*Bromus tectorum* L. – костер кровельный	anl	7-10	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
6	*Ceratocarpus arenarius* L. – рогач песчаный	anl	15-20	1	отм	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
7	*Ceratocephala falcata* (L.) Pers. – рогоглавник серповидный	anl	3-5	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
8	*Climacoptera longistylosa* (Iljin) Botsch. – климакоптера длинностолбиковая	anl	30-35	+	отм	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
9	*Erodium cicutarium* (L.) L'Her. – аистник обыкновенный	anl	7-10	1	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
10	*Gamanthus gamocarpus* (Moq.) Bunge – спайнobsметник спайноплannual ый	anl	40-50	1	ddpl	dprd	IUCN (2019): Not Evaluated (NE). National status: None. Native
11	*Holosteum umbellatum* L. – костенец зонтичный	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
12	*Hordeum murinum* subsp. *leporinum* (Link) Arcang. (*H. leporinum* Link) – ячмень заячий	anl	7-10	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
13	*Meniocus linifolius* (Steph.) DC. – плоскоплannual ик льнолистный	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
14	*Onopordum leptolepis* DC. –	bnl	20-25	1	veg	nml	IUCN (2019): Not Evaluated

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
	татарник тонкочешуйчатый						(NE). National status: None. Native. Weed
15	*Poa bulbosa* L. – мятлик луковичный	pnl	5-7	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
16	*Salsola orientalis* S.G. Gmel. – солянка восточная, кейреук	sshb	30-40	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
17	*Salsola paulsenii* Litv. – солянка Паульсена	anl	40-50	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
18	*Salsola sclerantha* C.A. Mey. – солянка хрящebsметная	anl	30-40	1	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
19	*Suaeda altissima* (L.) Pall. – сведа высокая	anl	45-50	1	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
20	*Tamarix laxa* Willd. – гребенщик рыхлый	shb	100-120	2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
	Total 20 species						

Photo 1. Old fallow site with ephemeroid-saltwort assosiations plants

Photo 2. Virgin site with saltwort- assosiations plants

Photo 3. Small site with halophytes in landscape depression

Photo 4. Uncontrollably organised dumps

Kattakum Sands and Khaudag Ridge

A site to the north and east of the town of Jarkurgan featuring the transformer station and power transmission line, where an additional power transmission line is planned for Sherabad Solar IPP. The site is situated between 37°31'26" N 67°23'45" E in the east, 37°31'48" N 66°50'49" E in the north-west, 37°30'23" N 66°51'28" E in the south-west and 37°31'08" N 66°52'49" E in the south-east. The landscape consists of fixed, semi-fixed and loose sands (Kattakum) (Photos 5, 6) interspersed with saline depressions, with a row of hills (Khaudag) in the centre composed of red sandstones, sandy loams and saliferous variegated rocks with relatively gentle bulging slopes intersected with gullies formed by erosion (Photo 7). The residents of nearby villages use Khaudag to pasture their livestock and dispose of their rubbish in an uncontrolled way, with dumps of domestic and construction waste recorded in many parts of the site. A small open pit can be found to the north of the existing power transmission line, providing raw material for a cement plant. Overgrazing is the main anthropogenic impact on the vegetation (Photo 8).

Photo 5. Kattakum. Sandy plain with bindweed-ephemeral-ephemeroid associations

Photo 6. Kattakum. Small-dune half-stable sands with ephemeral-bindweed- Calligonum associaions

Photo 7. Khaudag and solonchak near eastern foothill

Photo 8. Pastuting near Khaudag

The vegetation cover of the sands is mosaic, the projective cover is 15–20% on fixed sands and 5–10% on loose sands. Most of the sandy area is covered with bindweed-ephemeral-ephemeroid (*Convolvulus hamadae, Carex pachystylis, Carex physodes, Poa bulbosa, Bromus tectorum, Hordeum murinum* subsp. *leporinum*) and saltwort-bindweed-ephemeroid (*Convolvulus hamadae, Salsola orientalis, Carex pachystylis, Carex physodes, Poa bulbosa*) associations, with small areas covered abundantly with camelthorn (*Alhagi kirghisorum*) and *Hulthemia persica* (Photo 9). These associations are characteristic of less ragged, wavier landscapes. There is no clear borderline between the bindweed-ephemeral-ephemeroid and saltwort-bindweed-ephemeroid associations, with the only difference lying in the proportion of *Salsola orientalis* and *Convolvulus hamadae* – in all other aspects the composition of both associations is the same (Table 3). A total of 40 species were recorded on the site, with 17 aboriginal weeds and only 1 adventitious plant – ruderal weed *Xanthium spinosum* common throughout Uzbekistan, a few individuals of which were recorded on the sides of a dirt road running along the existing power transmission line.

Ephemeral-ephemeroid-Calligonum (*Calligonum microcarpum, Carex physodes, Poa bulbosa, Bromus tectorum, Hordeum murinum* subsp. *leporinum*) and ephemeral-bindweed-Calligonum (*Calligonum microcarpum, Convolvulus hamadae, Poa bulbosa, Bromus tectorum, Hordeum murinum* subsp. *leporinum*) associations are locally common, occupying a small area (Photo 10). Vertically, the upper storey of these associations at a height of 50—100 cm is represented by shrub *Calligonum microcarpum*, whose density is up to 0.3. The species composition in the herbage storey is generally similar to that in the previous association, with insignificant differences. Such associations typical of sands with low dunes were recorded in points 37°32’57” N 67°20’32” E and 37°34’147” N 67°16’21” E. Plant species are given in Table 4, with no adventitious plants recorded among them.

Rhizogenous psammophyte *Carex physodes* – a most important edificatory in Central Asian deserts – predominates in the herbage storey in the abovementioned associations, alongside *Poa bulbosa* and annual cereals.

Halophytes abundant in the lower parts of the area at the foot of Khaudag are represented by a saltwort-tamarisk association, whose species composition is similar to those given in Table 2. The projective cover makes up 30–40% (Photo 11), with just occasional annual saltworts (*Climacoptera sp., Salsola sp., Suaeda sp.*) or no vegetation at all in the most heavily salinised areas (Photo 12). As halophytes usually begin to grow quite late into the season, it is recommended that to make a comprehensive study of the species composition an additional

survey should be carried out in the saltwort's blossoming and fruiting periods, in late August—September.

The vegetation on Khaudag is represented by saltwort-bindweed-ephemeroid associations, which are generally similar to those in Table 3, with just minor differences in the species composition (Table 5). The vegetation on the top of Khaudag is heavily degraded by overgrazing, with harmala-ephemeral-ephemeroid and harmala-saltwort-ephemeroid associations (*Peganum garmala, Salsola orientalis, Carex pachystylis, Poa bulbosa, Bromus tectorum Hordeum murinum* subsp. *leporinum*) typical of desert pastures predominating in this part of the site (Photos 13, 14).

The overall plant degradation in the Kattakum Sands with small-size dunes can be described as moderate. The phytocoenoses are composed of natural dominant, subdominant and typical species. Weeds are not abundant and do not play any significant part in the vegetation of the sands, while adventitious species were represented by individual specimens of *Xanthium spinosum*. In the Khaudag Ridge some areas are moderately degraded, while others are strongly degraded by overgrazing.

No rare species included in the national or international Red Data Books were recorded during the surveys in the Kattakum Sands or in the Khaudag ridge. However, it is possible that they inhabit the sites (Appendix 1), so it is recommended that an additional survey should be carried out, best in late April—first half of May.

Table 3. The list of plant species in bindweed-ephemeral-ephemeroid (*Convolvulus hamadae, Carex pachystylis, Carex physodes, Poa bulbosa, Bromus tectorum, Hordeum murinum* subsp. *leporinum*) and saltwort-bindweed-ephemeroid (*Convolvulus hamadae, Salsola orientalis, Carex pachystylis, Carex physodes, Poa bulbosa*) associations in Kattakum Sands

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
1	*Agriophyllum lateriflorum* (Lam.) Moq. – кумарчик бокоцветковый	anl	35-45	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
2	*Alhagi kirghisorum* Schrenk ex Fisch. & C.A. Mey. – верблюжья колючка киргизская	pnl	30-40	+ (на локальных участках до 1-2)	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
3	*Alyssum desertorum* Stapf – бурачок пустынный	anl	5-6	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
4	*Astragalus excedens* Popov & Kult. – астрагал выступающий	sshb	30-40	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
5	*Astragalus oxyglottis* M. Bieb. – астрагал остроплодный	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
6	*Astragalus tribuloides* Del. – астрагал якорцевый	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
7	*Bromus tectorum* L. – костер кровельный	anl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Сорный
8	*Carex pachystilis* J. Gay. – осока толстостолбиковая	pnl	5-7	1	bud	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
9	*Carex physodes* M. Bieb. – осока вздутая, илак	pnl	7-10	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
10	*Ceratocarpus arenarius* L. – рогач песчаный	anl	15-20	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
11	*Ceratocephala falcata* (L.) Pers. – рогоглавник серповидный	anl	3-5	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
12	*Chorispora tenella* (Pall.) DC. – хориспора нежная	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
13	*Climacoptera sp.* – климакоптера	anl	20-30	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
14	*Convolvulus hamadae* (Vved.) Petrov – вьюнок пустыни, партек	sshb	30-40	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
15	*Cousinia sp.* – кузиния	bnl	10-15	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
16	*Descurainia sophia* (L.) Webb. & Prantl – дескурения София	anl	10-15	+	bud	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
17	*Eminium lehmanii* (Bunge) O. Kuntze – эминиум Лемана	pnl	15-20	+-1	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
18	*Erodium ciconium* (Jusl.) L'Her. – аистник длинноклювый	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
19	*Erodium cicutarium* (L.) L'Her. – аистник обыкновенный	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
20	*Gagea divaricata* Regel – гусиный лук растопыренный	pnl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
21	*Gagea pseudoreticulata* Vved. – гусиный лук ложносетчатый	pnl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
22	*Gagea stipitata* Merckl. ex Bunge – гусиный лук стебельчатый	pnl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
23	*Gamanthus gamocarpus* (Moq.) Bunge – спайноцветник спайноплодный	anl	30-40	+	ddpl	dprd	IUCN (2019): Not Evaluated (NE). National status: None. Native.
24	*Holosteum umbellatum* L. – костенец зонтичный	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
25	*Hordeum murinum* subsp. *leporinum* (Link) Arcang. (*H. leporinum* Link) – ячмень заячий	anl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
26	*Hulthemia persica* (Michx. & Juss.) Bornm. – хультемия персидская	shb	30-40	+ (на локальных участках до 1-2)	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
27	*Ixiolirion tataricum* (Pall.) Schult. & Schult. f. – иксиолирион татарский	pnl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
28	*Koelpinia linearis* Pall. – кельпиния линейная	anl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
							status: None. Native.
29	*Leptaleum filifolium* (Willd.) DC. – лепталеум нителистный	anl	5-6	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
30	*Meniocus linifolius* (Steph.) DC. – плоскоплодник льнолистный	anl		+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
31	*Merendera robusta* Bunge – мерендера крупная	pnl	5-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
32	*Onopordum leptolepis* DC. – татарник тонкочешуйчатый	bnl	20-25	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
33	*Peganum harmala* L. – гармала обыкновенная	pnl	30-40	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
34	*Phlomoides boissieriana* (Regel) Adylov, Kamelin & Makhm. – фломоидес Буасье	pnl	20-25	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
35	*Poa bulbosa* L. – мятлик луковичный	pnl	7-10	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
36	*Salsola orientalis* S.G. Gmel. – солянка восточная, кейреук	sshb	30-40	+ - 1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
37	*Salsola paulsenii* Litv. – солянка Паульсена	anl	30-35	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
38	*Streptoloma desertorum* Bunge – завиток пустынный	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
39	*Trigonella geminiflora* Bunge – пажитник парноцветковый	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
40	*Xanthium spinosum* L. – дурнишник колючий	anl	20-25	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Adventive Weedy
	Всего видов: 40						

Table 4. The list of plant species, recorded on small-dunes degraded sands in ephemeral-ephemeroid-Calligonum (*Calligonum microcarpum, Carex physodes, Poa bulbosa, Bromus tectorum, Hordeum murinum* subsp. *leporinum*) and ephemeral-bindweed-Calligonum (*Calligonum microcarpum, Convolvulus hamadae, Poa bulbosa, Bromus tectorum, Hordeum murinum* subsp. *leporinum*) associations

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
1	*Agriophyllum lateriflorum* (Lam.) Moq. – кумарчик бокоцветковый	anl	35-45	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
2	*Alhagi kirghisorum* Schrenk ex Fisch. & C.A. Mey. – верблюжья колючка киргизская	pnl	30-40	+ (на локальных участках до 1-2)	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
3	*Alyssum desertorum* Stapf – бурачок пустынный	anl	5-6	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
4	*Artemisia diffusa* Krasch. ex Poljakov – полынь раскидистая	sshb	30-35	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
5	*Astragalus excedens* Popov & Kult. – астрагал выступающий	sshb	30-40	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
6	*Astragalus oxyglottis* M. Bieb. – астрагал остроплодный	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
7	*Astragalus tribuloides* Del. – астрагал якорцевый	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
8	*Bromus tectorum* L. – костер кровельный	anl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
9	*Calligonum microcarpum* I.G.	shb	50-100	2	veg	nml	IUCN (2019): Not Evaluated

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
	Borshch. – кандым мелкоплаnlый						(NE). National status: None. Native. Natural dominant
10	*Carex physodes* M. Bieb. – осока вздутая, илак	pnl	7-10	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
11	*Ceratocarpus arenarius* L. – рогач песчаный	anl	15-20	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
12	*Ceratocephala falcata* (L.) Pers. – рогоглавник серповидный	anl	3-5	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
13	*Chorispora tenella* (Pall.) DC. – хориспора нежная	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
14	*Convolvulus hamadae* (Vved.) Petrov – вьюнок пустыни, партек	sshb	30-40	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
15	*Eminium lehmanii* (Bunge) O. Kuntze – эминиум Лемана	pnl	15-20	+-1	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
16	*Erodium ciconium* (Jusl.) L'Her. – аистник длинноклювый	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
17	*Erodium cicutarium* (L.) L'Her. – аистник обыкновенный	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
18	*Gagea divaricata* Regel – гусиный лук растопыренный	pnl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
19	*Gagea stipitata* Merckl. ex Bunge – гусиный лук стебельчатый	pnl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
20	*Gamanthus gamocarpus* (Moq.) Bunge –	anl	30-40	+	ddpl	dprd	IUCN (2019): Not Evaluated (NE). National

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
	спайноцветник спайноплодный						status: None. Native.
21	*Holosteum umbellatum* L. – костенец зонтичный	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
22	*Hordeum murinum* subsp. *leporinum* (Link) Arcang. (*H. leporinum* Link) – ячмень заячий	anl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
23	*Hulthemia persica* (Michx. & Juss.) Bornm. – хультемия персидская	shb	30-40	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
24	*Iris longiscapa* Ledeb. – ирис длинностебельный	pnl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
25	*Ixiolirion tataricum* (Pall.) Schult. & Schult. f. – иксиолирион татарский	pnl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
26	*Koelpinia linearis* Pall. – кельпиния линейная	anl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
27	*Leptaleum filifolium* (Willd.) DC. – лепталеум нителистный	anl	5-6	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
28	*Meniocus linifolius* (Steph.) DC. – плоскоплодник льнолистный	anl		+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
29	*Merendera robusta* Bunge – мерендера крупная	pnl	5-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
30	*Onopordum leptolepis* DC. – татарник тонкочешуйчатый	bnl	20-25	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
31	*Peganum harmala* L. – гармала обыкновенная	pnl	30-40	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
32	*Phlomoides boissieriana* (Regel)	pnl	20-25	+	veg	nml	IUCN (2019): Not Evaluated

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
	Adylov, Kamelin & Makhm. – фломоидес Буасье						(NE). National status: None. Native.
33	*Poa bulbosa* L. – мятлик луковичный	pnl	7-10	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
34	*Salsola arbuscula* Pall. – солянка деревцевидная, боялыш	shb	50-100	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
35	*Salsola orientalis* S.G. Gmel. – солянка восточная, кейреук	sshb	30-40	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
36	*Salsola paulsenii* Litv. – солянка Паульсена	anl	30-35	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
37	*Stipagrostis karelinii* (Trin. & Rupr.) H.Scholz (*Aristida karelinii* (Trin. & Rupr.) Roshev.) – селин Карелина (аристида Карелина)	pnl	50-60	+-1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
38	*Stipagrostis pennata* (Trin.) De Winter (*Aristida pennata* Trin.) – селин перистый (аристида перистая)	pnl	50-60	+-1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
39	*Streptoloma desertorum* Bunge – завиток пустынный	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
40	*Strigosella turkestanica* (Litv.) Botsch. – стригозелла туркестанская	anl	10-20	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
41	*Trigonella geminiflora* Bunge – пажитник парноцветковый	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
	Всего видов: 41						

Table 5. The list of plant species of saltwort-bindweed-ephemeroid (*Convolvulus hamadae, Salsola orientalis, Carex pachystylis, Poa bulbosa*) and harmala-saltwort-ephemeroid (*Peganum garmala, Salsola orientalis, Carex pachystylis, Poa bulbosa*) associations in Khaudag

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
1	*Alhagi kirghisorum* Schrenk ex Fisch. & C.A. Mey. – верблюжья колючка киргизская	pnl	30-40	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
2	*Allium protensum* Wendelbo (*Allium schubertii* Zucc.) – лук вытянутый (лук Шуберта)	pnl	10-15	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
3	*Alyssum desertorum* Stapf – бурачок пустынный	anl	5-6	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
4	*Artemisia diffusa* Krasch. ex Poljakov – полынь раскидистая	sshb	30-35	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
5	*Astragalus excedens* Popov & Kult. – астрагал выступающий	sshb	30-40	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
6	*Astragalus tribuloides* Del. – астрагал якорцевый	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
7	*Bromus tectorum* L. – костер кровельный	anl	7-10	+-1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
8	*Capparis spinosa* L. – каперцы колючие	pnl	50-60	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
9	*Carex pachystilis* J. Gay. – осока толстостолбиковая	pnl	5-7	1-2	bud	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
10	*Carex physodes* M. Bieb. – осока вздутая, илак	pnl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
11	*Ceratocarpus arenarius* L. – рогач песчаный	anl	15-20	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
12	*Ceratocephala falcata* (L.) Pers. – рогоглавник серповидный	anl	3-5	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
13	*Chorispora tenella* (Pall.) DC. – хориспора нежная	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
14	*Convolvulus hamadae* (Vved.) Petrov – вьюнок пустыни, партек	sshb	30-40	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
15	*Descurainia sophia* (L.) Webb. & Prantl – дескурения София	anl	10-15	+	bud	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
16	*Eminium lehmanii* (Bunge) O. Kuntze – эминиум Лемана	pnl	15-20	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
17	*Erodium cicutarium* (L.) L'Her. – аистник обыкновенный	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
18	*Gagea pseudoreticulata* Vved. – гусиный лук ложносетчатый	pnl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
19	*Gagea stipitata* Merckl. ex Bunge – гусиный лук стебельчатый	pnl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
20	*Gamanthus gamocarpus* (Moq.) Bunge – спайноцветник спайноплодный	anl	30-40	+	ddpl	dprd	IUCN (2019): Not Evaluated (NE). National status: None. Native.
21	*Holosteum umbellatum* L. – костенец зонтичный	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
22	*Hordeum murinum* subsp. *leporinum* (Link) Arcang. (*H.*	anl	7-10	1	veg	nml	IUCN (2019): Not Evaluated (NE). National

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
	leporinum Link) – ячмень заячий						status: None. Native. Weed
23	*Hulthemia persica* (Michx. & Juss.) Bornm. – хультемия персидская	shb	30-40	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
24	*Ixiolirion tataricum* (Pall.) Schult. & Schult. f. – иксиолирион татарский	pnl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
25	*Koelpinia linearis* Pall. – кельпиния линейная	anl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
26	*Leptaleum filifolium* (Willd.) DC. – лепталеум нителистный	anl	5-6	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
27	*Meniocus linifolius* (Steph.) DC. – плоскоплодник льнолистный	anl		+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
28	*Merendera robusta* Bunge – мерендера крупная	pnl	5-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
29	*Onopordum leptolepis* DC. – татарник тонкочешуйчатый	bnl	20-25	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
30	*Peganum harmala* L. – гармала обыкновенная	pnl	30-40	+-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
31	*Poa bulbosa* L. – мятлик луковичный	pnl	7-10	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
32	*Ranunculus sewerzowii* Regel – лютик Северцова	pnl	5-6	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
33	*Salsola orientalis* S.G. Gmel. – солянка восточная, кейреук	sshb	30-40	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
34	*Salsola paulsenii* Litv. – солянка Паульсена	anl	30-35	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
35	*Streptoloma desertorum* Bunge – завиток пустынный	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
36	*Strigosella turkestanica* (Litv.) Botsch. – стригозелла туркестанская	anl	10-20	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
37	*Trigonella geminiflora* Bunge – пажитник парноцветковый	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
38	*Zygophyllum atriplicoides* Fisch. & C.A. Mey. (*Halimiphyllum atriplicoides* Boriss.) – парнолистник лебедовидный	shb	50-70	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
	Всего видов: 38						

Photo 9. Bindweed -ephemeral-ephemeroid associations

Photo 10. Ephemeral-bindweed- Calligonum associations

Photo 11. Halophytes (Salsola-Tamarix associations) in relief depression

Photo 12.Sparse Salsola associations in relief depression

Photo 13. Harmala - ephemeral –ephemeroid associations on the top of Khaudag

Photo 14. Harmala - ephemeral –ephemeroid associations on the top of Khaudag

Sherabad valley

The part of the Sherabad valley with the existing and prospect power transmission lines features an anthropogenic landscape (cotton, wheat and alfalfa fields, orchards, vegetable gardens, tree lines, roads, networks of irrigation canals and villages (Photos 15—18). Secondary associations of ruderal and segetal weeds occupy small areas along roads, canals and field borders. Riparian and halophytic (tamarisk, camelthorn, reed) associations were recorded fragmentarily on the floodplain of the Karasu River. A total of 48 plant species, including cultivated plants (Table 6) were recorded in this part of the project territory, with 4 adventitious species and 12 synanthropic weeds. As halophytes, *tugai* plants and weeds usually begin to grow quite late in the season, it is recommended that to make a comprehensive study of the species composition an additional survey should be carried out in late summer (August—September).

Table 6. The list of plant species of anthropogenic landscape of Sherabad valley

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
1	*Aeluropus litoralis* (Gouan.) Parl. – прибрежница солончаковая	pnl	10-15	1	veg	nml	IUCN (2019): Least Concern (LC). National

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
							status: None. Native.
2	*Alhagi kirghisorum* Schrenk ex Fisch. & C.A. Mey. – верблюжья колючка киргизская	pnl	40-45	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
3	*Alhagi pseudalhagi* (M. Bieb.) Desv. – верблюжья колючка ложная	pnl	40-45	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
4	*Artemisia scoparia* Waldst. & Kitag. – полынь метельчатая	bnl	15-20	+-1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
5	*Arundo donax L.* – арундо тростниковидный	pnl	180-250	+	veg	nml	IUCN (2019): Least Concern (LC). National status: None. Native.
6	*Atriplex micrantha* C.A. Mey. – лебеда мелкоплодная	anl	10-15	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
7	*Bromus tectorum* L. – костер кровельный	anl	7-10	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
8	*Capparis spinosa* L. – каперцы колючие	pnl	50-60	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
9	*Ceratocarpus arenarius* L. – рогач песчаный	anl	15-20	+-1	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
10	*Ceratocephala falcata* (L.) Pers. – рогоглавник серповидный	anl	3-5	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
11	*Climacoptera sp.* – климакоптера	anl	30-35	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
12	*Convolvulus arvensis* L. – вьюнок полевой	anl	15-20	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Adventive. Weed

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
13	*Cynodon dactylon* (L.) Pers. – свинорой пальчатый	pnl	15-20	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Adventive. Weed
14	*Elaeagnus angustifolia* L. – лох узколистный	дер	200-400	+	veg	nml	IUCN (2019): Least Concern (LC). National status: None. Native. Planted
15	*Erianthus ravennae* (L.) P. Beauv. – эриантус равеннский	pnl	150-200	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
16	*Erodium cicutarium* (L.) L'Her. – аистник обыкновенный	anl	7-10	1	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
17	*Gamanthus gamocarpus* (Moq.) Bunge – спайноцветник спайноплодный	anl	40-50	1	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
18	*Gossypium hirsutum* – хлопчатник мохнатый	anl	40-70		ddpl		IUCN (2019): Vulnerable (VU). National status: None. In culture
19	*Halimodendron halodendron* (Pall.) Voss – чемыш серебристый	shb	100-150	+-1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
20	*Holosteum umbellatum* L. – костенец зонтичный	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
21	*Hordeum murinum* subsp. *leporinum* (Link) Arcang. (*H. leporinum* Link) – ячмень заячий	anl	7-10	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
22	*Hulthemia persica* (Michx. & Juss.) Bornm. – хультемия персидская	shb	30-40	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
23	*Ixiolirion tataricum* (Pall.) Schult. & Schult. f. – иксиолирион татарский	pnl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
24	*Karelinia caspia* (Pall.) Less. – карелиния каспийская	pnl	50-100	+-1	veg	nml	IUCN (2019): Not Evaluated (NE). National

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
							status: None. Native.
25	*Lycium depressum* Stocks (Lycium turcomanicum Fisch. & C.A.Mey. ex Bunge) – дереза прижатая (дереза туркменская)	shb	100-120	+-1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
26	*Malus domestica* Borkh. – яблоня домашняя (я. садовая)	tree	200-400		bud, bsm		IUCN (2019): Not Evaluated (NE). National status: None. In culture
27	*Triticum aestivum* – пшеница мягкая	anl	20-25		veg		IUCN (2019): Not Evaluated (NE). National status: None. In culture
28	*Medicago sativa* L. – люцерна посевная	pnl	20-25		veg		IUCN (2019): Least Concern (LC). National status: None. Introduced plant. In culture
29	*Meniocus linifolius* (Steph.) DC. – плоскоплодник льнолистный	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
30	*Morus alba* L. – шелковица белая	дер	200-400		veg		IUCN (2019): Not Evaluated (NE). National status: None. Introduced plant. In culture
31	*Onopordum leptolepis* DC. – татарник тонкочешуйчатый	bnl	20-25	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
32	*Peganum harmala* L. – гармала обыкновенная	pnl	30-40	+-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
33	*Phragmites australis* (Cav.) Trin. & Steud. – тростник южный	pnl	100-120	1	Veg, ddpl	nml	IUCN (2019): Least Concern (LC). National status: None. Native.
34	*Picnomon acarna* (L.) Cass. – пикномон колючий	anl	50-60	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
35	*Pinus nigra* ssp. *pallasiana* (D. Don) Holmboe *(P. pallasiana* D. Don) – сосна	tree	700-1500		Veg, bsm		IUCN (2019): Least Concern (LC). National status: None.

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
	Палласова (с. крымская)						Introduced plant. In culture
36	*Poa bulbosa* L. – мятлик луковичный	pnl	5-7	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
37	*Populus afghanica* (Aitch. & Hemsl.) C.K. Schneid. – тополь афганский	tree	700-1500		Veg, bsm		IUCN (2019): Not Evaluated (NE). National status: None. In culture
38	*Populus alba* L. – тополь белый	tree	700-1500		Veg, bsm		IUCN (2019): Least Concern (LC). National status: None. In culture
39	*Prunus armeniaca* L. (*Armeniaca vulgaris* Lam.) – абрикос обыкновенный	tree	300-500		bsm		IUCN (2019): Endangered B2ab(iii) (EN). National status: None. In culture
40	*Prunus dulcis* (Mill.) D.A. Webb (*Amygdalus communis* L.) – миндаль обыкновенный	tree	200-300		bsm		IUCN (2019): Not Evaluated (NE). National status: None. In culture
41	*Salix alba* L. – ива белая	tree	300-1000		Veg, bsm		IUCN (2019): Least Concern (LC). National status: None. In culture
42	*Salsola paulsenii* Litv. – солянка Паульсена	anl	40-50	+-1	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
43	*Suaeda altissima* (L.) Pall. – сведа высокая	anl	45-50	1-2	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
44	*Tamarix laxa* Willd. – гребенщик рыхлый	shb	100-150	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
45	*Tamarix sp.* – гребенщик	shb	150-180	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
46	*Taraxacum officinale* F.H. Wigg. – одуванчик лекарственный	pnl	12-15	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None.

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
							Adventive. Weed
47	*Ulmus glabra* Huds. – вяз голый	tree	300-1000		Veg		IUCN (2019): Data Deficient (DD). National status: None. In culture
48	*Xanthium spinosum* L. – дурнишник колючий	anl	20-25	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Adventive Weed
	Всего видов: 48						

Photo 15. Agrolandscape of Sherobad valley: apple orchard, in the background a forest belt, in the foreground weedy vegetation along the side of the road

Photo 16. Agrolandscape of Sherobad valley: irrigated weet field, Karasu river and solonchak fragments

Photo 17. Cultural landscape of Sherobad valley

Photo 18. Agrolandscape of Sherobad valley and fragments of *tugai* plants and weeds along channels

Kelif-Sherobad mountain chain [in Russian]

Невысокий горный хребет к северу и западу от территории, где планируется строительство Sherabad Solar IPP. Была обследована часть этой горной гряды, сложенной загипсованными и засоленными пестроцветными породами и красными глинами (горы Кызылтау и долина речки Музрабат) между 37°40’24” N 66°55’24” E на юго-востоке и

37°36’10” N 66°45’15” E на северо-западе. Ландшафт местности представляет собой холмистые предгорья и расчлененные многочисленными каньонами аридные низкогорья с крутыми эродированными глинистыми и каменистыми склонами (фото 19, 20). Территория используется жителями окружающих селений как пастбище для домашнего скота, некоторые выровненные участки распаханы под посевы сельхозкультур, встречаются также залежные земли, заброшенные из-за истощения почвы и недостатка воды (фото 21, 22). Основным антропогенным фактором, негативно влияющим на растительность, является чрезмерный выпас скота, склоны густо покрыты сетью скотобойных тропинок.

В растительном покрове предгорий Келиф-Шерабадской гряды преобладают кейреуково-эфемероидовые сообщества (*Salsola orientalis, Carex pachystylis, Poa bulbosa*), аналогичные тем, что отмечены на возвышенности Каракыр (таблица 1). Крутые эродированные склоны почти лишены растительного покрова, здесь произрастают единичные экземпляры гипсофильных растений. Отмечены характерные для предгорий и низкогорий Памиро-Алая разреженные сообщества ксерофильных кустарников с доминированием миндаля колючейшего (*Prunus (Amygdalus) spinosissima*) на крутых каменистых склонах урочища Музрабат и с доминированием парнолистника (*Zygophyllum atriplicoides*) на крутых глинистых склонах каньонов Кызылтау. Проективное покрытие на крутых склонах не превышает 5%, а на пологих задернованных участках в предгорьях в среднем составляет 20–30%. Степень деградации растительности может быть оценена как средняя на целинных участках и сильная на залежах.

Всего в обследованной части Келиф-Шерабадской гряды было выявлено 78 видов растений, из них сорные растения представлены 4 адвентивными и 13 аборигенными видами (таблица 7). В урочище Музрабат (37°36’53” N 66°45’05” E, 582 м н.у.м.) на крутом каменистом склоне западной экспозиции обнаружены два вида, внесенных в Красную книгу Узбекистана: *Tulipa korolkowii* (12 экземпляров) и *Cousinia spryginii* (3 экземпляра) (фото 23, 24). Для более полного выявления видового состава флоры этой территории, в том числе эндемичных и редких видов, рекомендуется провести дополнительное обследование, наилучшим периодом для этого является конец апреля–первая половина мая и конец августа–первая половина сентября.

Photo 19. Kelif-Sherobad maountain chain, Kyzyltau mounts

Photo 20. Kelif-Sherobad maountain chain, Muzrabat river valley

Photo 21. Kelif-Sherobad maountain chain, fallow with weedy vegetation

Photo 22. Kelif-Sherobad maountain chain, over-grazed gypsum slopes

Table 7. The list of plant species recorded in Kelif-Sherobad valley

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
1	*Alhagi kirghisorum* Schrenk ex Fisch. & C.A. Mey. – верблюжья колючка киргизская	pnl	30-40	+ (на локальных участках до 1-2)	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
2	*Alhagi pseudalhagi* (M. Bieb.) Desv. – верблюжья колючка ложная	pnl	40-45	+ (на локальных участках до 1-2)	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
3	*Allium margaritiferum* Vved. – лук жемчужный	pnl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
4	*Allium ophiophyllum* Vved. – лук змеелистный	pnl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
5	*Alyssum desertorum* Stapf – бурачок пустынный	anl	5-6	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
6	*Artemisia diffusa* Krasch. ex Poljakov – полынь раскидистая	sshb	30-35	+-1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
7	*Artemisia scoparia* Waldst. & Kitag. – полынь метельчатая	bnl	10-15	+-1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
8	*Artemisia scotina* Nevski – полынь темная	sshb	30-35	+	veg	nml	IUCN (2019): Not Evaluated (NE). National

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
							status: None. Native.
9	*Artemisia sogdiana* Bunge – полынь согдийская	sshb	30-35	+-1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
10	*Arundo donax L.* – арундо тростниковидный	pnl	180-250	+	veg	nml	IUCN (2019): Least Concern (LC). National status: None. Native.
11	*Astragalus excedens* Popov & Kult. – астрагал выступающий	sshb	30-40	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
12	*Astragalus oxyglottis* M. Bieb. – астрагал остроплодный	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
13	*Astragalus tribuloides* Del. – астрагал якорцевый	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
14	*Atraphaxis spinosa* L. – курчавка колючая	shb	50-70	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
15	*Bromus tectorum* L. – костер кровельный	anl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
16	*Carex pachystilis* J. Gay. – осока толстостолбиковая	pnl	5-7	1	bud	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
17	*Ceratocarpus arenarius* L. – рогач песчаный	anl	15-20	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
18	*Ceratocephala falcata* (L.) Pers. – рогоглавник серповидный	anl	3-5	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
19	*Chorispora tenella* (Pall.) DC. – хориспора нежная	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
20	*Climacoptera sp.* – климакоптера	anl	20-30	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
21	*Convolvulus arvensis* L. – вьюнок полевой	anl	15-20	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Adventive. Weed
22	*Cynodon dactylon* (L.) Pers. – свинорой пальчатый	pnl	15-20	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Adventive. Weed
23	*Corydalis popovii* Nevski ex Popov – хохлатка Попова	pnl	12-15	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
24	*Convolvulus hamadae* (Vved.) Petrov – вьюнок пустыни, партек	sshb	30-40	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
25	*Cousinia spryginii* Kult. – кузиния Спрыгина	bnl	30-35	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National Status: RedListUzb 1. Native
26	*Descurainia sophia* (L.) Webb. & Prantl – дескурения София	anl	10-15	+	bud	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
27	*Elymus hispidus* (Opiz) Melderis (*Agropyron trichophorum* (Link) K. Richt., *Elytrigia trichophora* (Link) Nevski) – пырей волосоносный	pnl	12-15	+	Veg, ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
28	*Ephedra foliata* Boiss. ex C.A. Mey. (*E. kokanica* Regel) – хвойник облиственный (х. кокандский)	shb	40-50	+	veg	nml	IUCN (2019): Least Concern (LC). National status: None. Native.
29	*Eremurus sp.* – эремурус	pnl	20-30	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: unclear. Native

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
30	*Erodium cicutarium* (L.) L'Her. – аистник обыкновенный	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
31	*Ferula kelifi* Korovin – ферула Келифа	pnl	30-40	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
32	*Gagea graminifolia* Vved. – гусиный лук злаколистный	pnl	3-5	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
33	*Gagea olgae* Regel – гусиный лук Ольги	pnl	3-5	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
34	*Gagea pseudoreticulata* Vved. – гусиный лук ложносетчатый	pnl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
35	*Gagea stipitata* Merckl. ex Bunge – гусиный лук стебельчатый	pnl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
36	*Gamanthus gamocarpus* (Moq.) Bunge – спайноцветник спайноплодный	anl	30-40	+	ddpl	y	IUCN (2019): Not Evaluated (NE). National status: None. Native.
37	*Glaucium elegans* Fisch. & C.A. Mey. – глауциум изящный	anl	10-12	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
38	*Halimodendron halodendron* (Pall.) Voss – чемыш серебристый	shb	100-150	+-1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
39	*Heliotropium sp.* – гелиотроп	anl	20-30	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: unclear. Native
40	*Holosteum umbellatum* L. – костенец зонтичный	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
41	*Hordeum murinum* subsp. *leporinum* (Link) Arcang. (*H.*	anl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
	leporinum Link) – ячмень заячий						status: None. Native. Weed
42	*Hulthemia persica* (Michx. & Juss.) Bornm. – хультемия персидская	shb	30-40	+ (на локальных участках до 1-2)	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
43	*Ixiolirion tataricum* (Pall.) Schult. & Schult. f. – иксиолирион татарский	pnl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
44	*Iris narbuti* O. Fedtsch. (*Juno narbutii* (O.Fedtsch.) Vved.) – ирис Нарбута (юнона Нарбута)	pnl	10-15	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
45	*Koelpinia linearis* Pall. – кельпиния линейная	anl	7-10	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
46	*Lallemantia royleana* (Benth.) Benth. – лаллемантия Ройля	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
47	*Leptaleum filifolium* (Willd.) DC. – лепталеум нителистный	anl	5-6	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
48	*Lycium depressum* Stocks (Lycium turcomanicum Fisch. & C.A.Mey. ex Bunge) – дереза прижатая (дереза туркменская)	shb	100-120	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
49	*Matthiola bucharica* Czerniak. – левкой бухарский	anl	5-7	–	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
50	*Meniocus linifolius* (Steph.) DC. – плоскоплодник льнолистный	anl		+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
51	*Merendera robusta* Bunge – мерендера крупная	pnl	5-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
52	*Onopordum leptolepis* DC. – татарник тонкочешуйчатый	bnl	20-25	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
53	*Peganum harmala* L. – гармала обыкновенная	pnl	30-40	+	vego	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
54	*Phlomoides sogdiana* (Pazij & Vved.) Salmaki – фломоидес согдийский	pnl	20-25	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
55	*Phragmites australis* (Cav.) Trin. & Steud. – тростник южный	pnl	100-120	1	Veg, ddpl	nml	IUCN (2019): Least Concern (LC). National status: None. Native.
56	*Picnomon acarna* (L.) Cass. – пикномон колючий	anl	50-60	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
57	*Poa bulbosa* L. – мятлик луковичный	pnl	7-10	1-2	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
58	*Prunus spinosissima* (Bunge) Franch. (*Amygdalus spinosissima* Bunge) – миндаль колючейший	shb	50-120	+-1	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
59	*Pulicaria sp.* – блошница	pnl	20-25	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
60	*Ranunculus sewerzowii* Regel – лютик Северцова	pnl	5-6	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
61	*Rheum maximowiczii* Losinsk. – ревень Максимовича	pnl	20-30	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
62	*Salsola arbuscula* Pall. – солянка деревцевидная, боялыш	shb	50-100	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
63	*Salsola orientalis* S.G. Gmel. – солянка восточная, кейреук	sshb	30-40	+ - 1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native
64	*Salsola paulsenii* Litv. – солянка Паульсена	anl	30-35	+	ddpl	nml	IUCN (2019): Not Evaluated

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
							(NE). National status: None. Native. Weed
65	*Streptoloma desertorum* Bunge – завиток пустынный	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
66	*Strigosella intermedia* (C.A. Mey.) Botsch. – стригозелла промежуточная	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
67	*Strigosella trichocarpa* (Boiss. & Buhse) Botsch. – стригозелла волосистоплодная	anl	7-10	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
68	*Strigosella turkestanica* (Litv.) Botsch. – стригозелла туркестанская	anl	10-20	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
69	*Suaeda altissima* (L.) Pall. – сведа высокая	anl	45-50	1-2	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
70	*Taeniatherum caput-medusae* (L.) Nevski (*T. crinitum* (Schreb.) Nevski) – лентоостник голова Медузы (л. длинноволосый)	anl	15-20	+	ddpl	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Weed
71	*Tamarix laxa* Willd. – гребенщик рыхлый	shb	100-150	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
72	*Tamarix sp.* – гребенщик	shb	150-180	1	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native. Natural dominant
73	*Taraxacum officinale* F.H. Wigg. – одуванчик лекарственный	pnl	12-15	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Adventive. Weed
74	*Trigonella geminiflora* Bunge – пажитник парноцветковый	anl	5-7	+	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.

№	Species	Life form	Height, sm	Abundance	Phenophase	Condition	Status
75	*Tulipa korolkowii* Regel – тюльпан туркестанский	pnl	10-12	+	bud	nml	IUCN (2019): Not Evaluated (NE). National status: RedList Uzb3. Native
76	*Tulipa turkestanica* Regel – тюльпан туркестанский	pnl	10-12	+	bud	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
77	*Xanthium spinosum* L. – дурнишник колючий	anl	20-25	+	veg	nml	IUCN (2019): Not Evaluated (NE). National status: None. Adventive Weedy
78	*Zygophyllum atriplicoides* Fisch. & C.A. Mey. (*Halimiphyllum atriplicoides* Boriss.) – парнолистник лебедовидный	shb	50-120	+-1	bsm	nml	IUCN (2019): Not Evaluated (NE). National status: None. Native.
	Total 78 species						

Photo 23. Kelif-Sherobad mountain chain, threatened species *Tulipa korolkowii*

Photo 24. Kelif-Sherobad mountain chain, threatened species *Cousinia spryginii*

Conclusion

The field survey of the project territory shows that the vegetation of this region is greatly impacted by anthropogenic factors, such as irrigation-based agriculture, pasturing, waste dumps and uncontrolled development of a network of roads. Approximately 70% of the territory designated for the construction of a power transmission line is occupied by cultivated vegetation (agrophytocoenoses).

After the processing of obtained field research material, lists of plants recorded on each of the studied sites were compiled.

The site designated for the construction of a solar power station (Karakyr Upland), which is composed of virgin and fallow land, is occupied by a saltwort-ephemeroid association (*Salsola*

orientalis, Carex pachystylis, Poa bulbosa) consisting of 35 plant species, all of which are aboriginal and 12 are synanthropic weeds. The saltwort-camelthorn-tamarisk association on the *solonchak* (*Tamarix laxa, Alhagi pseudalhagi, Suaeda altissima, Climacoptera longistylosa*) consists of 20 species of vascular plants. No rare species from the national and/or international Red Data Books or adventitious plants were recorded on this site during the survey. The overall degradation of the vegetation on the Karakyr Upland can be described as moderate. The phytocoenoses are composed of natural dominants, subdominants and typical species.

The bindweed-ephemeral-ephemeroid and saltwort-bindweed-ephemeroid associations (*Convolvulus hamadae, Salsola orientalis, Carex pachystylis, Carex physodes, Poa bulbosa*) in the Kattakum Sands comprise 40 plant species, 41 plant species were recorded in the ephemeral-ephemeroid-Calligonum (*Calligonum microcarpum, Carex physodes, Poa bulbosa, Bromus tectorum, Hordeum murinum* subsp. *leporinum*) and ephemeral-bindweed-Calligonum (*Calligonum microcarpum, Convolvulus hamadae, Poa bulbosa, Bromus tectorum, Hordeum murinum* subsp. *leporinum*) associations in the small-dune sands. The saltwort-bindweed-ephemeroid (*Convolvulus hamadae, Salsola orientalis, Carex pachystylis, Poa bulbosa*) and harmala-saltwort-ephemeroid (*Peganum garmala, Salsola orientalis, Carex pachystylis, Poa bulbosa*) associations in the Khaudaktau ridge comprise 38 plant species, 17 of which are aboriginal weeds and only 1 adventitious plant – ruderal weed *Xanthium spinosum* common throughout Uzbekistan, a few individuals of which were recorded on the sides of a dirt road running along the existing power transmission line. The phytocoenoses are composed of natural dominants, subdominants and typical species. The degradation of the vegetation in the Kattakum Sands can be described as moderate, in the Khaudag Ridge – moderate and strong. Livestock grazing is the main negative anthropogenic factor.

In the anthropogenic landscapes of the Sherabad valley 48 plant species, including cultivated ones, were recorded along the existing power transmission line, 4 of which were adventitious weeds and 12 aboriginal synanthropic weeds.

The background area (Kelif-Sherabad Range) features 76 plant species, including 4 adventitious weeds and 2 species from the Red Data Book of Uzbekistan. The vegetation of the Kelif-Sherabad Ridge is moderately degraded, with livestock grazing as the main negative anthropogenic factor.

Since the research was carried out in early spring, these lists are far from being complete. To make a complete list of plants growing in the study area (including adventitious and rare species), more research need be carried out in late spring—early summer and in late summer—early autumn.

The results of the field research in the project area show that, overall, the construction of the solar power station and power transmission line in this territory will not have any significant negative impact on the vegetation.

Citing literature [in Russian]

Гранитов И.И, Гранитов А.И., Попов В.А., Демерза О.П. Растительность [Карта]. Масштаб 1:2500000 // Географический атлас Узбекистана. – Ташкент: Госкомземгеодезкадастр, 2012. – С. 138-139.

Гранитов И.И., Попов В.А. Растительность [Текст] // Географический атлас Узбекистана. – Ташкент: Госкомземгеодезкадастр, 2012. – С. 136-137.

Джумаев К. Дикорастущие эфиромасличные растения Сурхан-Шерабадской долины

// Автореф. дис. канд. биол. наук. – Ташкент, 1974. – 39 с.

Заключительный отчет о научно-исследовательской работе по государственному инновационному проекту И5-ФА-1-11821 «Кадастр краснокнижных видов флоры и фауны Ташкентской и Сурхандарьинской областей Узбекистана». – Ташкент, 2013. – 196 с.

Закон Республики Узбекистан «Об охране и использовании растительного мира» № 543-I от 26 декабря 1997 года (в новой редакции согласно Закону РУз № ЗРУ-409 от 21 сентября 2016 года)

Камелин Р.В. Флорогенетический анализ естественной флоры горной Средней Азии. – Л.: Наука, 1973. – 356 с.

Камелин Р.В., Хасанов Ф.О. Вертикальная поясность растительного покрова хребта Кугитанг (Юго-Западный Памиро-Алай) // Ботан. журн., 1987, т. 72, № 1. – С. 49-58.

Коровин Е.П. Ботанико-географические районы Узбекистана и особенности его растительности / В кн.: Флора Узбекистана. Т. 1. – Ташкент, 1941. – С. 51-54.

Коровин Е.П. Краткий очерк истории исследования растительности Узбекистана / В кн.: Флора Узбекистана. Т. 1. – Ташкент, 1941. – С. 31-38.

Коровин Е.П. Растительность Средней Азии и Южного Казахстана. – Ташкент, 1934. – 479 с.

Коровин Е.П. Растительность Средней Азии и Южного Казахстана. 2-е изд. – Ташкент: Изд-во АН УзССР, 1961, 1962. Т. 1-2. 452 с., 547 с.

Красная Книга Республики Узбекистан: Редкие и исчезающие виды растений и животных: (в 2-х томах): Т.1. Растения и грибы. – Ташкент: Chinor ENK, 2009. – 356 с.

Красная Книга Республики Узбекистан: Редкие и исчезающие виды растений и животных (в 2-х томах). Т. 1. Растения. – Ташкент: Tasvir, 2019. – Т. 1. – 356 с.

Критерии оценки экологической обстановки территорий для выявления зон чрезвычайной экологической ситуации и зон экологического бедствия. Утверждено Министерством природных ресурсов Российской Федерации 30 ноября 1992 года

Липский В.И. Горная Бухара. В 3 кн. – СПб, 1902–1905.

Липский В.И. Флора Средней Азии (русского Туркестана, ханств Бухары и Хивы). В 3 кн. – СПб, 1902–1905.

Меркулович Н.А. Ботанико-географический очерк южной части Гиссарского хребта с картой растительности // Труды Узбекского ун-та. № 3. – Ташкент, 1935. – с...

Меркулович Н.А. Растительность Ширабадского и Байсунского районов // Тр. Узб. гос. ун-та, 1936, т. 3. с. – 9-59.

Невский С.А. Материалы к флоре Кугитангтау и его предгорий // Флора и систематика высших растений. – М.-Л.: Изд. АН СССР, 1937.– С. 199-346.

Методические указания по геоботаническому обследованию естественных кормовых угодий Узбекистана / под ред. А.И. Гранитова. – Ташкент: Узгипрозем, 1980. – 170 с.

Никитин В.В. Сорные растения флоры СССР. – Л.: Наука, 1983. – 454 с.

Опекунов А.Ю. Экологическое нормирование и оценка воздействия на окружающую среду. – СПб.: Изд-во С.-Петерб. Ун-та, 2006. – 260 с.

Опекунов А.Ю., Ганул А.Г. Теория и практика экологического нормирования в России. – СПб.: Изд-во С.-Петерб. Ун-та, 2014. – 332 с.

Определитель растений Средней Азии. Критический конспект флоры. В 10 томах. – Ташкент, ФАН, 1968–1993.

Определитель растений Средней Азии. 11 т. Под. Ред. Ф.О. Хасанова. – Ташкент: Фан, 2015. – 455 с.

Оценка состояния и устойчивости экосистем. – М.: Изд-во ВНИИприрода, 1992. – 128 с.

Отчет о научно-исследовательской работе за 2019 год по государственному фундаментальному проекту Ф3МВ-2016-0914113123 «Систематика двудольных растений природной флоры Узбекистана». – Ташкент, 2019. – 302 с.

Отчет о научно-исследовательской работе за 2019 год по государственному прикладному проекту П3-20170925347 «Сеточное картирование флоры западных отрогов Зеравшанского хребта и идентификация ключевых ботанических территорий». – Ташкент, 2019. – 300 с.

Полевая геоботаника. В 4-х т. М.-Л.: Изд-во АН СССР, 1959–1976.

Попов М.Г. Новые и редкие растения Бухары // Тр. Пензен. О-ва. любит. естеств., 1916, – вып. 3-4. – С. 269-272.

Попов М.Г. Флора пестроцветных толщ краснопесчаниковых низкогорий Бухары // Труды Туркестанского науч. о-ва. Т. 1. – Ташкент, 1923. – С. 3-42.

Постановление Правительства Республики Казахстан от 31 июля 2007 года № 653 «Об утверждении критериев оценки экологической обстановки территорий».

Растительный покров Узбекистана и пути его рационального использования. В 4-х т. – Ташкент: ФАН, 1971–1984.

Рекомендации по расширению системы охраняемых природных территорий в Узбекистане / Отв. ред. А.Т. Исматов. Программа развития ООН в Узбекистане, Министерство сельского и водного хозяйства, Главное управление лесного хозяйства, ГЭФ. – Ташкент: Baktria press, 2013. – 256 с.

Сенников А.Н. (ред.). Флора Узбекистана, т. 1. – Ташкент: Навруз, 2016. – i-xxviii + 121 с.

Сенников А.Н. (ред.). Флора Узбекистана, т. 2. – Ташкент: Навруз, 2017. – xii + 200 с.

Сенников А.Н. (ред.). Флора Узбекистана, т. 3. – Ташкент: Маънавият, 2019. – xii + 201 с.

СП 11-102-97. Инженерно-экологические изыскания для строительства. – М.: ПНИИИС Госстроя России, 1997. – 37 с.

Тожибаев К.Ш., Бешко Н.Ю., Попов В.А. Ботанико-географическое районирование Узбекистана // Ботанический журнал, 2016. Т. 101, №10. – С. 1105–1132.

Флора Узбекистана. В 6 т. Ташкент: Изд-во АН УзССР, 1951–1962.

Хасанов Ф.О. Эндемичные растения Юго-западных отрогов Гиссарского хребта // Узб. биол. журн., 1991. № 2. – с.41-45.

CABI: Invasive Species Compendium, 2017. [Электронный ресурс]. – URL: www.cabi.org/isc.

Catalogue of Life: 2019 Annual Checklist [Электронный ресурс]. – URL: http://www.catalogueoflife.org/annual-checklist/2019/search/all.

International Plant Names Index [Электронный ресурс]. – URL: www.ipni.org.

IUCN Red List of Threatened species. 2019. [Электронный ресурс]. – URL: http://www.iucnredlist.org.

Sennikov A.N., Tojibaev K.Sh., Beshko N.Yu., Esanov H.K., Jenna Wong L., Pagad S. Global Register of Introduced and Invasive Species - Uzbekistan. Version 1.3. Invasive Species Specialist Group ISSG. 2018. [Электронный ресурс]. – URL: https://doi.org/10.15468/m5vdwk.

The Plant List. 2019. [Электронный ресурс]. – URL: www.theplantlist.org.

Tojibaev K.Sh., Beshko N.Yu., Popov V.A., Jang C.G., Chang K.S. Botanical Geography of Uzbekistan. – Korea National Arboretum, Pocheon, Republic of Korea, 2017. – 250 p.

Appendix 1

List of rare and endemic plant species of project area included in Uzbekitan RedList (2019) and IUCN Red List

№	Latin name	Russian name	Family	Status	Notes
1	*Allium rhodanthum* Vved.	лук красноцветковый	Amaryllidaceae	RedList Uzb 0	Probably disappeared. Narrow rare endemic plant of the southern Pamir-Alay.
2	*Andrachne vvedenskyi* Pazij	андрахне Введенского	Rubiaceae	RedList Uzb 1	Narrow rare stenobiont endemic of Kelif-Sherobad ridge.
3	*Astragalus rubrigalli* Popov	астрагал кызыл-хуразский	Fabaceae	RedList Uzb 1	Relict stenobiont endemic of Kelif sherobad Ridge.
4	*Cephalorhizum oopodum* Popov & Korovin	корнеглав яйценогий	Plumbaginaceae	RedList Uzb 2	Rare stenobiont endemic of variegated lowlands south-western Pamir-Alay.
5	*Chesneya tribuloides* Nevski	Чезнея якорцевая	Fabaceae	RedList Uzb 3	Rare stenotopic endemic of Kelif-Sheribad Ridge and Kugitang
6	*Cleome gordjaginii* Popov	Клеоме Гордягина	Capparaceae	RedList Uzb 1	Rare stenotopic endemic of Kelif-Sheribad Ridge and Kopetdag
7	*Cousinia spryginii* Kult.	Кузиния Спрыгина	Asteraceae	RedList Uzb 1	Rare stenotopic endemic of southern Pamir-Alay
8	*Cynomorium songaricum* Rupr.	Циноморий джунгарский	Cynomoriaceae	RedList Uzb 1	Rare species
9	*Dipcadi turkestanicum* Vved.	дипкади туркестанский	Hyacintaceae	RedList Uzb 0	Probably disappeared. Narrow rare endemic of Khaudagtau sands
10	*Eremurus luteus* Baker	Эремурус желтый	Asphodelaceae	RedList Uzb 1	Rare species
11	*Euphorbia densiuscula* Popov	молочай густоватый	Euphorbiaceae	RedList Uzb 2	Rare stenotopic endemic of southern Pamir-Alay
12	*Iris victoris* F.O.Khass., Khuzhan. & Rakhimova	Ирис Виктора	Iridaceae	RedList Uzb 1	Narrow rare stenotopic endemic of Kelif-Sherobad ridge
13	*Oligochaeta vvedenskyi* (Popov) Soják	олигохета Введенского	Asteraceae	RedList Uzb 3	Rare endemic of Surkhan-Sherobad valley
14	*Phlomoides baburii* (Adylov) Adylov, Kamelin & Makhm.	фломоидес Бабура	Lamiaceae	RedList Uzb 1	Rarest stenotopic endemic of Kelif-Sheribad Ridge,
15	*Plocama botschantzevii* (Lincz.) M. Backlund et Thulin	Плокама Бочанцева	Rubiaceae	RedList Uzb 1	Rarest stenotopic endemic of Kelif-Sheribad Ridge
16	*Spryginia winklerii* (Regel) Popov	Спрыгиния Винклера	Brassicaceae	RedList Uzb 1	Rare endemic of southern Pamir-Alay
17	*Tulipa korolkowii* Regel	Тюльпан Королькова	Liliaceae	RedList Uzb 3	Rare endemic of Western Tian-Shan and south-western Pamir-Alay.
18	*Tulipa tubergeniana* Hoog	тюльпан Тубергена	Liliaceae	RedList Uzb 3	Rare endemic south-western Pamir-Alay.
19	*Zygophyllum bucharicum* B Fedtsch.	Парнолистник бухарский	Zygophyaceae	RedList Uzb 1, IUCN Red List CR	Relict stenobiont endemic of Kelif-Sheribad Ridge.

Appendix 2 [in Russian]

РАЗМЕРЫ
платежей за заготовку (сбор) видов растений, занесенных в Красную книгу Республики Узбекистан (согласно Приложению 1 к Положению о порядке использования объектов растительного мира и прохождения разрешительных процедур в сфере пользования объектами растительного мира)

Статус вида в Красной книге	Стоимость 1 экземпляра растения	
	для юридических и физических лиц - граждан Республики Узбекистан (в коэффициентах от минимальной заработной платы)	для иностранных граждан и юридических лиц (в долларах США)
1 — исчезающие	0,2	30
2 — редкие	0,1	15
3 — сокращающиеся	0,02	3
1 кг семян и луковиц — в 10-кратном размере от стоимости растений того же статуса 1 кг корней, листьев и смолы (сока) — в 3-кратном размере от стоимости растений того же статуса		

РАЗМЕРЫ
взыскания за ущерб, причиненный растениям, занесенным в Красную книгу Республики Узбекистан (согласно Приложению 19 к Положению о порядке использования объектов растительного мира и прохождения разрешительных процедур в сфере пользования объектами растительного мира)

Статус вида в Красной книге	Размер взыскания в коэффициентах от минимальной заработной платы (за 1 растение)
1 — исчезающие	2
2 — редкие	0,8
3 — сокращающиеся	0,5

Размеры взыскания за ущерб, причиненный объектам растительного мира, не внесенным в Красную книгу Республики Узбекистан (согласно Приложению 15 к Положению о порядке использования объектов растительного мира и прохождения разрешительных процедур в сфере пользования объектами растительного мира)

Объекты растительного мира и вид ущерба	Размер взыскания в коэффициентах от минимальной заработной платы (за 1 га)
уничтожение растительного покрова техногенными действиями (прокладка автомобильных и железных дорог, трубопроводов, проведение геологоразведочных и буровых работ, загрязнение нефтепродуктами и др.)	10
уничтожение лесных культур на горных склонах и террасах	30
Уничтожение молодняка и самосева естественного происхождения в горных лесах	15

РАЗМЕРЫ
платежей за рубку деревьев и кустарников вне государственного лесного фонда (согласно Приложению 2 к Положению о порядке использования объектов растительного мира и прохождения разрешительных процедур в сфере пользования объектами растительного мира)

Диаметр дерева (см) на высоте 1,3 м	Размер стоимости разрешения на рубку 1 экземпляра (в коэффициентах от минимальной заработной платы)	
	деревья и кустарники малоценных пород: айлант, акация белая, клен ясенелистный, тополь, шелковица и др.	ценные древесные и кустарниковые породы: грецкий орех, груша, можжевельник, чинара, ясень и др.
до 4	0,1	0,2
4,1 — 8	0,2	0,3
8,1 — 12	0,3	0,5
12,1 — 16	0,5	0,8
16,1 — 20	0,9	1,2
20,1 — 24	1,3	1,5
24,1 — 28	1,5	2,2
28,1 — 32	2,0	2,8
32,1 — 36	2,8	3,8
36,1 — 40	3,6	5,0
40,1 — 44	4,9	7,0
44,1 — 48	6,0	8,3
48,1 — 52	6,8	9,5
52,1 — 56	7,7	10,7
56,1 — 60	8,6	12,2
60,1 — 64	9,5	13,6
свыше 64 см за каждый последующий сантиметр платеж увеличивается на 0,1 коэффициент		

РАЗМЕР
взыскания за ущерб, причиненный незаконной рубкой и повреждением деревьев и кустарников на территории Республики Узбекистан (согласно Приложению 14 к Положению о порядке использования объектов растительного мира и прохождения разрешительных процедур в сфере пользования объектами растительного мира)

Вид нарушения	Размер взыскания в коэффициентах от минимальной заработной платы	
	Леса, деревья и кустарники, выполняющие водоохранные и противоэрозионные функции, особо ценные лесные массивы, городские леса, леса зеленых зон вокруг городов и населенных пунктов, леса, имеющие научное или историческое значение, лесопарки, лесоплодовые насаждения, другие леса, имеющие важное значение для защиты окружающей среды, а также древесно-кустарниковые зеленые насаждения населенных пунктов и транспортных магистралей, не входящие в лесной фонд	Леса и древесно-кустарниковая растительность на охраняемых природных территориях (государственные заповедники, биосферные заповедники, природные парки, ландшафтные заказники, биорезерваты, национальные парки)
За каждое срубленное или поврежденное до степени прекращения роста дерева диаметром у пня (см):		
до 4 включительно	0,3	0,4
4,1 — 8	0,4	0,5
8,1 — 12	0,6	0,7

Вид нарушения	Размер взыскания в коэффициентах от минимальной заработной платы	
	Леса, деревья и кустарники, выполняющие водоохранные и противоэрозионные функции, особо ценные лесные массивы, городские леса, леса зеленых зон вокруг городов и населенных пунктов, леса, имеющие научное или историческое значение, лесопарки, лесоплодовые насаждения, другие леса, имеющие важное значение для защиты окружающей среды, а также древесно-кустарниковые зеленые насаждения населенных пунктов и транспортных магистралей, не входящие в лесной фонд	Леса и древесно-кустарниковая растительность на охраняемых природных территориях (государственные заповедники, биосферные заповедники, природные парки, ландшафтные заказники, биорезерваты, национальные парки)
12,1 — 16	0,9	1,2
16,1 — 20	1,3	1,8
20,1 — 24	1,9	2,3
24,1 — 28	2,4	2,7
28,1 — 32	2,9	3,2
32,1 — 36	3,3	4,0
36,1 — 40	4,1	4,6
40,1 — 44	5,3	7,8
44,1 — 48	8,4	9,0
48,1 — 52	9,6	12,6
52,1 — 56	12,7	13,0
56,1 — 60	13,2	13,6
60,1 — 64	14,1	15,0
за каждый сантиметр диаметра сверх 64 см	0,3	0,6
за каждый куст декоративных и технических культур всех пород	0,4	0,6
за один складочный $м^3$:		
саксаула	1,4	2,0
черкеса, кандыма, гребенщика и других кустарниковых пород	0,3	0,4
за каждое дерево, поврежденное не до степени прекращения роста	0,3	0,4
за каждый кустарник, поврежденный не до степени прекращения роста	0,1	0,2

Примечание: физическим лицам, осуществляющим незаконную рубку или повреждение деревьев до степени прекращения роста (ореха грецкого, фисташки, груши, яблони, а также сосны, арчи всех видов, туи восточной, дуба, платана, ясеня, клена, березы), размер взыскания исчисляется по таксе, установленной для лесов, деревьев и кустарников, выполняющих водоохранные и противоэрозионные функции, увеличенной в 5 раз. Юридические лица, осуществляющие незаконную рубку или повреждение деревьев и кустарников до степени прекращения роста, возмещают ущерб в 5-кратном размере от таксы для лесов, деревьев и кустарников, выполняющих водоохранные и противоэрозионные функции.

Appendix 3 [in Russian]

Показатели для оценки состояния растительности как индикатора экологического состояния территории, принятые в Российской Федерации и Республике Казахстан

Показатели	Экологическое бедствие	Чрезвычайная экологическая ситуация	Относительно удовлетворитель-ная ситуация
Уменьшение биоразнообразия (индекса биоразнообразия Симпсона), % от нормы	Более 50	50-10	Менее 10
Плотность популяции вида-индикатора антропогенной нагрузки, % от фонового состояния	Более (менее 50%)	20-50	Более (менее) 20
Площадь коренных (квазикоренных) ассоциаций, % от общей площади	Менее 5	5-80	Более 80
Видовой состав естественной травянистой растительности	Уменьшение обилия вторичных видов	Естественные доминанты и субдоминанты сменились на вторичные	Естественные доминанты, субдоминанты и характерные виды
Возрастной спектр популяций доминантов, возобновление в относительных единицах	Менее 0,1	0,1-0,3	Более 0,3
Лесистость, % от оптимальной для данной природной зоны	Менее 10	10-90	Более 90
Запас древесины основных лесообразующих пород, % от нормы	Менее 30	30-80	Более 80
Техногенное повреждение древостоя, % от площади	Более 50	50-5	Менее 5
Заболевание древостоя, %	Более 50	50-10	Менее 10
Гибель лесных культур, % от площади	Более 70	70-5	Менее 5
Площадь гари, не облесившейся в течение не менее 10 лет	Более 10 тыс. га	10-5 тыс. га	До 5 тыс. га
Площадь посевов, поврежденных вредителями и болезнями растений, % от площади	Более 50	50-10	Менее 10
Гибель посевов, % от общей площади	Более 30	30-5	Менее 5
Проективное покрытие пастбищной сухостепной и полупустынной растительности, % от нормальной	Менее 10	10-80	Более 80
Продуктивность пастбищной растительности, % от потенциальной	Менее 5	5-80	Более 80
Изменение ареалов редких видов	исчезновение	Фрагментация и сокращение	Без изменений
Повреждение растительности заповедников	Смена формаций	Смена ассоциаций	Фенотипические, не вызывающие смены ассоциаций
Площадь зеленых насаждений (на человека в крупных городах и промышленных центрах), % от нормативного	Менее 10	10-30	Более 30

Initial Environmental Examination

April 2021

Uzbekistan: Partial Credit Guarantee Facility for Uzbekistan Solar PPP Program

Appendix 3.1(c): Annex 5 Herpetological Assessment

Prepared by the Ministry of Energy of the Republic of Uzbekistan for the Asian Development Bank.

INFORMATION REPORT

EVALUATION OF THE CURRENT STATE OF REPTILES IN THE SHERABAD SOLAR IPP PROJECT TERRITORY (SURKHANDARYA PROVINCE, UZBEKISTAN)

Accomplished by: T. V. Abduraupov

Tashkent 2020

TABLE OF CONTENTS

INTRODUCTION

This report provides a faunistic survey of the site designated for the construction of a Solar plant PV (Karakyr Upland), the site around a transformer substation (site 2) connected to Transmission lines running across the Karasu riverbed (site 3). All the sites are situated in the southern portion of Surkhandarya Province, in Jarkurgan, Muzrabad and, partially, Sherabad and Angor Districts. The laboratory survey of the fauna which is now being carried out is based on literary and official data, as well as the personal data of the authors of the report.

Structurally, the Surkhandarya oasis is a depression surrounded with mountain ranges from the north, west and east and bordered from the south by the Amudarya, Central Asia's largest river. The Sherabad and Surkhandarya, the main arteries of the Surkhandarya oasis crossing the depression from north to south and merging with the Amudarya, form the Surkhan-Sherabad basin. The Surkhan-Sherabad valley which begins as a narrow depression at the feet of the spurs of the Hissar Range in the north and north-east, lowers and broadens gradually in the southward direction until it reaches the Amudarya. From the east, north and west it is enclosed with the spurs of the Hissar Range which prevent cold air from penetrating into the valley from the north.

The right side of the Sherabad valley lies to the east of the Kelif-Sherabad Ridge; its left side is to the south and south-east of the Sarykamysh-Sherabad Ridge. The Sherabad valley is separated from the Surkhandarya valley by Khaudag, a low ridge with the highest point in Mount Kushtepa (554 m a.s.l.), and Kattakum Sands.

The southern and south-western parts of Surkhandarya Province are open to warm tropical air masses. Thus, the mountain ranges do not allow in cold air masses from the north, while the warm air coming from the south forms a zone with subtropical climate, with extremely hot, dry and long summers and very mild winters. Almost the entire territory of the Surkhan-Sherabad depression has been turned into a cultivated area and is now used for irrigation-based agriculture. The land is used to grow various industrial crops; the largest number of sunny days in Uzbekistan allows some vegetable plants in the region to produce 2–3 crops a year; the territory is also widely used for gardening and viticulture (Tsaruk, Chikin, 2005).

The area's orography has endowed it with specific natural and climatic features.

The lowland in the southern part of the valley (the former bottom of a brackish lagoon) is a flat alluvial fan which has been repeatedly affected by aeolian processes – a natural ancient desert isolate with unique flora and fauna.

The isolation of sandy areas in Surkhandarya Province resulted in the development of a unique reptile fauna, which encouraged a number of researchers to propose the establishment of a special reserve (zakaznik) in the Kattakum desert (Tsaruk, 2001, Tsaruk, Chikin, 2005).

1. The history of research in the region [in Russian]

История изучения гадов, населяющих территорию Узбекистана, как и других позвоночных в Средней Азии, началась с путешествия Э. А. Эверсманна и К. Пандера из Оренбурга в Бухару (октябрь 1820 г. - апрель 1821 г.). Немногочисленные и случайные сборы Э. А. Эверсманна, переданные в Берлинский университет, были обработаны проф. Г. Лихтенштейном и в 1823 г. опубликованы в виде приложения к работе Э. А. Эверсманна.

А. Э. Регель в 1881 г. проехал от Термеза через Шерабад в Гузар, а в 1882-1883 гг. побывал в Самарканде, собрав некоторые коллекции позвоночных, которые были использованы А. М. Никольским.

Книга А. М. Никольского «Пресмыкающиеся и амфибии Туркестанского генерал-губернаторства», полная литературная сводка того времени, была издана в 1899 г. Автор обработал материалы А. П. Федченко и других лиц, собравших их в Средней Азии. В работе приведены сведения по распространению 7 видов земноводных, 3 видов черепах, 42 видов ящериц, 28 видов змей. Из них 2 вида земноводных, вид черепах и более половины видов ящериц и змей добыты на территории Узбекистана (Султанов, Персианова, 1982).

Н. А. Зарудный и С. И. Билькевич с препараторами С. А. Александровым и М. А. Гаркаем 14 мая 1910 г. прибыли в кишлак Хатак, с 15 по 22 мая исследовали горы Кугитанг, 23 мая вышли к Ходжа-Улькану (Ходжа-Булган) на р. Шерабад-Дарья ниже Дербента, прошли в Лайлякан, а 25 мая в Шерабад. Отсюда в один день проехали в Термез (26 мая), 1 июня выехали в Кокайды на р. Сурхан, куда прибыли 2 июня. Далее они прошли вверх по Сурхану через Кокайды в Ходжа-Мильки, 6 июня свернули на юго-восток, достигли Хазретбаба в Бабатаге, затем спустились к Кафирнигану в Таджикистане. В конце июля они вернулись в Узбекистан, высадились у устья Сурхана, а 31 июля выехали в Чарджоу. Материалы, собранные во время этого путешествия, были обработаны А. М. Никольским (1911). Необходимо заметить, что в его работе под названием средняя ящурка фигурирует черноглазчатая.

С. М. Алексеев в мае 1911 г. в Кашкадарьинской и Сурхандарьинской областях собрал небольшое количество пресмыкающихся. Они были переданы в Музей природы в Ташкенте. В своей статье С. М. Алексеев (1911) упоминает только варана, кобру и степную черепаху.

С. Ф. Царевский (1914) упомянул несколько экземпляров пресмыкающихся, пойманных в Узбекистане, а в другой работе (1915) говорит об экземплярах удавчиков, добытых на той же территории.

В. Я. Лаздин с 13 до 21 мая 1915 г. работал в Термезе, затем вышел вверх по Амударье, прибыл в Хатын-Рабат - 22 мая, а 24 мая Айвадж. В августе он вернулся из Таджикистана в Термез, где пробыл два дня, а затем выехал в Чарджоу. Собранные В. Я. Лаздиным данные по земноводным и пресмыкающимся были обработаны и опубликованы С. Ф. Царевским (1917). В статье указаны новые для Узбекистана местонахождения многих видов.

С. А. Чернов в 1935 г. опубликовал заметку, в которой сообщается о нахождении поперечнополосатого волкозуба в окрестностях Термеза.

Г. С. Султанов (1939) указывает степную черепаху, степную агаму, серого варана, длинноногого сцинка и полоза Zamenis sp. для Шерабадского района.

Г. И. Ишунин в 1948 г. (с 27 июля по 22 августа) в Сурхандарьинской области (в Термезском и Шерабадском районах) изучал биологию песчаной эфы. Попутно им была собрана

коллекция других видов пресмыкающихся, поступившая в Институт зоологии и паразитологии АН УзССР. В опубликованной им в 1953 г. статье приведены результаты анализов содержимого 44 желудков. К сожалению, автор исследовал не только желудок, но и кишечник пресмыкающихся, где сохранился хитин муравьев и других насекомых, попавших в их кишечник из желудка ящериц и лягушек. Этим объясняется неверный вывод автора, что взрослые и молодые эфы питаются муравьями. В 1950 г. вышла в свет популярная книга Г. И. Ишунина «Ядовитые змеи Узбекистана». Содержащиеся в ней сведения о точных пунктах нахождения ряда видов представляют определенный интерес.

О. П. Богданов в своей работе «Фауна УзССР. Земноводные и пресмыкающиеся» (1960) приводит данные которые собирал в Сурхандарьинской области в 1949, 1950, 1954 и 1955 годы.

В более поздних работах, данные по пресмыкающимся Сурхандарьинской области, а в частности проектной территории можно найти у Т.Я. Ядгарова (1964, 1968, 1969), Л.А. Персиановой (1972), Я.Д. Давлятова (1985) и А.Ф. Ходжаева (1985).

Н.Н. Щербак (1974) изучал ящурок (род *Eremias*) по всему ареалу их обитания, в том числе в Сурхандарьинской области близ Термеза.

В работе Р.А. Назарова и Н.А. Пояркова (2013), указываются данные по распространению некоторых видов голопалых гекконов рода Tenuidactylus, в том числе в южной части Сурхандарьинской области.

В публикации Д.А. Бондаренко и Е.А. Перегонцева (2017), описано пространственное распределение среднеазиатской черепахи *Testudo horsfieldii* в Узбекистане, в том числе в южной части Сурхандарьинской области.

Так же, в данном отчете представлены собственные данные автора отчета, собранные в ходе полевых исследований района в 2013, 2016, 2017 и 2019 годах.

2. Field herpetological research methods

The field herpetological research was carried out using the following methodological guides: L. G. Dinesman, M. L. Kaletskaya (1978), V. M. Makeyev, A. T. Bozhansky (1988), N. N. Scherbak (1989), Bondarenko (1994) and Bondarenko, Chelintsev, (1996).

The field research aimed to evaluate the state of reptile species in the study area and consisted in the estimation of a species composition and territorial distribution, including concentration areas and habitats' condition.

The species composition and numbers of reptiles were specified using transect surveys, which were made when the animals were most active during the day.

The transect survey method consists in counting individuals along a special marked line (transect), on both sides of it. The duration of the survey depends on the length of the transect line, which is determined based on the types of reptiles and landscape but never exceeds 1 km in one direction. Every individual seen on the transect is recorded irrespective of the distance from the observer. The distance is measured between the recorded individual animal and transect along a perpendicular line (perpendicular distance). The obtained data is used to calculate the density of recorded reptiles. The length of 1 km is selected as optimal, because longer transects in the evaluation of species whose density and activity fluctuate greatly throughout the day and season, like those of the tortoise, as well as an incorrect minimum survey area selected for a specific species, may result in grave errors (Vashetko et al, 2001).

In the analysis of the presence/absence of amphibians and reptiles and specification of their activity a hygro thermometer Nasedal with an elongated indicator was used to measure air temperature and humidity and a non-contact infra-red electronic thermometer DT-8380 to measure the temperature of the substrate. GPS receivers were utilised to specify the coordinates of survey locations/routes. A digital camera Nikon D-3200 with a wide-angle lens AF-S NIKKOR 55-300mm 1:4,5-5,6 G ED VR was used to make visual records (Fig. 1).

Figure 1. Field researchers photographing an object (photo by A. Ten)

3. RESULTS

Given below are descriptions of faunistic complexes that presumably inhabit the sites designated for the construction of a Solar plant PV in the south of Surkhandarya Province – the Karakyr Upland, Khaudag Ridge with a part of the Kattakum Sands and the bed of the Karasu River. It should be kept in mind that the abovementioned lists of species are preliminary and based on available literary and official sources and, partially, on the author's personal field records. To have a full picture of the current situation it is necessary to carry out concentrated field research in the reptiles' most active period (April, May, June) in order to obtain a full list of species, study the condition of populations and specify the numbers of reptiles in each of the sites in question.

The preliminary list of reptiles in the study area is based on the current list of species of herpetofauna in the Uzbekistan Red Data Book (2019), which comprises 60 species from 13 families.

According to external sources of information and the author's personal observations, the project territory is currently inhabited by 31 reptile species from 13 families, which makes this relatively small area quite unique. They comprise 51.7% or more than a half of the total reptile fauna of Uzbekistan! It is also necessary to note that the reptiles inhabiting the area represent all the reptile families found in Uzbekistan. Among the species recorded in the project territory, 9 (29% of the total for the project territory) are listed in the Uzbekistan Red Data Book, 3 (9.7%) are included in the IUCN Red List and 4 (12.9%) are present in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (Table 1).

Table 1. List of reptile species inhabiting the project area

№	Species	Published data	Author's data for previous period	Field data – March 2020	Abundance	Endemism	Protected status		
							Uzbekistan Red List (2019)	IUCN	CITES
Family *Testudinidae*									
1	Central Asian tortoise Среднеазиатская черепаха *Testudo horsfieldii*	+	+	+	Rare		VU	VU	II
Family *Gekkonidae*									
2	Smooth even-fingered gecko Гладкий геккончик *Alsophylax laevis*	+			Rare	UZ, TM	VU:D	CR	
3	Comb-toed gecko Гребнепалый геккон Эверсманна *Crossobamon eversmanni*	+	+		Common				
4	Bogdanov's bent-toed gecko Тонкопалый геккон Богданова *Tenuidactylus bogdanovi*	+	+	+	Common	UZ, TJ, TM			

№	Species	Published	Author's	Field data	Abundance	Endemism	Protected status		
Family *Sphaerodactylidae*									
5	Turkestan Plate-tailed Gecko Сцинковый геккон *Teratoscincus scincus*	+	+		Common				
Family *Agamidae*									
6	Steppe agama Степная агама *Trapelus sanguinolentus*	+	+	+	Common				
7	Frilled toad-headed agama Ушастая круглоголовка *Phrynocephalus mystaceus galli*	+			Not numerous				
8	Boettger caspian toad-head agama Закаспийская круглоголовка Беттгера *Phrynocephalus raddei boettgeri*	+	+		Not numerous	UZ, TJ, TM	VU:D		
9	Sogdian toad-headed agama Согдианская круглоголовка *Phrynocephalus sogdianus*	+	+	+	Common	UZ, TJ			
Family *Anguidae*									
10	Glass lizard Желтопузик *Pseudopus apodus*	+			Not numerous				
Family *Scincidae*									
11	Asian snake-eyed skink Азиатский гологлаз *Ablepharus pannonicus*	+			Common				
12	Long-legged skink Длинноногий сцинк *Eumeces schneideri*	+			Not numerous				
Family *Lacertidae*									
13	Reticulate racerunner Сетчатая ящурка *Eremias grammica*	+	+		Not numerous				
14	Striped racerunner Линейчатая	+	+		Common	UZ, TJ, TM, KZ, AF			

№	Species	Published	Author's	Field data	Abundance	Endemism	Protected status		
	ящурка *Eremias lineolata*								
15	Black-ocellated racerunner Черноглазчатая ящурка *Eremias nigrocellata*	+	+	+	Common	UZ, TJ, TM, AF			
16	Tajik racerunner Таджикская ящурка *Eremias regeli*	+	+		Common	UZ, TJ, TM, AF			
17	Rapid Lizard Быстрая ящурка Eremias velox	+	+		Common				
18	Sand racerunner Полосатая ящурка *Eremias scripta lazdini*	+		+	Common	UZ, TJ			
Family *Varanidae*									
19	Desert Monitor Среднеазиатский серый варан *Varanus griseus caspius*	+	+		Rare		VU:D		I
Family *Typhlopidae*									
20	Eurasian blind snake Червеобразная слепозмейка *Xerotyphlops vermicuaris*	+	+		Rare				
Family *Boidae*									
21	Tatary sand boa Восточный удавчик *Eryx tataricus*	+	+	+	Rare		NT		II
Family *Colubridae*									
22	Indian gamma snake Индийская бойга *Boiga trigonata melanocephala*	+	+		Not numerous		VU:R		
23	Sand racer Стрела-змея *Psammophis lineolatus*	+	+		Common				
24	Spotted whip snake Разноцветный полоз *Hemorrhois ravergieri*	+		+	Common				
25	Spotted desert racer Поперечнопол	+	+		Not numerous				

№	Species	Published	Author's	Field data	Abundance	Endemism	Protected status		
	осатый полоз *Platyceps karelinii*								
26	Diadem snake Чешуелобый полоз *Spalerosophis diadema*	+	+		Not numerous				
27	Dice snake Водяной уж *Natrix tessellata*	+	+		Common				
28	Northern wolfsnake Поперечнополосатый волкозуб *Lycodon striatus bicolor*	+			Rare		VU:R		
29	Afgan Awl-headed snake Афганский литоринх *Lythorhynchus ridgewayi*	+	+		Rare		VU:R		
Family *Elapidae*									
30	Oxus cobra Среднеазиатская кобра *Naja oxiana*	+			Rare		NT	DD	II
Family *Viperidae*									
31	Saw-scaled viper Среднеазиатская эфа *Echis multisquamatus*	+	+		Not numerous				

Notes to Table 1: RDB RUz – species/subspecies included in the Uzbekistan Red Data Book (2019) (CR – Critically Endangered; VU – Vulnerable; NT - Near Threatened); IUCN – species included in the International Union for Conservation of Nature Red List (VU - Vulnerable; NT – Near Threatened); CITES I, II –species included in the Appendices (I, II) of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF- Afghanistan, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

3.1. Annotated list of reptiles inhabiting the project territory

1. Central Asian tortoise *Testudo horsfieldii* (Gray, 1844).

Vulnerable, decreasing endemic of Central Asia. Included in IUCN Red List as Vulnerable (VU) and in Uzbekistan Red Data Book (2019) also as Vulnerable (VU).

In Surkhandarya region, a tortoise was noted by G.S. Sultanov (1939) in a wormwood-cereal semi-desert in Sherabad region. There, the tortoise was observed by O.P. Bogdanov (1960). In the vicinity of Termez and in Ak-Kurgan, not far from Termez, the tortoise was obtained by V. Ya. Lazdin (S.F. Tsarevsky, 1917). O.P. Bogdanov (1956, 1960) observed a tortoise along Karasu (between Termez and Sherabad), as well as in the Surkhandarya valley from the outskirts of Termez to Djarkurgan.

The development of the Sherabad and Surkhandarya valleys almost completely replaced the tortoise from the valleys and separated the habitats of the species on the Babatag ridge, Kugitang ridge, Gissar ridge and Pashkhurt depression (Bogdanov, 1956, 1965; Bond, 1956, 1965; Bondarenko, Peregontsev, 2017).

According to D.A. Bondarenko (Bondarenko, Peregontsev, 2017), the landscapes of the Kugitang ridge and the Kelif-Sherabad ridge, composed of salted variegated deposits, are unsuitable for habitat of the Central Asian tortoise. In the same work, it is indicated that in the Sherabad and Surkhandarya valleys the tortoise was driven out from the plains and gentle foothills. Many places in which it was record earlier were developed (Tsarevsky, 1917; Bogdanov, 1960). On the right bank of the Surkhandarya river between Sherabad oasis and river valley, this species is rarely found on undeveloped gravelly-sandy hills - in two days of counting only 2 individuals were found (0.05 indiv / ha) (Bondarenko et al, 2003, Bondarenko, Peregontsev, 2017).
Due to the relatively small abundance in the survey area and low temperatures, the tortoise was not observed, however wintering holes were calculated (Figure 2).
The oral survey of local people conducted in the area of the Karakir Upland, showed that tortoises are rare in the area (see the part about work with local stakeholders in report on field survey).

Figure 2. Wintering holes of Cental Asian tortoise in Karakyr Upland.

2. Smooth even-fingered gecko *Alsophylax laevis* Nikolsky, 1907.

Vulnerable, decreasing, mosaic-widespread endemic of Uzbekistan and Turkmenistan. Included in IUCN Red List as Critical endangered (CR) and in Uzbekistan Red Data Book (2019) with status Vulnerable (VU: D).
Six specimens of this species were obtained by O.P. Bogdanov (1955, 1956, 1960) on Karasu, on the road from Termez to Sherabad, in 18 km from the last settlement.
We didn't record this species in project area during field works on March 2020 and in previous years.
However, based on similar habitats of the areal of this species in Uzbekistan and close location of the place of findings in the past, we suggest the presence of this gecko on the Karakyr Uplands.

3. **Comb-toed gecko *Crossobamon eversmanni (Wiegmann, 1834).***

This species is an exceptional psammophile and inhabits only weakly fixed, semi-fixed sands. In the Surkhandarya region, A.N Kirichenko (A.M. Nikolsky, 1915) in Termez obtained this species. And also O.P. Bogdanov (1960) – in adjacent of Djarkurgan. In the valley of Surkhandarya, L.S. Barschevsky (Zoological Museum of Moscow University) also caught it.
On 3 km route, we noted 6 individuals of this species on May 31, 2019 in Kattakum sands near the Khaudag.
In March 2020, due to low temperatures, we didn't observed in the project area.

4. **Bogdanov's bent-toed gecko *Tenuidactylus bogdanovi* Nazarov et Poyarkov, 2013.**

A relatively recently described new species isolated from the Turkestan fine-fingered gecko *Tenuidactylus fedtschenkoi* (Strauch, 1887), the paratypes of which are described from the south of Uzbekistan - 20 km north of Sherabad and 15 km west of Djarkurgan (Nazarov, Poyarkov, 2013). Therefore, all individuals described from this territory in earlier publications belong to the Bogdanov's bent-toed gecko.

In Termez, this species was collected by S.I. Bilkevich (A. M. Nikolsky, 1911), A. N. Kirichenko (A. M. Nikolsky, 1915), V. Ya. Lazdin (Zoological institute), O. P. Bogdanov and G. I. Ishunin (IZIP AN SSR); O.P. Bogdanov (1956, 1960), caught these geckos on Karasu between Termez and Sherabad. In the villages Angor, Khotak, Tengri-Haram, the gecko was obtained by N. A. Bobrinsky (Zoological Museum of Moscow University).

On the 3 km route, we noted 12 individuals of this species during night count on May 31, 2019 at the foothills of the Khaudag. The next day, June 1, 2019, during day count on 2 km route, 23 individuals of this species were recorded on subvertical surfaces of sandstone outcrops (Figure 3).

During this field work in March 2020, in the daytime we observed 5 individuals on 1 km route on subvertical sandstone at the foot of the Khaudag at 9th March.

Figure 3. Bogdanov's bent-toed gecko on sandstone at the foothill of the Khaudag.

5. Turkestan plate-tailed gecko *Teratoscincus scincus* (Schlegel, 1858).

Like the Comb-toed gecko, it is a psammophil reptile and lives on similar surfaces.

In the Surkhandarya region the gecko was obtained in Termez by A.N. Kirichenko (A.M. Nikolsky, 1915), O.P. Bogdanov (1956, 1960) on Karasu, in 20 km from Sherabad, and in the vicinity of Djarkurgan (7 km to the south of the city). Ya.D. Davlyatov (1985) observed this species on the sandy massifs of the Kattakum Sands.
31.05.2019 we observed 18 individuals on 3 km route during night count in Kattakum, near Khaudag (Figure 4).
In March 2020, due to low temperatures, it was not observed in the project area.

Figure 4. Turkestan plate-tailed gecko in Kattakum Sands.

6. Steppe agama *Trapelus sanguinolentus* (Pallas, 1814).

In the Surkhandarya region, Steppe agama was noted in the Sherabad region by G.S. Sultanov (1939); in the same area - O.P. Bogdanov (1960) at the villages of Shalkan, Zarabak, Vandop and 10 km to the south from Sherabad; and G.I. Ishunin (IZIP AN UzSSR) - in Zarautsai near the village of Kyzyl-Alma. In Sherabad this species was caught by A. N. Kirichenko and A. E. Regel, in Termez - A. N. Zarudny and A. N. Kirichenko, in Kempir-Tepa - N. A. Zarudny, in Kokaydy - G. E. Grum Grzhimailo (A.M. Nikolsky, 1915). O.P. Bogdanov (1960) caught this agama on Karasu (1956), between Termez and Sherabad, in Surkhan, Kum-Kurgan, Avzikent and Djarkurgan. In the last settlement and in Kattakum Sands Steppe agama was caught by V. Ya. Lazdin (S.F. Tsarevsky, 1917).
1.06.2019 we recorded only two individuals of this species during day count on 2 km route in foothill of Khaudag (Figure 5).

During the field work in March 2020, the species was noted by us twice. 6.03.2020 in the daytime one individual was recorded per 1 km route in Kattakum Sands, in the vicinity of the Khaudag. 12.03.2020 over 1 km of the route we met only one individual on the Karakir Upland in the daytime.

Figure 5. Male of Steppe agama in Kattakum sands.

7. Frilled toad-headed agama *Phrynocephalus mystaceus galli* Krassowsky, 1932.

It is a typical psammophilic reptiles and lives only in sand dunes and semi-fixed sands. It was caught by Roshevich and A.N. Kirichenko in Termez, V. Ya. Lazdin in Kattakum (A.M. Nikolsky, 1915). In Zoological institute (Russia) there are specimens from the vicinity of Termez from E.N. Pavlovsky. The collection of the Institute of Zoology of Uzbekistan contains the collections of O.P. Bogdanov (1960) from the ruins of Old Termez, the environs of Djarkurgan, Kokaida, Avzykent, as well as individuals caught at the Salt Lake, located 25 km from Termez up the Amudarya river, and along the road from Djarkurgan to Avzykent 20 km from the first point.

We didn't record this species in project area during field works on March 2020 and in previous years.

8. **Boettger caspian toad-head agama *Phrynocephalus raddei boettgeri* Von Bedriaga, 1906.**

Vulnerable, decreasing endemic subspecies listed in the Uzbekistan Red Data Book (2019) with status Vulnerable (VU: D). Endemic to the south of Central Asia. In Uzbekistan it lives only in the south of Surkhandarya region. In addition to Uzbekistan, this subspecies lives on the territory of southwestern Tajikistan and eastern Turkmenistan.

It is most abundant on small clay takyrs, the outskirts of which are covered with stunted vegetation of camel-thorn, salsola, wormwood, bluegrass, and on clay soils near Uchkyzyl. Here and in Karasu it is possible to count more than a dozen in 1 hour. On the gravel-sandy soils in the region of Uchkyzyl and Salt Lake, they are much smaller and we were not able to find more than 2-3 individuals in an hour (Bogdanov, 1956, 1960).

This toad-head agama was first obtained by A.E. Regel (Y. V. Bedryaga, 1905; A.M. Nikolsky, 1905a, 1915) in Sherabad. Later it was caught in Termez by V. Ya. Lazdin and A.N. Kirichenko, in Kattakum Sands near Termez - S. F. Tsarevsky (ZIN). The Institute of Zoology of Uzbekistan contains collection of O.P. Bogdanov (1956, 1960) from Karasu (20 km from Sherabad to Termez), Uchkyzyl and Salt Lake (25 km from Termez up the Amudarya).
During the day count on 1 km route along the Khaudag we noted 12 individuals of this species on June 1.06.2019 (Figure 6). The population density of Boettger caspian toad-head agama is relatively high in this territory.
In March 2020, due to low temperatures, we didn't note this species in project area.

Figure 6. Boettger caspian toad-head agama on the Khaudag.

9. **Sogdian toad-headed agama *Phrynocephalus sogdianus* Cernov, 1948.**

Endemic of south-eastern Uzbekistan and south-western Tajikistan. In Uzbekistan lives only in the south of Surkhandarya region. It is a typical representative of psammophilic reptiles and lives only in sand dunes and semi-fixed sands.
In the Surkhandarya region, it was caught by G. E. Grum-Grzhimailo in Ak-Kurgan along Surkhandarya and V. Ya. Lazdin - in the vicinity of Old Termez, near Kazgan-Kuduk, near Termez and in Kattakum sands (ZIN). There are collection of O.P. Bogdanov (1960) from Uchkyzyl, Old Termez, Djarkurgan, Avzykent, from the vicinity of Salt Lake, located 25 km from Termez.
1.06.2019 we noted 5 individuals on 1 km route on sands of Kattakum near Khaudag.

During the field work in March 2020, we recorded 3 individuals on two 1 km routes 9.03.2020 in the Kattakum sands near Khaudag (Figure 7).

Figure 7. Sogdian toad-headed agama in Kattakum sands.

11. Glass lizard *Pseudopus apodus* (Pallas, 1775).

It keeps river valleys (Surkhandarya, Karasu), orchards, gardens, vineyards, banks of irrigation canals, common in rainfed crops and in undeveloped foothills in Surkhandarya region.

A.E. Regel (A.M. Nikolsky, 1905a, 1915) caught the Glass lizard in Sherabad; V. Ya. Lazdin (S.F. Tsarevsky, 1917) - in Termez and Akkurgan (up from Termez along Surkhandarya), O.P. Bogdanov (1960) - in Termez and Djarkurgan.

We didn't record this species in project area during field works on March 2020 and in previous years.

However, the oral survey of local people conducted in the area of the Karakir Upland, showed that some people regularly see the Glass lizard in the Karakyr Upland (see the part about work with local stakeholders in report on field survey).

12. Asian snake-eyed skink *Ablepharus pannonicus* (Fitzinger, 1824).

In Surkhandarya region, A.E. Regel caught skink in Sherabad (A. M. Nikolsky, 1905, 1915); V. Ya. Lazdin (S.F. Tsarevsky, 1917) -in Termez.

We didn't record this species in project area during field works on March 2020 and in previous years.

13. Long-legged skink *Eumeces schneideri princeps* Eichwald, 1839.

The Long-legged skink was caught by E.N. Pavlovsky (ZIN) in Termez and O.P. Bogdanov - in Djarkurgan (1960).
We didn't record this species in project area during field works on March 2020 and in previous years.

14. Reticulate racerunner *Eremias grammica* (Lichtenstein, 1823).

It is a typical representative of psammophilic reptiles and lives only in sand dunes and semi-fixed sands.
Reticulate racerunner was caught by V. Ya. Lazdin (S. F. Tsarevsky, 1917) in the vicinity of Old Termez and in Kattakum; E. N. Pavlovsky (ZIN) and N. A. Zarudny (A. M. Nikolsky, 1905, 1915) in Termez; O.P. Bogdanov (1960) in Uchkizyl, Djarkurgan, at the Salt Lake (25 km from Termez) and in Avzikent.
In April 2013, we noted it in Kattakum, near Khaudag (own data).

15. Striped racerunner *Eremias lineolata* (Nikolsky, 1897).

Striped racerunner was caught by N. A. Zarudny. and A.N. Kirichenko (ZIN) in Termez, G.E. Grum-Grzhimailo (ZIN) in Ak-Kurgan; V.Ya. Lazdin (S.F. Tsarevsky, 1917) - in Patta-Gissar, Old Termez and Khargali (ZIN), O.P. Bogdanov (1960) - in 10 km south of Sherabad, at the station. Uchkyzyl, in the vicinity of Djarkurgan, between Djarkurgan and Avzykent, in Avzykent and at the Salt Lake, 25 km above Termez along the Amudarya.
1.06.2019 we noted 8 individuals of this species on 1 km route during the day count along the Khaudag (Figure 8).
In March 2020, due to low temperatures, we didn't note it in the project area.

Figure 8. Striped racerunner on Khaudag.

16. Black-ocellated racerunner *Eremias nigrocellata* Nikolsky, 1896.

Vulnerable, decreasing, locally widespread species listed in the Uzbekistan Red Data Book (2019) with the status VU:D. It is endemic of Iran, Afghanistan, Turkmenistan and the southern parts of Tajikistan and Uzbekistan.

This species is morphologically and genetically close to the Aralo-Caspian racerunner. Black-ocellated racerunner is widespread only in the flat part of the Surkhandarya region. Here, it keeps clay soils with sparse vegetation; it also occurs on takyr-like soils, almost devoid of vegetation. The place of shelter are the holes of rodents and their own.

Caught by A. E. Regel (ZIN) and G. E. Grum-Grzhimailo (ZIN) - in Sherabad; G. E. Grum-Grzhimailo (ZIN) - in Ak-Kurgan on Surkhandarya; O.P. Bogdanov (1956, 1960) noted it on Karasu between Sherabad and Termez, in Uchkizil, in Surkhan, Kum-Kurgan and Avzykent.

1.06.2019 we noted 4 individuals on the 1 km route of day count along the Khaudag.

During field work in March 2020, we observed 18 individuals on 6 transects on different days in Kattakum Sands, in environs of Khaudag and on the Karakyr Upland (Figure 9). This species, despite its rarity, is a fairly common and widespread species of reptiles in the project area.

Figure 9. Black-ocellated racerunner in Katakyr Upland.

17. Tajik racerunner *Eremias regeli* Nikolsky, 1905.

Endemic of Central Asia and Afghanistan. Distributed in Afghanistan, Turkmenistan and the southern parts of Tajikistan and Uzbekistan. A typical species of the foothills of southern Uzbekistan. In Uzbekistan lives only in Surkhandarya region.
One specimen was taken by A. Regel in Sherabad, as reported by Y. V. Bedryaga (1905, 1912) and A. M. Nikolsky (1905, 1915).
Earlier, we observed this species in the vicinity of Karakyr Upland in 2013, 2016 and 2017 (own data).
In March 2020, we didn't record it in the project area.

18. Rapid lizard *Eremias velox* (Pallas, 1771).

In Uzbekistan, Rapid lizard is a typical species of river valleys, where it is most numerous. However, this lizard is also found in other very diverse biotopes, the population of which depends on the presence of other racerunners. In Sherobad valley near Karasu river, it adheres to the floodplain of the river, and the adjacent steep clay cliffs are populated by the Tajik racerunner (Bogdanov, 1960).
Rapid lizard is indicated by O.P. Bogdanov (1956, 1960) at the Kainar-Ata spring, Karasu river and Termez. In Termez it was caught by A.N. Kirichenko (A.M. Nikolsky, 1915), and in the vicinity of the same city in Patta Gisar - by V. Ya. Lazdin (ZIN).
In April 2013, we noted it along the Karasu River (own data).
In March 2020, we didn't record it in the project area.

19. Sand racerunner *Eremias scripta lasdini* (Tzarevsky, 1918).

Endemic of south-eastern Uzbekistan and south-western Tajikistan. In Uzbekistan lives only in the south of Surkhandarya region. It is a typical representative of psammophilic reptiles and lives only in sand dunes and semi-fixed sands. This subspecies is found only in the southern part of the Surkhandarya region. T.Ya. Yadgarov (1969) in his work notes that Sand racerunner is one of the characteristic and numerous species of lizards in the lowland part of Surkhandarya. He noted this species in the vicinity of Uchkyzyl, Avzikent and Djarkurgan.
Caught by G. E. Grum-Grzhimailo (A. M. Nikolsky, 1905) in Ak-Kurgan on Surkhandarya; A. N. Kirichenko (ZIN) - in Termez; V. Ya. Lazdin (S.F. Tsarevsky, 1917) - in the Kattakum near Termez (holotype); O.P. Bogdanov (1960) - in Uchkizyl, Djarkurgan, at the Salt Lake (25 km from Termez up the Amudarya) and in Avzikent. N.N. Scherbak (1974) noted racerunner in the vicinity of Djarkurgan.
One specimen was noted by us on the loosely sands of the Kattakum 9.03.2020.

20. Desert monitor *Varanus griseus caspius* Eichwald, 1831.

Vulnerable, decreasing subspecies listed in the Uzbekistan Red Data Book (2019) with VU:D status.
Desert monitor was noted by G. S. Sultanov (1939) and G.E. Grum-Grzhimailo (A.M. Nikolsky, 1905a) in Sherabad. O.P. Bogdanov (1956, 1960), indicates that he often observed it in 11 km to the south from Sherabad and caught it in Karasu between Sherabad and Termez and in the vicinity of Djarkurgan. The same author points out that in the Surkhandarya region, the monitor lizard is found in semi-fixed and fixed sands, on takyr-like soils and in the steppe foothills. T.Ya. Yadgarov (1968), notes that on the plains of Sherabad and Karasu, the monitor lizard is quite rare - no more than one individual for 2-3 excursions, and in the floodplain of the Amudarya - 3-4 individuals for one excursion.
1.06.2019 we met 1 young specimen (Figure 10) on 2 km route and several chains of footprints of adult individuals during day count in the foothills of Khaudag.

In March 2020, we didn't record it in the project area.
However, the oral survey of local people conducted in the area of the Karakir Upland, showed that Desert monitor may occur in the project area. Local people also claim that lizards are caught for use in traditional medicine (see the part about work with local stakeholders in report on field survey).

Figure 10. Young Desert monitor in Kattakum.

21. Eurasian blind snake *Xerotyphlops vermicuaris* Merrem, 1820.

It is known in the country for only few finds, one of which was, in 2019, 10 km west of the Karakyr Upland, in the foothills of the Kelif-Sherabad ridge (own data).
V. B. Grinberg (Zoological Museum Of Moscow University) in 1937 noted this snake in Karasu valley (Sherabad region); I.F. Lamaev - in June 1946 in the mountains of the Sherabad region (Bogdanov, 1960).

22. Tatary sand boa *Eryx tataricus* (Lichtenstein, 1823).

Close to vulnerable, a mosaic-widespread subspecies listed in the Uzbekistan Red Data Book (2019) with NT status.
This boa usually adheres to clay and loess soils with sparse vegetation. However, in places where there is no Desert sand boa, for example, in the vicinity of Djarkurgan and Avzykent, and where relatively small sections of sand are scattered among the clay desert, the Tatary sand boa comes in scattered sand.
In southern Uzbekistan, a Tatary sand boa was obtained in the vicinity of Termez - A.N. Kirichenko (ZIN) and Kwaskovsky (A.M. Nikolsky, 1916); in Patta Gissar at Termez - V. Ya. Lazdin (S.F. Tsarevsky, 1917); in Djarkurgan, at st. Surkhan and in Avzikent O.P. Bogdanov (1960).
31.05.2019 we noted 2 individuals on 3 km route during night count in Kattakum near Khaudag (Figure 11).

Figure 11. Tatary sand boa in Kattakum sands.

In March 2020, due to low temperatures, we were not noted in the project area.
However, later we received photo of this species taken by geologists on March 16, 2020 on the Karakyr Upland (Figure 12). Also, a survey of local stakeholders showed that Tatary sand boa are often caught in this area for use in traditional medicine (see the part about work with local stakeholders in report on field survey).

Figure 12. Tatary sand boa in Karakyr upland (Zoir)

23. Indian gamma snake *Boiga trigonata melanocephala* (Annandale, 1904).

Vulnerable, naturally rare, locally distributed subspecies listed in the Uzbekistan Red Data Book (2019) with VU:R status.

Indian gamma snake leads a strictly nocturnal lifestyle, therefore it is very rarely seen. Only sometimes in February snakes bask in sunny places.

One individual was taken by I.F. Lamaev, four - by O.P. Bogdanov (1960) on Karasu at 18 and 25 km from Sherabad. Habitat was a clay desert with poor vegetation, crossed by a deep canyon and ravines.

Two adult individuals of this extremely rare snake we met during night count 31.05.2019 in Kattakum near the Khaudag (Figure 13). This territory is one of the few sites where this species has been preserved on the territory of the Republic of Uzbekistan.

In March 2020, we didn’t record Indian gamma snake in the project area.

Figure 13. Indian gamma snake in Kattakum Sands

24. Sand racer *Psammophis lineolatus* (Brandt, 1838).

In the Surkhandarya region, it adheres to fixed and mobile sands, gravelly plains, mountains, and degraded sierozems near settlements.

Indicated for the project area by O.P. Bogdanov (1956, 1960) - 6 km south of Sherabad and Karasu (18 km from Shirabad); in Termez - V. Ya. Lazdin (ZIN), Kwaskovsky (A.M. Nikolsky, 1908) and Central Asian Expedition AN (ZIN) and O.P. Bogdanov (1960) - in the ruins of Old Termez, at the Salt Lake.

1.06.2019 we met 2 individuals of this species on 2 km route during day count near Khaudag.

In March 2020, we didn't record Sand racer in the project area.

25. Spotted whip snake *Hemorrhois ravergieri* (Menetries, 1832).

Typical habitats of this species in the Surkhandarya region are foothills rich with ravines or colonies of rodents, as well as clay cliffs bordering floodplains of rivers, and human settlements in the foothills.

In Kugitang the snake was caught by O.P. Bogdanov (1960) in Shalkan and Vandop and along Karasu, 18 km from Sherabad; V. B. Grinberg (Zoological museum of Moscow University) - in the Sherabad region. In the Surkhandarya Valley O.P. Bogdanov (1956, 1960) caught it in Termez, Kum-Kurgan and Karasu. V. Ya. Lazdin (ZIN) - in the vicinity of Termez - in Patta Gissar.

During our field work in March 2020, we observed this species on 2 transects on different days on the Karakyr Upland. In total, 2 individuals were recorded on 2 transects (tab. 2) (Figure 14). Also, a survey of local stakeholders showed that local people regularly see Spotted whip snake in the Karakyr Upland (see the part about work with local stakeholders in report on field survey).

Figure 14. A young Spotted whip snake in the Karakyr Upland

26. Spotted desert racer *Platyceps karelinii* (Brandt, 1838).

In Surkhandarya region the species is quite common - in a few hours it was possible to meet up to 6 individuals (Bogdanov, 1960). O.P. Bogdanov (1956, 1960) noted it on Karasu (18 km from Sherabad), V. Ya. Lazdin caught it in Termez (S.F. Tsarevsky, 1917), A.N. Kirichenko (ZIN) and O.P. Bogdanov (1960) - in Uchkizyl, Djarkurgan and 20 km from Djarkurgan to Avzykent.

31.05.2019 we recorded one adult on a 2 km route during day count in Kattakum, near the Khaudag.

In March 2020, we didn't record Spotted desert racer in the project area.

27. Diadem snake *Spalerosophis diadema* (Schlegel, 1837).

This snake habitats in desert mountains and on gravelly plains. In Kattakum, the snake lives on fixed sand, and on Karasu - in a clay desert. This snake is a typical inhabitant of clay and sandy desert, from where it penetrates the desert uplands.

O.P. Bogdanov (1960) caught a snake on Karasu in 18 km from Sherabad, and in Kattakum; E.N. Pavlovsky (ZIN) - in Termez.

Earlier, we noted this species in the vicinity of the Karakir Upland in 2013 and 2016 (own data).

In March 2020, we didn't record Diadem snake in the project area.

28. Dice snake *Natrix tessellate* (Laurenti, 1768).

The valleys of large rivers are the most typical habitats of Dice snake in the Surkhandarya region. Here it is quite numerous along the banks of the river, along floodplain lakes, along small channels and rice fields. In such places in the spring during a one-day excursion it is possible to meet 20-30 snakes and more. They are most numerous along the banks of ponds overgrown with wild rose, different bushes and other herbs. Less commonly could be found in stones and along banks with poor vegetation.

In the Surkhandarya region A.N. Kirichenko (ZIN, A.M. Nikolsky, 1916), and V. Ya. Lazdin (ZIN) caught it in Termez and Karasu river. O.P. Bogdanov (1956, 1960) caught in Djarkurgan and the vicinity of Shurchi and Karasu.

Earlier, we noted Dice snake on the Karasu River in 2013 (own data).

In March 2020, we didn't record it in the project area.

29. Northern wolfsnake *Lycodon striatus bicolor* (Nikolsky, 1903).

Vulnerable, naturally rare, locally distributed subspecies listed in the Uzbekistan Red Data Book (2019) with VU:R status.

The shores of Karasu, where V.G. Greenberg caught this wolfsnake, are a typical clay desert rich with takyrs and almost devoid of vegetation (Bogdanov, 1960).

2 wolfsnakes were caught by V. G. Grinberg (Zoological museum of Moscow University) in Karasu (Sherabad region), Central Asian Zoological Expedition of the Academy of Sciences (ZIN) in Termez, and O.P. Bogdanov – on Shurchi (1960).

We didn't record this species in project area during field works on March 2020 and in previous years.

30. Afgan Awl-headed snake *Lythorhynchus ridgewayi* Boulenger, 1887.

Vulnerable, naturally rare, locally distributed species listed in Uzbekistan Red Data Book (2019) with the status of VU: R.

Key distribution data for Uzbekistan has been collected over the past 35 years. Prior to the first record (Bondarenko, 1985) of this species in Uzbekistan, it was believed that Afgan Awl-headed snake lives only in the left bank of the Amudarya, in Turkmenistan, Afghanistan, Iran and Pakistan. It should be said that in literary sources there is no mention of the location in the south of the Surkhandarya region. However, we met one adult individual in early June 2019 in the foothills of the Kelif-Sherabad ridge, 12 km west of the Karakir Upland. Given the proximity of the find and the similarity of the biotope, we assume the presence of this species in the project area.

31. Oxus cobra *Naja oxiana* (Eichwald, 1831).

Close to vulnerable, mosaic widespread species. The species is included in the IUCN Red List with status DD and in the Uzbekistan Red Data Book (2019) with NT status.

In the south of the Surkhandarya region Oxus cobra is found in diverse habitats. However, cobras most often were observed in hilly foothills with sparse vegetation, rich with rodent colonies and often completely devoid of water. The place of shelter are the burrows of rodents (large and red-tailed gerbils, lamellate rat).

B.V. Pestinsky (1939), according to D.E. Arapov, indicates it for the Sherabad region. G. I. Ishunin, (1950) reports that specimens in Termez zoo were from the vicinity of Uchkyzyl.

We didn't record this species in project area during field works on March 2020 and in previous years.

However, the oral survey of local people conducted in the area of the Karakir Upland, showed that Oxus cobra may occur in the project area. Local people also claim that cobra is rarely found along ravines and canals, and on perimeter of the Karakir Upland, people caught it for use in traditional medicine (see the part about work with local stakeholders in report on field survey).

32. Saw-scaled viper *Echis multisquamatus* Cherlin, 1981.

In Surkhandarya region Saw-scaled viper is most abundant on loess soils covered with camel-thorn, Salsola and ephemeral plants, along ravines and under the cliffs of Karasu and Surkhandarya rivers, less often it was found in the sands near Old Termez, Uchkyzyl, Djarkurgan and Avzykent.

S.F. Tsarevsky (1917), B.V. Pestinsky (1939), G.I. Ishunin (1953) and O.P. Bogdanov (1956) indicated it for the Termez environs; A. M. Nikolsky (1905) - for the vicinity of Sherabad; B.V. Pestinsky (1939), G.I. Ishunin (1953) and O.P. Bogdanov (1956) - for Karasu (18 km from Sherabad); B.V. Pestinsky (1939) - for Uchkyzyl. O.P. Bogdanov (1960) caught it near Djarkurgan. L.A. Persianova (1972) noted it along the Karasu river and even gave the number of this snake in her work, marking this area as a “snake hearth” (the highest density of the species on the territory).

Figure 15. Saw-scaled viper in the vicinity of Karakir Upland.

We found this species in surrounds of Karakyr upland in April 2017 (Figure 15). And one adult individual was noted by us during night count 31.05.2019 in Kattakum near the Khaudag (Figure 16) (own data).

In March 2020, we were not noted in the project area.

We didn’t record this species in project area during field works on March 2020 due to low temperatures.

Figure 16. Saw-scaled viper in the Kattakum sands.

3.2. The faunistic complexes of the objects in Surkhandarya province

1. Karakyr Upland (Solar plant PV construction site): the fauna of reptiles and amphibians is represented by 15 species (48.4 % of the full list), with 7 (22.6 %) rare species, 3 (9.7 %) endemics and 3 (9.7 %) synanthropic species.

2. Kattakum Sands (transformer substation site): the fauna of reptiles and amphibians is represented by 23 species (74.2 % of the full list), with 7 (22.6 %) rare species, 4 (12.9 %) endemics and 2 (6.5 %) synanthropic species.

3. Mouth of the Karasu River (the site for Transmission lines and other communications): the fauna of reptiles and amphibians is represented by 16 species (51.6 % of the full list), with 7 (22.6 %) rare species, 3 (9.7 %) endemics and 3 (9.7 %) synanthropic species.

Each of the three types of habitats in the study area features a specific faunistic complex, a combination of amphibian and reptile species. Each species has adapted to a specific combination of environmental factors, which determines its association with certain ecosystems and habitats. Two basic groups of species can be identified in any faunistic complex:

1. Species closely associated with a limited range of environmental factors (stenoecic species). These species inhabit only specific types of habitats. They can be quite abundant

(common) when the combination of essential environmental conditions is favourable. Any changes in these conditions may have a negative impact on their numbers and distribution. Thus, they can be used as indicators of the state of natural habitats. In the project area this group is represented largely by psammophilous species (*Crossobamon eversmanni*, Turkestan plate-tailed gecko (*Teratoscincus scincus*), Reticulate Racerunner (*Eremias grammica*), Sand Racerunner (*Eremias scripta*), Frilled toad-headed agama (*Phrynocephalus mystaceus*) and *Phrynocephalus sogdianus*), semi-aquatic species Dice Snake (*Natrix tessellate*) and local endemics (*Phrynocephalus raddei* and Black-ocellated Racerunner (*Eremias nigrocellata*) – the latter, like many other species from this group, classified as rare and endangered).

2. Species capable of adapting to a broader set of environmental conditions (resilient or eurybiontic species). This quality of theirs results in a high distribution and abundance in various types of habitats and higher resistance to anthropogenic impacts. Many species from this group are economically important; they can be very numerous and form diets for predators, including rare ones. The species from this group inhabiting the project area include Bogdanov's bent-toed gecko (*Tenuidactylus bogdanovi)*, Rapid Lizard (*Eremias velox*) and Spotted whip snake (*Hemorrhois ravergieri*).

It should be noted that territories near villages are inhabited, alongside the abovementioned faunistic complexes, by synanthropic reptile species, which include *Tenuidactylus bogdanovi*, the Mountain Racer (*Coluber ravergieri*) and Diadem Snake (*Spalerosophis diadema*). Sometimes the villages are visited by the rare Desert Monitor (*Varanus griseus*) (RDB RUz, 2019) and Saw-scaled Viper (*Echis multisquamatus*), which come there to forage. Strips of land along fields, heaps of earth along canals and the their vertical banks are inhabited by the Rapid Lizard (*Eremias velox*), Tajik Racerunner (*Eremias regeli*), Bogdanov's bent-toed gecko (*Tenuidactylus bogdanovi*), Steppe Agama (*Trapelus sanguinolentus*), Spotted Desert Racer (*Coluber karelini*), Sand racer (*Psammophis lineolatum*) and Oxus Cobra (*Naja oxiana*). The Oxus Cobra is a rare species included in the Uzbekistan Red Data Book (2019) and IUCN Red List.

3.3. Results of the field research in March 2020

The field expedition to the project territory was organised between 5 and 13 March 2020. Alongside ornithological and mammalogical research, the goal of the expedition was to study the herpetological fauna of the area. However, cold weather made it impossible to carry out a comprehensive study of the territory. The survey was possible only within short periods of warm weather, so its results do not quite reflect the actual state and species composition of the area's herpetofauna. Nevertheless, during the trip it was established that the reptiles woke up successfully from their hibernation. The data obtained during the field expedition are provided in Table 2.

Table 2. Results of the research into the reptile fauna of the project territory obtained during the field expedition in March 2020

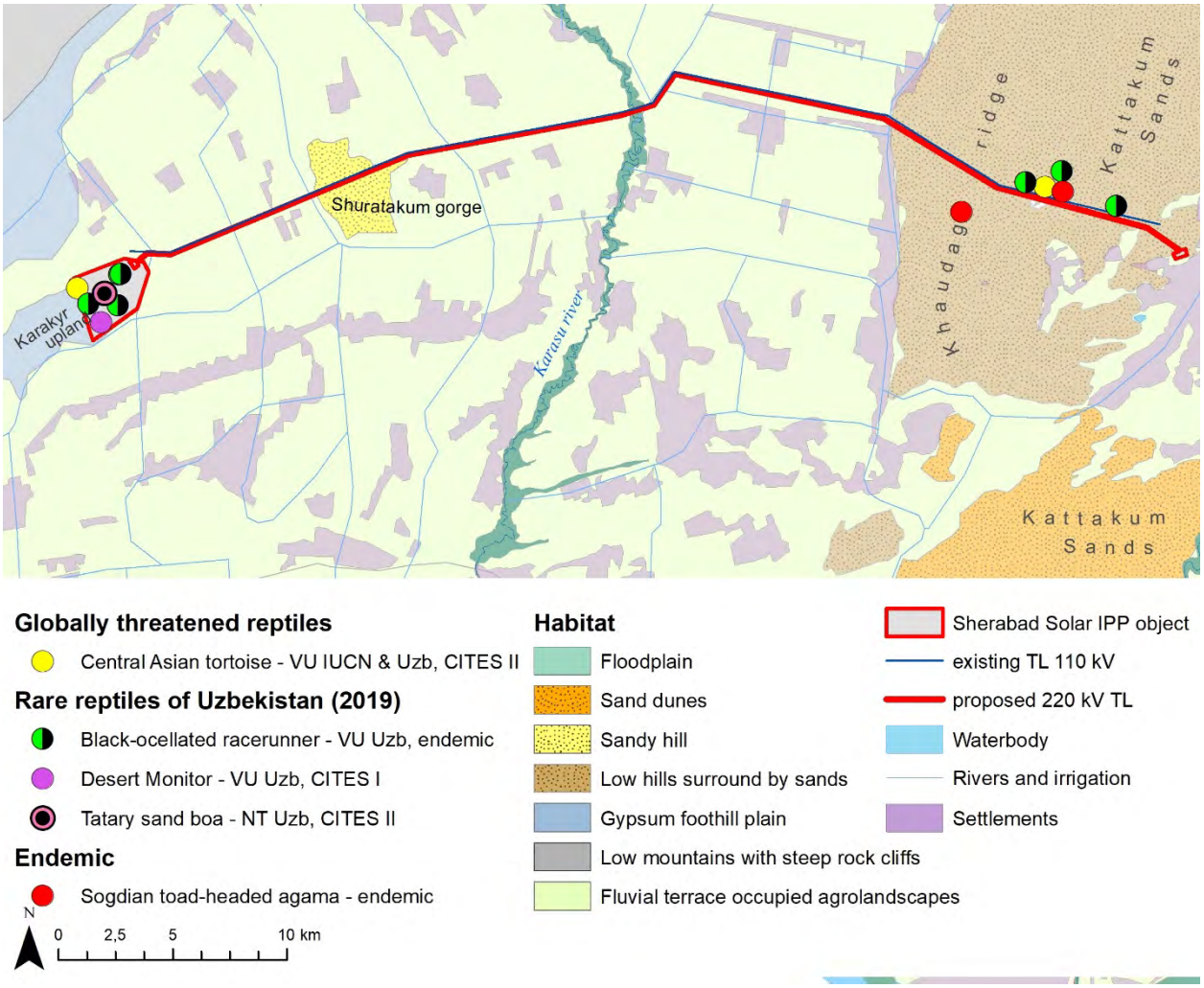
#	Date	Species	Soil t˚C	Air t˚C	Humidity	Number	Length of transect in m	Width of transect in m	Abundance, indiv./ha	Coordinates of the beginning of the transects.
1	06.03. 2020	Black-ocellated racerunner *Eremias nigrocellata*	+18,5	+15,6	43%	1 indiv	1000	10	1	Kattakum desert N 37,5407˚ E 67,3636˚
2	06.03. 2020	Steppe agama *Trapelus sanguinolentus*	+18,5	+15,6	43%	1 indiv	1000	10	1	Kattakum desert N 37,5407˚ E 67,3636˚

#	Date	Species	Soil t˚C	Air t˚C	Humidity	Number	Length of transect in m	Width of transect in m	Abundance, indiv./ha	Coordinates of the beginning of the transects.
3	06.03. 2020	Central Asian tortoise *Testudo horsfieldii*	+18,9	+13,1	56%	7 holes	1000	10	7	Kattakum desert N 37,5527˚ E 67,3231˚
4	06.03. 2020	Black-ocellated racerunner *Eremias nigrocellata*	+18,9	+13,1	56%	4 indiv	1000	10	4	Kattakum desert N 37,5527˚ E 67,3231˚
5	06.03. 2020	Central Asian tortoise *Testudo horsfieldii*	+14	+15,3	41%	3 holes	1000	10	3	Karakir hill N 37,5527˚ E 66,3231˚
6	09.03. 2020	Sand racerunner *Eremias scripta lazdini*	+17,3	+13,9	47%	1 indiv	1000	10	1	Kattakum desert N 37,52982˚ E 67,38650˚
7	09.03. 2020	Black-ocellated racerunner *Eremias nigrocellata*	+26,3	+18,3	31%	3 indiv	1000	10	3	Kattakum desert N 37,54933˚ E 67,34208˚
8	09.03. 2020	Sogdian toad-headed agama *Phrynocephalus sogdianus*	+26,3	+18,3	31%	1 indiv	1000	10	1	Kattakum desert N 37,54933˚ E 67,34208˚
9	09.03. 2020	Sogdian toad-headed agama *Phrynocephalus sogdianus*	+32,1	+15,9	30%	2 indiv	1000	10	2	Khaudag N 37,54445˚ E 67,29697˚
10	09.03. 2020	Bogdanov's bent-toed gecko *Tenuidactylus bogdanovi*	+32,1	+15,9	30%	5 indiv	1000	10	5	Khaudag N 37,54445˚ E 67,29697˚
11	11.03. 2020	Black-ocellated racerunner *Eremias nigrocellata*	+16,6	+12,8	47%	1 indiv	1000	10	1	Karakir hill N 37,5217˚ E 67,8639˚
12	11.03. 2020	Spotted whip snake *Hemorrhois ravergieri*	+16	+12,6	35%	1 indiv	1000	10	1	Karakir hill N 37,5201˚ E 66,8556˚
13	12.03. 2020	Black-ocellated racerunner *Eremias nigrocellata*	+22	+13,4	38%	6 indiv	1000	10	6	Karakir hill N 37,5223˚ E 66,8560˚
14	12.03. 2020	Spotted whip snake *Hemorrhois ravergieri*	+22	+13,4	38%	1 indiv	1000	10	1	Karakir hill N 37,5223˚ E 66,8560˚
15	12.03. 2020	Steppe Agama *Trapelus sanguinolentus*	+22	+13,4	38%	1 indiv	1000	10	1	Karakir hill N 37,5223˚ E 66,8560˚
16	12.03. 2020	Black-ocellated racerunner *Eremias nigrocellata*	+23	+14.2	36%	3 indiv	1000	10	3	Karakir hill N 37,5246˚ E 66,8617˚
17	16.03. 2020	Black-ocellated racerunner *Eremias nigrocellata*				1 indiv	Photo received from geologists (date 16 March 2020)			Karakir hill N 37,5217˚ E 66,8639˚
18	16.03.	Tatary sand boa				1 indiv	Photo received from geologists			Karakir hill

#	Date	Species	Soil t˚C	Air t˚C	Humidity	Number	Length of transect in m	Width of transect in m	Abundance, indiv./ha	Coordinates of the beginning of the transects.
	2020	*Eryx tataricus*					(date 16 March 2020)			N 37,5217˚ E 66,8639˚

Table 2 shows that the dominant reptile species at the end of the hibernation period are Black-ocellated Racerunner (*Eremias nigrocellata*) (RDB RUz, 2019) and Mountain Racer (*Coluber ravergieri*) on the Karakyr Upland, Black-ocellated Racerunner (*Eremias nigrocellata*) (RDB RUz, 2019) and *Tenuidactylus bogdanovi* in the Kattakum Sands. A total of 8 reptile species were recorded during the trip, 3 of which are rare species included in the Uzbekistan Red Data Book, 1 is an endemic species and 1 an endemic subspecies (Map 1).

Map 1. Survey locations and reptile species recorded in the project area during the field trip in March 2020



4. THREATS

4.1. Existing threats

1. Floods in some areas of the sand desert leading to the distruction of aboriginal species.
2. Rapid development of private cattle breeding and, as a result, overgrazing, which hinders the natural recovery of vegetation in the desert and facilitates erosion. The tramping ungulates break heavily the surface of the soil and make the sands drive. The habitats of a number of reptile species transform, the populations in the isolate shrink. This also causes damage to infrastructure.
3. Contamination of roadsides with domestic waste and dumps near human settlements.
4. Extraction of oil and gas; construction of pipelines and other communications.
5. Extraction of soil and carbonates; construction of a dirt road driven permanently by heavy vehicles; construction of a cement plant, waste from the cement plant; creation of open pits.

4.2. Threat associated with the construction of the Solar plant PV

1. Cultivation of areas that are natural habitats for many reptile species (including rare and endemic ones) may cause the destruction of a part of the population.
2. Animals (insects, amphibians, reptiles, birds (chicks), mammals) may fall into pits and ditches on the construction site, which may lead to their injuries and deaths. These pits and ditches are especially dangerous for the Central Asian Tortoise and Sheltopusik.
3. The deformation of the existing landscape will lead to a partial destruction of animals' habitats in the project area.
4. If the construction work is launched in winter, a part of the reptile population (including rare species) may be destroyed.
5. If solar panels are arranged too compactly (very close to each other), the reptiles will receive insufficient ultraviolet essential for their life.

RECOMMENDATIONS

Safety and environmental protection must be priorities in any type of activity, for which it is necessary to make steps to minimise potential damage based on the estimate of potential threats, in our case threats to biodiversity. In this respect we would like to give the following recommendations:

1. Seasonal operations. The construction activities must coincide with the reptiles' active period. It means that all construction work must be carried out when the period of hibernation (winter dormancy) is over for all reptile species. At this time the reptiles do not need a permanent shelter and can leave the territory in good time before the construction operations begin. Construction activities begun in the hibernation period may destroy underground wintering chambers, and in this case the reptile individual is doomed to die.

2. Performing construction operations strictly within the area of land designated for the purpose.

3. Upon the completion of the construction, all ditches and pits must be eliminated (filled with earth), and territories may not be protected with the help of ditches, as animals may be captured there.

4. It is essential to permanently monitor the populations of terrestrial animals within the existing sites after the completion of the construction phase.

5. Creating the so called 'closed areas' within the object (enclosed in a fence), where any type of activity is prohibited. They may act as both the object's 'buffer zones' and protected areas where wild animals can live undisturbed.

Sources of information [in Russian]

1. Алексеев С. М., Поездка в Бухарские владения летом 1911 г., газ. Туркестанский курьер, 1911, № 218 и 219.
2. Бедряга Я. В., Ежегодник Зоологического музея Академии наук, Т. X, СПб., 1905.
3. Бедряга Я. В., Земноводные и пресмыкающиеся, Научные результаты путешествия Н. М. Пржевальского по Центральной Азии, Т. III, ч. 1, вып. 4, СПб., 1912.
4. Богданов О. П., О распространении *Alsophylax laevis* Nik. в Узбекистане, Доклады АН УзССР, 1955, № 6.
5. Богданов О. П. 1956. Изменение герпетофауны под влиянием орошения // Докл. АН СССР. Т. 108, № 6. С. 1177 – 1178.
6. Богданов О.П. Фауна Узбекской ССР. Ч.1. Земноводные и пресмыкающиеся. – Ташкент: Изд-во АН УзССР, 1960. – 260с.
7. Богданов О. П. Экология пресмыкающихся Средней Азии. Ташкент: Наука. 1965. 257с.
8. Красная Книга Республики Узбекистан, II том: Животные; под редакцией Ж.А. Азимова. Т., 2019. - 374 с.
9. Бондаренко Д.А. О находке афганского литоринха в Узбекистане // Вестн. зоологии, 1985, № 5. С. 81.
10. Бондаренко Д. А. Распределение и плотность населения среднеазиатской черепахи в Центральных Кызылкумах (Узбекистан) // Бюл. Моск. о-ва испытателей природы. Отд. биол. 1994. Т. 99, вып. I. С. 22-26.
11. Бондаренко Д.А., Челинцев Н.Г. Сравнительная оценка различных способов маршрутного учета пустынных пресмыкающихся // Бюл. МОИП, 1996. Отд. биол. Т. 101, вып. 3. С. 26-35.
12. Бондаренко Д.А., Перегонцев Е.А. Распространение среднеазиатской черепахи *Agrionemis horsfieldii* (Gray, 1844) в Узбекистане (ареал, региональное и ландшафтное распределение, плотность населения) // Современная герпетология. 2017. Т. 17, вып. 3/4. С. 124 – 146.
13. Давлятов Я.Д., Ядгаров Т.Я., Сартаева Х.М., Ишанова М.А., Махмудов Б. Исследование экологических основ изменчивости и изучение редких видов рептилий. Отчёт Института зоологии и паразитологии АН УзССР. Ташкент, 1985г. – 78 с.
14. Динесман Л. Г., Калецкая М. Л. Методы количественного учета амфибий и рептилий // Методы учета и географическое распределение наземной фауны. М.: Изд-во АН СССР. 1952. С. 329 -341.
15. Ишунин Г. И., Ядовитые змеи Узбекистана, Изд-во АН УзССР. 1950.
16. Ишунин Г. И., Питание песчаной эфы в пустынях Средней Азии, Труды Ин статута зоологии и паразитологии АН УзССР, Т. II, 1953.
17. Макеев В. М., Божанский А.Т. Методические подходы к изучению численности рептилий // Редкие и малоизученные животные Туркменистана. Ашхабад: Ылым, 1988. С. 117-127.
18. Назаров Р.А., Поярков Н.А. Таксономическая ревизия рода *Tenuidactylus* Szczerbak et Golubev 1984 (*Reptilia, Squamata, Gekkonidae*) с описанием нового вида из Средней Азии // Зоологический журнал, 2013, том 92, № 11, с. 1312–1332
19. Никольский А. М., Пресмыкающиеся и земноводные Российской империи, СПб. 1905.
20. Никольский А. М., Материалы по герпетологии Русского Туркестана, Ежегодник Зоологического музея Академии Наук, XIII, СПб, 1908.
21. Никольский А. М. Материалы по герпетологии Восточной Бухары, Ежегодник Зоологического музея Академии наук, XII, № 3, СПб., 1911.
22. Никольский А. М. Фауна России и сопредельных стран. Пресмыкающиеся (*Reptilia*). Т. I. *Chelonia* и *Sauria*. Пг.: Типография Императ. Академии Наук. 1915. 532 с.
23. Никольский А. М., Фауна России и сопредельных стран, Пресмыкающиеся (*Reptilia*), Т. II, Пг., 1916.

24. Пестинский Б. В., Материалы по биологии ядовитых змей Средней Азии, их ловле и содержанию в неволе, Труды Узбекистанского зоологического сада, т. 1, Ташкент. 1939.
25. Персианова Л.А. Экология песчаной эфы *Echis carinatus* (SCHNEIDER 1801) в природе и неволе. Автореферат диссертации на соискание научной степени кандидата биологических наук. Ташкент, 1972. – 20с.
26. Султанов Г. С., Охотничьи и промысловые звери и птицы Шерабадского района, Труды Узбекистанского зоологического сада, т. 1, Ташкент, 1939.
27. Султанов Г.С., Персианова Л.А. Зоологические исследования в Средней Азии. - Ташкент: Фан, 1982, 239 с.
28. Ходжаев А.Ф. Современное состояние и перспектива сохранения серого варана в Узбекистане // Вопросы герпетологии. Тез. докл. 6 Всесоюз. герп. конф. Ленинград, 1985. С. 270–271.
29. Царевский С. Ф., Каталог коллекций Музея при зоологическом кабинете Петроградского университета, Пг., 1914.
30. Царевский С. Ф., Обзор представителей степных удавов (*Eryx*) главным образом из России и сопредельных стран. Ежегодник Зоологического музея Академии наук, Т. XX, № 3, СПб. 1915.
31. Царевский С. Ф., Пресмыкающиеся и земноводные, собранные Б. Я. Лаздиным в Южной и Восточной Бухаре и в северо-восточной части Закаспийской области летом 1915 г., Ежегодник Зоологического музея Академии наук, Т. XXII, Пг., 1917.
32. Царук О.И. Круглоголовки (*Phrynocephalus*) Узбекистана. Состояние популяций и перспективы сохранения // Труды заповедников Узбекистана. Выпуск 3. Ташкент: Chinor ENK, 2001. С. 72-77.
33. Царук О.И., Чикин Ю.А. Описания территориальных выделов элементов ЭКОНЕТА Республики Узбекистан. Отчет проекта. 2005г.
34. Чернов С. А., Новые данные о распространении индийской змеи волкозуб (*Lycodon striatus* (Shaw), (Ophidia, Colubridae) в Советской Средней Азии, Доклады АН СССР, Т. III (VIII), № 4 (64). 1935.
35. Щербак Н.Н. Ящурки Палеарктики. - Киев: Наукова думка, 1974. 296 с.
36. Щербак Н. Н. Количественный учет // Руководство по изучению земноводных и пресмыкающихся. Киев: «Наукова думка», 1989. С. 121-125.
37. Ядгаров Т.Я. К распространению и экологии кобры в бассейне реки Сурхандарья // Узбекский биологический журнал. № 3, 1964. С. 64–66.
38. Ядгаров Т. Я. Материалы по экологии серого варана (*Varanus griseus*) из бассейна Сурхандарьи // Герпетология Средней Азии. Ташкент: Фан, 1968. С. 24–28.
39. Ядгаров Т.Я. К экологии полосатой ящурки в бассейне реки Сурхандарья // Узбекский биологический журнал. № 5, 1969. С. 42–43.
40. Bondarenko D. A., Peregontsev E. A. The state of populations *Agrionemys horsfieldii* in Uzbekistan // Abstract of 12th Ordinary General Meeteng Sosietas Europaea Herpetologica (SEH). Saint Petersburg. 2003. P. 41.
41. IUCN Red List of Threatened Species. Version 2019.1. www.iucnredlist.org
42. Vashetko E.V., Khodjaev A.F., Nuridjanov A.S., Chikin Yu.A.. Resources of Testudo horsefieldii in Uzbekistan. // Congress of Testudo. Gonfaron, France, 2001.
43. http://www.reptile-database.org/data/Reptile_checklist_2019_07.xlsx.
44. www.cites.org

Initial Environmental Examination

April 2021

Uzbekistan: Partial Credit Guarantee Facility for Uzbekistan Solar PPP Program

Appendix 3.1(d): Terms of Reference Bird Survey

Prepared by the Ministry of Energy of the Republic of Uzbekistan for the Asian Development Bank.

TERMS OF REFERENCE

Objective: To Address Data Gaps and Data Analysis of Bird Impacts by the Sherabad IPP Solar PV Project

Background.

1. The Sherabad IPP Project has been proposed in southern Uzbekistan, comprising a Solar PV site, covering approx. 600 ha in the Karakyr Uplands, and a 220 kV transmission line of 52 km that will follow an existing 110 kV line across agrolandscapes, the Karasu River, and Khaudag Ridge in the east. The Project aims to align with the Asian Development Bank (ADB) Safeguard Policy Statement (SPS) 2009 and the IFC Performance Standards (PS6).

2. A Project Ecological Area of Analysis (EAA) was established for compiling the environmental baseline and critical habitat assessment, based on a 50 km radius around the proposed solar project site and proposed transmission line.

3. A field visit to the project site and transmission line alignment was conducted by Anna Ten (team leader), Timur Abduraupov, Natalya Beshko and Valentin Soldatov between 6 and 13 March 2020, and timed to coincide with the northward bird migration. An Ecological Survey Report was compiled following the field visit and serves as a baseline.

4. Observations of bird flight movements were made during the field survey. Data collected include date, location, bird species, flock size, flight altitude, direction and type of flight (migratory movements, foraging, daily movements or unspecified). Number of observations was 64 recorded from 11 different locations over a total period of six days, representing 1,751 individual birds and 27 bird species.

5. A Critical Habitat Assessment (CHA) was conducted, which found that endangered bird species do occur, but none of the species met the threshold requirements for critical habitat. The CHA report presents a basic analysis of the flight data, highlighting an important data gap where the transmission line crosses the Karusu River, but there were insufficient observations along the transmission line route to provide confidence on the levels of mitigation required.

6. Mitigation options were presented in the CHA report, which has been reviewed by the design engineers. However, the CHA report (paragraph 84) recommends that further surveys of bird flight patterns are conducted to address data gaps, to provide a higher standard of data analysis and get inputs from an ornithologist experienced in this kind of assessment.

Actions Required.

7. Further fieldwork is required to conduct vantage point surveys along the transmission line route. Key points to be assessed include the Karusu River crossing, the Solar PV site within the Karakyr Uplands and along the Khaudag Ridge. Field surveys are recommended to include bird carcass searches along the existing 110 kV line.

8. This Terms of Reference (ToR) recommends the Uzbekistan-based field team that conducted the March 2020 field survey led by Anna Ten[1] is appointed again, so that data collected are directly comparable with the existing dataset.

[1] Anna Ten, Email: aini.ten@gmail.com.

9. An ornithologist with experience in data analysis for transmission line assessments needs to be appointed. This ToR recommends that Dr Andrew Jenkins[2] of Avisense Consulting, Cape Town, South Africa is appointed for that purpose.

Procedures Required.

10. Planning of the field survey needs to incorporate inputs from the data analyst, who will guide the field team on the type of data to be collected and highlight key locations for vantage point surveys to be representative of the full transmission line route.

11. The field survey is recommended to cover 32 person days of data collection, which can be most efficiently achieved with a four-person team for 8 days. One week is recommended for data analysis and review of mitigation. These recommendations are presented in Table 1 with proposed rates provided in Table 2.

12. Field surveys are most productive during the migration period, when observations can be made for both migratory and resident bird populations. The northward bird migration takes place during March/April and the southward migration takes place during August/September.

Table 1 Recommended days for the field survey, data analysis and reporting

Study Component	Field Team (4 persons)	Data Analyst (1 person)
Preparation	1	0.5
Field survey	8	
Field report	4	
Data Analysis		3
Reporting		2

Table 2 Recommended rates for the various staff levels required for to conduct the survey

Position	Number of persons	Proposed Daily Rates
Field team lead	1	$200.00 to $500.00
Field assistants	3	$80.00 to $250.00
Data Analyst	1	$350.00 to $700.00

[2] Dr Andrew Jenkins, AVISENSE Consulting. Email: andrew@avisense.co.za; Web: www.avisense.co.za; Mobile: 082 959 9238.