

**THE INSTITUTE OF BIOLOGY AND SOIL
OF THE KR NATIONAL ACADEMY OF SCIENCES**

REPORT

ON STUDY OF VEGETATIVE COVER OF THE KUMTOR MINE AND BARSKAUN VALLEY.



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1. Introduction

"Kumtor" deposit is located on the northern slope of the Akshirak-Too ridge in the Basin of Kumtor River, which is the left tributary of Taragai River, at altitudes of 3685-3780 m above sea level. The road passes through the Barskaun Valley. The flora of the deposit area was studied in 1993, but the list was not published. Flora of Barskaun Valley has not been specifically investigated, including during the process of preparation of mine site Environmental Impact Assessment, and its composition is not known to the fullest extent.

According to the "Atlas of the Kyrgyz SSR," that has the geobotanical zoning (Golovkova et al. 1987) the area belongs to the Asian desert region of Central Tien-Shan province, North Sarydjaz constituency, Akshirak-Keolyunskomu region, meadow-steppe, with spruce forests and tundra in some places. The Barskaun Valley belongs to the Issyk-Kul province, Eastern Issyk-Kul region, Jetyoguz-Jergalan district, bushy-forest-medow.

According to the floristic zoning (Kamelin, 2002), the study area belongs to the ancient Mediterranean subkingdoms of the Holarctic kingdom, Syrtov floristic region of Dzungaria-Tien-Shan-Alai floristic province, and Barskaun belongs to the Eastern Issyk-Kul region.

A field expedition was organized to study the vegetation of the deposit area; the mine and the surrounding areas. The aim of the research was to study of the current state of the flora, to identify the main patterns and factors that influence on the environment of "Kumtor" deposit, determine the impact of mine activities on rare and endemic plant species, determine the effect of dust on vegetation in Barskaun Valley, and to determine the need for further measures to reduce negative impacts, recommend plant species that are suitable for use as a screen for protection against dust.

2. Methods of study

Vegetation

Vegetation descriptions were made on 100m² quadrats. Plants within the boundary of the same association that were beyond that site have also been taken into account. A total of at least 6 sites were laid within associations, the results of which have been summarized.

Abundance of species has been determined based on the Drude scale:

Soc – Sociales – plants were in masses, species are interlocking while forming background.

Cop – Copiosae – copiously

Cop₃ – very copiously (70–90% of plant stand volume)

Cop₂ – copiously (50–70 %)

Cop₁ – plenty (30–50 %)

Sp – Sparsae sparsely (5–30 %)

Sol – Solitaria very few (1-5 %)

Un – only one plant was found within given site

Life form was presented as follows:

Дер. (Der.) – Tree

Куст. (Kust) – Bush

Трав. (Trav.) – Grass

Species that were not identified on site were collected as dried specimens and identified in the laboratory, with the aid of “Key to Plants of Central Asia” (1968-1993), “Flora of Kyrgyz SSR” (1952 -1965) and comparison with specimens that had already been identified. Vegetation types were differentiated in accordance with R.V. Kamelin (2002).

Flora

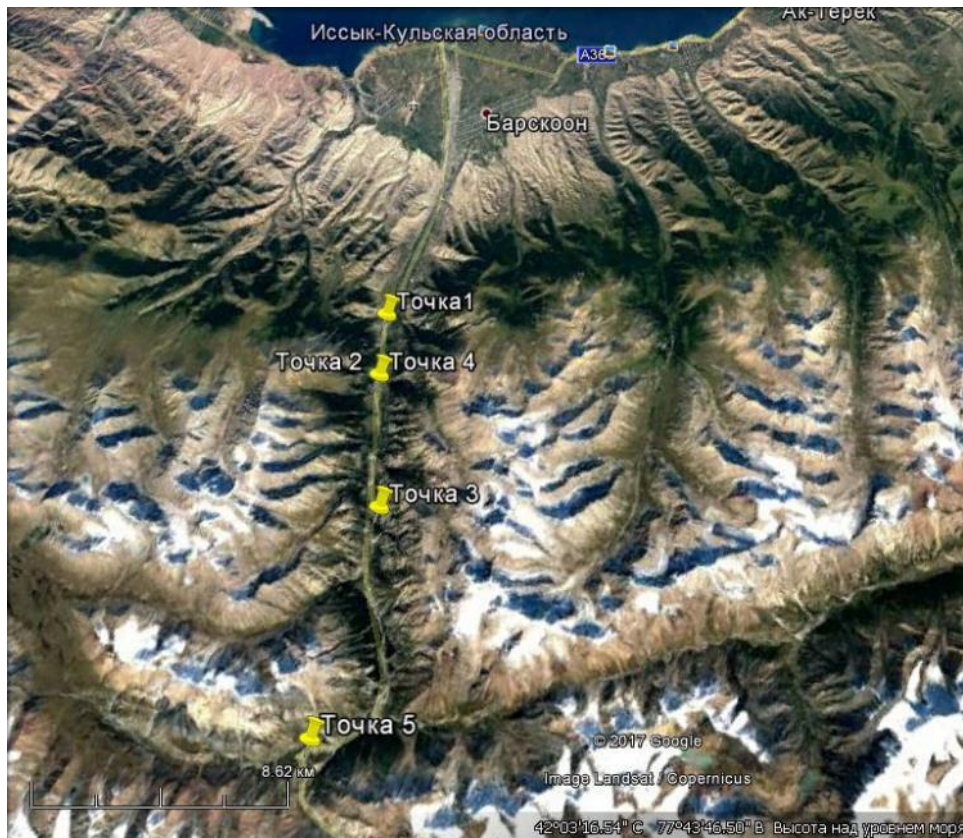
The flora of the region was studied through route-and-search method and on quadrats for vegetation description purposes. In Barskaun Valley it was studied only by quadrats. Coordinates and altitude above sea level were recorded with the use of GPS. However, not only the given area has been explored, but surrounding territories as well. All species have been identified. Photographs of individual plants and plant communities were taken. The lower part of Barskaun Valley is generally inhabited and surrounded with fences, consequently is not accessible for examination. Full and complete examination of flora requires a large amount of time, as well as several visits to the valley during the vegetative period. Consequently, it was decided to examine the flora within given sites only.

3. Description of flora and vegetation composition as of July 2017.

Barskaun Valley

Flora and vegetation examination sites in the Barskaun Valley (Fig. 1)

Fig. 1. Flora and vegetation examination sites in Barskaun Valley



Type of vegetation: Meadow-steppe

Date of observation: 24.08.2017.

Location: Barskaun Valley.

Altitude: 2130 m

Coordinates

42°3'46\".044

E 77°35'33\".144

Formation of meadow grass (*Poa pratensis*)

1. Poaceae-jiji grass association (*Poa pratensis* + *Achnatherum splendens*) (Photo 1).

Photo 1. Poaceae-jiji grass association



Table 1. Floristic composition of Poaceae-jiji grass association

No	Plants			Life form	Abundance
	Latin name	English name	Russian name		
1	<i>Achnatherum splendens</i> (Trin.) Nevski	Chee grass	Ахнатерум блестящий	Grassy	Sp
2	<i>Poa pratensis</i> L.	Birdgrass	Мятлик полевой	Grassy	Cop ₁
3	<i>Artemisia</i> sp.	Wormwood	Польнь	Grassy	Un
4	<i>Potentilla orientalis</i> Juz.	Potentilla <i>orientalis</i>	Лапчатка восточная	Grassy	Un
5	<i>Potentilla</i> sp.	Potentilla	Лапчатка	Grassy	Un
6	<i>Plantago depressa</i> Schlecht.	<i>Plantago depressa</i>	Подорожник прижатый	Grassy	Sp.
7	<i>Phlomoides pratensis</i> (Kar. et Kir.) Adylov et al.	<i>Phlomoides pratensis</i>	Фломоидес луговой	Grassy	Sol
8	<i>Lappula</i> sp.	Stickseed	Липучка	Grassy	Un
9	<i>Salvia deserta</i> Schangin	<i>Salvia deserta</i>	Шалфей пустынный	Grassy	Un

10	<i>Bupleurum thianschanicum</i> Freyn	Thoroughwax	Володушка тяньшанская	Grassy	Un
11	<i>Festuca valesiaca</i> Gaudin	Volga fescue	Овсяница валлисская	Grassy	Sol
12	<i>Agropyron sp.</i>	Bluegrass (Wheat-grass)	Пырей	Grassy	Sol
13	<i>Carex turkestanica</i> Regel	Turkestan sedge	Осока туркестанская	Grassy	Sol
14	<i>Aster canescens</i> (Nees) Fisjun	<i>Aster canescens</i>	Астра седеющая	Grassy	Un
<ul style="list-style-type: none"> Abundance of species has been determined based on Drude scale. <p>Cop₃ – very copiously (70–90% of plant stand volume) Cop₂ – copiously (50–70 %) Cop₁ – plenty (30–50 %) Sp – Sparsae sparsely (5–30 %) Sol – Solitaria very few (1-5 %) Un – only one plant</p>					

Coverage – 80 %

Used for pasture.

“Red Book” species: *absent*

Kyrgyzstan Endemic species: *absent*

Type of vegetation. Bushes

Date of observation: 25.08.2017

Location: Barskaun Valley.

Altitude: 2253 m

Coordinates

N 42°2'26".592

E 77°35'59".136

Formation of spherocarpous barberry (*Berberis sphaerocarpa*)

2. Barberry-Caragana association (*Berberis sphaerocarpa* + *Caragana laeta*) (Photo 2).

Photo 2. Barberry-Caragana association

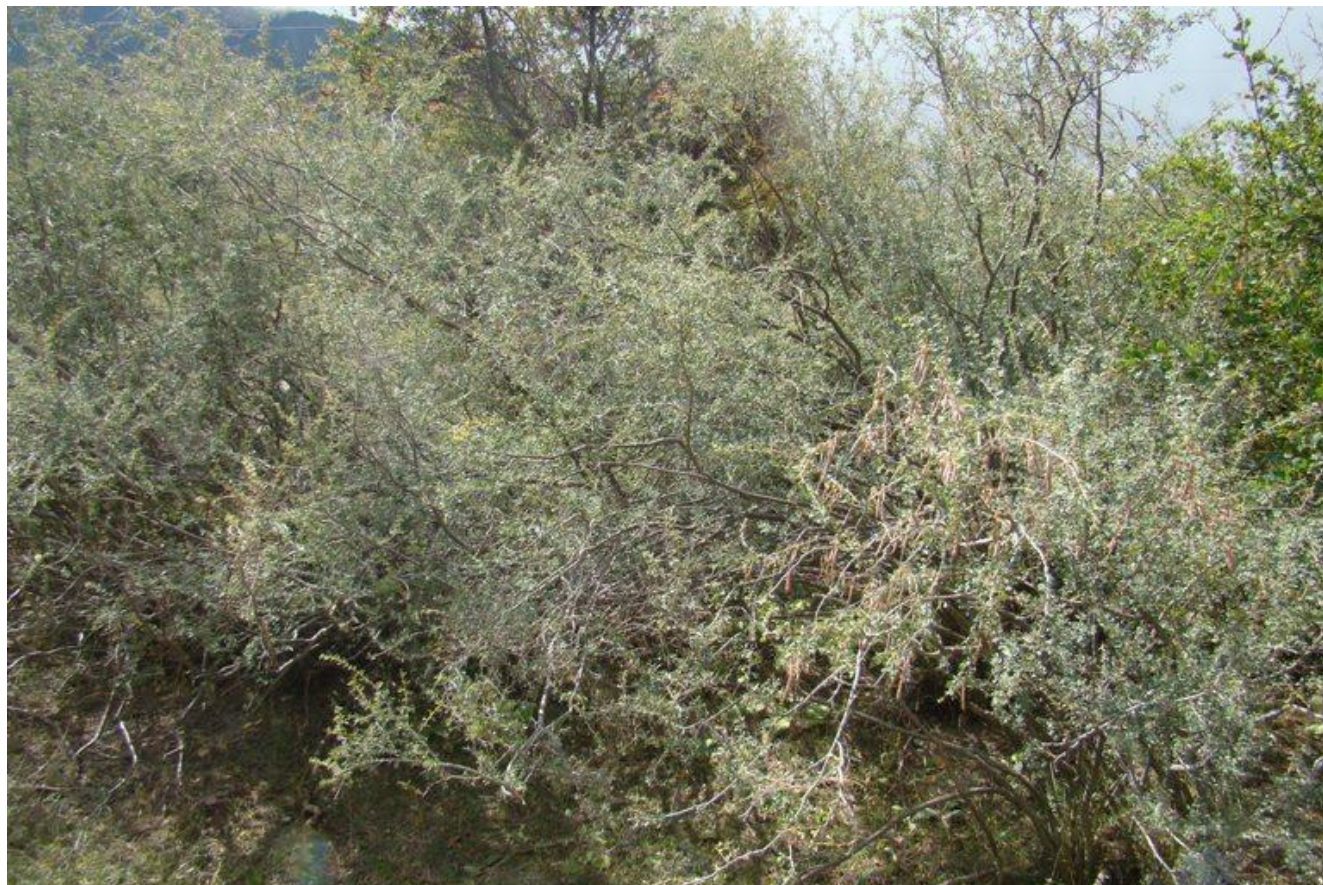


Table 2. Floristic composition of Barberry-Caragana association

No	Plants			Life forms	Abundance
	Latin name	English name	Russian name		
1	<i>Berberis sphaerocarpa</i> Kar. et Kir.	Barbery	Барбарис круглоплодный	Bush	Sp
2	<i>Cotoneaster roborowskii</i> Pojark.	<i>Cotoneaster roborowskii</i>	Кизильник Роборовского	Bush	Sol
3	<i>Poa pratensis</i> L.	Birdgrass	Мятлик полевой	Grassy	Sol
4	<i>Artemisia</i> sp.	Wormwood	Полынь	Grassy	Sol
5	<i>Potentilla orientalis</i> Juz.	<i>Potentilla orientalis</i>	Лапчатка восточная	Grassy	Un
6	<i>Potentilla</i> sp.	<i>Potentilla</i>	Лапчатка	Grassy	Un
7	<i>Plantago depressa</i> Schlecht.	Plantain (<i>Plantago depressa</i>)	Подорожник прижатый	Grassy	Sol
8	<i>Phlomooides pratensis</i> (Kar. et Kir.) Adylov et al.	<i>Phlomooides pratensis</i>	Фломоидес луговой	Grassy	Un
9	<i>Agropyron cristatum</i> (L.) Beauv.	Crested wheatgrass	Пырей гребенчатый	Grassy	Un

10	<i>Thymus seravschanicus</i> Klok.	Thyme)	Тимьян зеравшанский	Grassy	Un
11	<i>Androsace dasyphylla</i> Bunge	Rock jasmine	Проломник шерстистолистный	Grassy	Un
12	<i>Festuca valesiaca</i> Gaudin	Volga fescue	Овсяница валлиская	Grassy	Sol
13	<i>Iris halophila</i> Pall.	<i>Iris halophila</i>	Ирис солелюбивый	Grassy	Un
14	<i>Carex turkestanica</i> Regel	Turkestan sedge	Осока туркестанская	Grassy	Sol
15	<i>Aster canescens</i> (Nees) Fisjun	<i>Aster canescens</i>	Астра седеющая	Grassy	Un
16	<i>Caragana laeta</i> Kom.	Pea shrub	Карагана красивая	Bush	Sp
<ul style="list-style-type: none"> Abundance of species has been determined based on Drude scale. <p>Cop₃ – very copiously (70–90% of plant stand volume) Cop₂ – copiously (50–70 %) Cop₁ – plenty (30–50 %) Sp – Sparsae sparsely (5–30 %) Sol – Solitaria very few (1-5 %) Un – only one plant</p>					

Coverage – 80 %

Used under capacity of pasture.

“Red Book” species: *absent*

Kyrgyzstan Endemic species: *absent*

Type of vegetation: Spruce forest

Date of observation: 25.08.2017

Location: Barskaun Valley.

Altitude: 2284 m

Coordinates

N 41°59'45".924

E 77°37'20".892

Picea schrenkiana formation (*Picea schrenkiana*)

3. Spruce-bush association (*Picea schrenkiana* + *Cotoneaster roborowskii* + *Berberis sphaerocarpa*) (Photo 3).

Photo 3. Spruce-bush association



Table 3. Floristic composition of spruce-bush association

No	Plants			Life forms	Abundance
	Latin name	English name	Russian name		
1	<i>Picea schrenkiana</i> Fisch. et C.A.Mey.	Schrenk's spruce	Ель Шренка	Tree	Cop ₂
2	<i>Berberis sphaerocarpa</i> Kar. et Kir.	Barberry	Барбарис круглоплодный	Bush	Sp.
3	<i>Stellaria soongorica</i> Roshev. ex Schischk.	Chickweed	Звездчатка джунгарская	Grassy	Sol
4	<i>Cotoneaster roborowskii</i> Pojark.	Cotoneaster	Кизильник Роборовского	Bush	Sp
5	<i>Cotoneaster melanocarpus</i> (Bunge) Loudon	Cotoneaster	Кизильник черноплодный	Bush	Sol
6	<i>Poa pratense</i> L.	<i>Poa pratense</i>	Мятлик полевой	Grassy	Sol
7	<i>Viola dissecta</i> Ledeb.		Фиалка рассеченная	Grassy	Sol
8	<i>Thalictrum minus</i> L.	Lesser meadowrue	Василистник малый	Grassy	Sol
9	<i>Potentilla orientalis</i> Juz.	<i>Potentilla orientalis</i>	Лапчатка восточная	Grassy	Un
10	<i>Iris ruthenica</i> Ker-Gawl.	<i>Iris ruthenica</i>	Ирис русский	Grassy	Sp

11	<i>Gentiana kirilowii</i> Turcz.	Kirilov's Gentian	Горечавка Кирилова	Grassy	Un
12	<i>Fragaria vesca</i> L.	Alpine strawberry	Земляника лесная	Grassy	Sol
13	<i>Bupleurum densiflorum</i> Rupr.	<i>Bupleurum densiflorum</i>	Володушка густоцветковая	Grassy	Un
14	<i>Rosa alberti</i> Regel	Albert's rose	Шиповник Альберта	Bush	Un
15	<i>Plantago depressa</i> Schlecht.	Plantain (<i>Plantago depressa</i>)	Подорожник прижатый	Grassy	Un
16	<i>Astragalus tibetanus</i> Benth. ex Bunge	Tibetan locoweed	Астрагал тибетский	Grassy	Un
17	<i>Silene graminifolia</i> Otth	Campion	Смолёвка злаколистная	Grassy	Un
18	<i>Thymus seravschanicus</i> Klok.	Thyme	Тимьян зеравшанский	Grassy	Un
19	<i>Erigeron umbrosus</i> (Kar. et Kir.) Boiss.	Fleabane	Мелколепестник теневой	Grassy	Un
20	<i>Lonicera microphylla</i> Willd. ex Schult.	Button tree	Жимолость мелколистная	Grassy	Sol
21	<i>Adenophora himalayana</i> Feer	Himalayan Ladybell	Бубенчик гималайский	Grassy	Un

- Abundance of species has been determined based on Drude scale.

Cop₃ – very copiously (70–90% of plant stand volume)

Cop₂ – copiously (50–70 %)

Cop₁ – plenty (30–50 %)

Sp – Sparsae sparsely (5–30 %)

Sol – Solitaria very few (1-5 %)

Un – only one plant

Coverage – 95 %

Used for pasture.

“Red Book” species: *Tulipa tetraphylla*

Kyrgyzstan Endemic species: *absent*

Type of vegetation: Meadows

Date of observation: 25.08.2017

Location: Barskaun Valley

Altitude: 2130 m

Coordinates

N 42°2'26".592

E 77°35'59".136

Meadow grass formation (*Poa pratensis*)

4. Meadow grass-Iridaceae association (*Poa pratensis* + *Iris ruthenica*) (Photo 4).

Photo 4. Meadow grass-Iridaceae association



Table 4. Floristic composition of Meadow grass-Iridaceae association

No	Plants			Life forms	Abundance
	Latin name	English name	Russian name		
1	<i>Taraxacum</i> sp.	Dandelion	Одуванчик	Grassy	Un
2	<i>Carex</i> sp.	Sedge (<i>Carex</i> sp)	Осока	Grassy	Sol
3	<i>Cerastium pusillum</i> Ser.	<i>Cerastium pusillum</i>	Ясколка маленькая	Grassy	Un
4	<i>Leontopodium ochroleucum</i> Beauverd	Edelweiss)	Эдельвейс бледно-желтый	Grassy	
5	<i>Urtica dioica</i> L.	Nettle	Крапива двудомная	Grassy	
6	<i>Poa pratense</i> L.	Birdgrass	Мятлик полевой	Grassy	Sol
7	<i>Viola dissecta</i> Ledeb.	Violet	Фиалка рассеченная	Grassy	
8	<i>Thalictrum minus</i> L.	Lesser meadowrue	Василистник малый	Grassy	Sol
9	<i>Potentilla</i> sp.	Bloodroot	Лапчатка	Grassy	Un
10	<i>Iris ruthenica</i> Ker-Gawl.	<i>Iris ruthenica</i>	Ирис русский	Grassy	

11	<i>Alchemilla sibirica</i> Zām.	Siberian Lady's Mantle	Манжетка сибирская	Grassy	
12	<i>Gentiana kirilowii</i> Turcz.	Kirilov's Gentian	Горечавка Кирилова	Grassy	
13	<i>Plantago depressa</i> Schlecht.	<i>Plantago depressa</i>	Подорожник прижатый	Grassy	Un
14	<i>Cirsium alberti</i> Regel et Schmalh.	Thistle	Бодяк Альберта	Grassy	Sol
15	<i>Silene graminifolia</i> Otth	Campion	Смолёвка злаколистная	Grassy	Un
16	<i>Thymus seravschanicus</i> Klok.	Thyme	Тимьян зеравшанский	Grassy	Un
17	<i>Erigeron aurantiacus</i> Regel	Orange daisy	Мелколепестник оранжевый	Grassy	Un
18	<i>Dactylis glomerata</i> L.	Cocksfoot	Ежа сборная	Grassy	Un

- Abundance of species has been determined based on Drude scale.

Cop₃ – very copiously (70–90% of plant stand volume)

Cop₂ – copiously (50–70 %)

Cop₁ – plenty (30–50 %)

Sp – Sparsae sparsely (5–30 %)

Sol – Solitaria very few (1-5 %)

Un – only one plant

Coverage – 95 %

Used for pasture.

“Red Book” species: *Tulipa tetraphylla*

Kyrgyzstan Endemic species: *absent*

Type of vegetation. Sazs

Date of observation: 25.08.2017 г.

Location: Barskaun Valley

Altitude: 2935 m

Coordinates

N 41°55'8".256

E 77°37'48".720

25.08.2017.

Formation of Low kobresia (*Kobresia humilis*)

5. Kobresia association (*Kobresia humilis* + *K. capilliformis*) (Photo 5).

Photo 5. Kobresia association



Table 5. Floristic composition of Kobresia association

No	Plants			Life forms	Abundance
	Latin name	English name	Russian name		
1	<i>Kobresia humilis</i> (C.A.Mey. ex Trautv.) Serg.	Low Bog-Sedge	Кобрезия низкая	Grassy	Сop ₁
2	<i>K. capilliformis</i> Ivanova	Hair-like Bog-Sedge	Кобрезия волосовидная	Grassy	Sp
3	<i>Gentiana barbata</i> Froel.	<i>Gentiana barbata</i>	Горечавка бородатая	Grassy	Un
4	<i>G. karelinii</i> Griseb.	Karelina Gentian	Горечавка Карелина	Grassy	Un
5	<i>G. turkestanorum</i> Gand.	<i>Gentian turkestanorum</i>	Горечавка туркестанцев	Grassy	Un
6	<i>Carex melanantha</i> C.A.Mey.	Black-flowered Sedge	Осока черноцветковая	Grassy	Sp
7	<i>Ranunculus alberti</i> Regel et Schmalh.	Buttercup <i>alberti</i>	Лютик Альберта	Grassy	Un
8	<i>Lomatogonium carinthiacum</i> (Wulfen) Reichenb.	<i>Lomatogonium carinthiacum</i>	Ломатогониум каринтийский	Grassy	Un
9	<i>Plantago arachnoidea</i> Schrenk	<i>Plantago arachnoidea</i>	Подорожник паутинистый	Grassy	Un

10	<i>Pentaphylloides parvifolia</i> (Fisch. ex Lehm.) Soják	<i>Pentaphylloides parvifolia</i>	Курильский чай мелколистный	Grassy	Un
11	<i>Sibbaldia tetrandra</i> Bunge (<i>Dryadanthe tetrandra</i> (Bunge) Juz.)	<i>Sibbaldia</i>	Сиббалдия четырёхтычиночная	Grassy	Sol
12	<i>Trisetum spicatum</i> (L.) K.Richt.	Bristle grass	Трищетинник колосистый	Grassy	Sol
13	<i>Carex stenocarpa</i> Turcz. ex V.Krecz.	Stenocarpous Sedge	Осока узкоплодная	Grassy	Un
14	<i>Polygonum songaricum</i> Schrenk	Buckwheat <i>songaricum</i>	Горец джунгарский	Grassy	Un
15	<i>Androsace dasyphylla</i> Bunge	Rock jasmine	Проломник шерстистолистный	Grassy	Un
16	<i>Leucopoa olgae</i> (Regel) V.Krecz. et Bobrov	<i>Leucopoa olgae</i>	Беломятлик Ольги	Grassy	Sol
17	<i>Festuca coelestis</i> (St.-Yves) V.Krecz. et Bobrov	<i>Fescue coelestis</i>	Овсяница поднебесная	Grassy	Un
18	<i>Viola biflora</i> L.	<i>Violet biflora</i>	Фиалка двухцветковая	Grassy	Un
19	<i>Dracocephalum stamineum</i> Kar. et Kir.	Dragonhead <i>stamineum</i>	Змееголовник тычиночный	Grassy	Un
20	<i>Hordeum brevisubulatum</i> (Trin.) Link	Barley <i>brevisubulatum</i>	Ячмень короткошиловидный	Grassy	Un
21	<i>Potentilla asiae-mediae</i> Ovcz. et KGCzk.	Bloodroot <i>asiae-mediae</i>	Лапчатка Средней Азии	Grassy	Un
22	<i>Scabiosa alpestris</i> Kar. et Kir.	Gipsy-rose <i>alpestris</i>	Скабиоза высокогорная	Grassy	Un
23	<i>Calamagrostis anthoxanthoides</i> (Munro) Regel	Woodreed <i>anthoxanthoides</i>	Вейник пахучеколосниковидный	Grassy	Sol

- Abundance of species has been determined based on Drude scale.

Cop₃ – very copiously (70–90% of plant stand volume)

Cop₂ – copiously (50–70 %)

Cop₁ – plenty (30–50 %)

Sp – Sparsae sparsely (5–30 %)

Sol – Solitaria very few (1-5 %)

Un – only one plant

Coverage – 75 %

Used for pasture.

“Red Book” species: *absent*

Kyrgyzstan Endemic species: *absent*

Kumtor mine and surrounding areas



Type of vegetation. Sazs

Site location: Bordu area. Beyond the site.

Date of observation: 26.08.2017

Altitude: 3462 m

Coordinates

N 41°50'14".208

E 78°6'8".640

Formation of *Kobresia stenocarpus* (*Kobresia stenocarpa*)

6. *Kobresia-Carex* association (*Kobresia humilis* + *C. melanantha*) (Photo 6).

Photo 6. Kobresia-Carex association



Table 6. Floristic composition of Kobresia-Carex association

No	Plants			Life forms	Abundance
	Latin name	English name	Russian name		
1	<i>Kobresia stenocarpa</i> (Kar. et Kir.) Steud.	Stenocarpous Bog-Sedge	Кобрезия узкоплодная	Grassy	Sp
2	<i>Carex aterrima</i> Hoppe	Sedge <i>aterrima</i>	Осока темная	Grassy	Un
3	<i>Carex melanantha</i> C.A.Mey.	Black-flowered Sedge	Осока черноцветковая	Grassy	Sp.
4	<i>Festuca alata</i> (St.-Yves) Roshev. (<i>F. tianschanica</i> Roshev.)	Alatau Fescue	Овсяница алатавская	Grassy	Sol
5	<i>Calamagrostis tianschanica</i> Rupr.	Woodreed <i>tianschanica</i>	Вейник тьяньшанский	Grassy	Sol
6	<i>Gentiana falcata</i> Turcz.	<i>Gentiana falcata</i>	Горечавка серповидная	Grassy	Sol
7	<i>Primula algida</i> Adams	Primula	Первоцвет холодный	Grassy	Un
8	<i>Saussurea leucophylla</i> Schrenk	Sawwort <i>leucophylla</i>	Соссюрея серебристолистая	Grassy	Sol
9	<i>Viola tianschanica</i> Maxim.	Violet <i>tianschanica</i>	Фиалка тьяньшанская	Grassy	Un

10	<i>Thalictrum alpinum</i> L.	Alpine meadowrue	Василистник альпийский	Grassy	Un
11	<i>Potentilla asiae-mediae</i> Ovcz. et KGCzk.	Bloodroot <i>asiae-</i> <i>mediae</i>	Лапчатка Средней Азии	Grassy	Un
<ul style="list-style-type: none"> Abundance of species has been determined based on Drude scale. <p>Cop₃ – very copiously (70–90% of plant stand volume) Cop₂ – copiously (50–70 %) Cop₁ – plenty (30–50 %) Sp – Sparsae sparsely (5–30 %) Sol – Solitaria very few (1-5 %) Un – only one plant</p>					

Coverage – 75 %

Type of vegetation: Sazs

“Red Book” species: *absent*

Kyrgyzstan Endemic species: *absent*

Type of vegetation. Sazs

Site location: Site. Close to the landslide.

Date of observation: 27.08.2017

Altitude: 3603 m

Coordinates

N 41° 52' 02,6''

E 78° 08' 54,9''

Formation of black flower Carex (*Carex melanantha* + *Kobresia stenocarpa*)

7. Carex-Cobresia association (*Carex melanantha* + *Kobresia stenocarpa*) (Photo 7).

Photo 7. Carex-Kobresia association



Table 7. Floristic composition of Carex-Kobresia association

No	Plant			Life form	Abundance
	Latin name	English name	Russian name		
1	<i>Kobresia stenocarpa</i> (Kar. et Kir.) Steud.	Stenocarpous Bog-Sedge	Кобрезия узкоплодная	Grassy	Cop ₁
2	<i>Carex stenocarpa</i> Turcz. ex V.Krecz.	Stenocarpous Sedge	Осока узкоплодная	Grassy	Sp
3	<i>Carex melanantha</i> C.A.Mey.	Black-flowered Sedge	Осока черноцветковая	Grassy	Cop ₁
4	<i>Gentiana algida</i> Pall.	Algid Gentian	Горечавка холодная	Grassy	Un
5	<i>Saxifraga hirculus</i> L.	Yellow marsh saxifrage	Камнеломка болотная	Grassy	Un
6	<i>Gentiana falcata</i> Turcz.	<i>Gentiana falcata</i>	Горечавка серповидная	Grassy	Sol
7	<i>Primula algida</i> Adams	Violet primrose	Первоцвет холодный	Grassy	Un
8	<i>Saussurea leucophylla</i> Schrenk	Sawwort <i>leucophylla</i>	Соссюрея серебристолистная	Grassy	Sol
9	<i>Leontopodium</i> <i>ochroleucum</i> Beauverd	Edelweiss (<i>Leontopodium</i> <i>ochroleucum</i>)	Эдельвейс бледно- желтый	Grassy	Sol
10	<i>Viola tianschanica</i> Maxim.	Violet <i>tianschanica</i>	Фиалка тьяншанская	Grassy	Un
11	<i>Thalictrum alpinum</i> L.	Alpine meadowrue	Василистник альпийский	Grassy	Un
12	<i>Polygonum viviparum</i> L.	Alpine Knotweed	Горец живородящий	Grassy	Sol
13	<i>Potentilla asiae-mediae</i> Ovcz. et KGCzk.	Bloodroot <i>asiae-mediae</i>	Лапчатка Средней Азии	Grassy	Sol
14	<i>Erigeron heterochaeta</i> (Benth. ex Clarke) Botsch.	Oregon <i>heterochaeta</i>	Мелколепестник разноцетинный	Grassy	Sol
15	<i>Trisetum spicatum</i> (L.) K. Richt.	Bristle grass	Трищетинник колосистый	Grassy	Sol
16	<i>Oxygraphis glacialis</i> (Fisch.) Bunge	<i>Oxygraphis glacialis</i>	Оксиграфис ледниковый	Grassy	Sol
17	<i>Deschampsia</i> <i>koelerioides</i> Regel	Hairgrass <i>koelerioides</i>	Луговик тонконоговидный	Grassy	Un

• Abundance of species has been determined based on Drude scale.

Cop₃ – very copiously (70–90% of plant stand volume)

Cop₂ – copiously (50–70 %)

Cop₁ – plenty (30–50 %)

Sp – Sparsae sparsely (5–30 %)

Sol – Solitaria very few (1-5 %)

Coverage – 95 %

“Red Book” species: *absent*

Kyrgyzstan Endemic species: *absent*

Type of vegetation: steppe

Site location: Site. Diversion Ditch.

Date of observation: 27.08.2017

Altitude: 3599 m

Coordinates

N 41° 55' 38,5''

E 78° 09' 08,1''

Formation of fescue alatafica (*Festuca alatafica* + *Poa litvinoviana*)

8. Fescue-Poaceae association (*Festuca alatafica* + *Poa litvinoviana*) (Photo 8).

Photo 8. Fescue-Poaceae association



Table 8. Floristic composition of Fescue-Poaceae association

No	Plant			Life form	Abundance
	Latin name	English name	Russian name		
1	<i>Poa litvinoviana</i> Ovcz.	Bluegrass <i>litvinoviana</i>	Мятлик Литвинова	Grassy	Cop ₁
2	<i>Festuca alatafica</i> (St.-Yves) Roshev.	Alatau Fescue	Овсяница алатавская	Grassy	Cop ₁
3	<i>Festuca coelestis</i> (St.- Yves) V.Krecz. et Bobrov	Fescue <i>coelestis</i>	Овсяница поднебесная	Grassy	Sol

4	<i>Papaver croceum</i> Ledeb.	Ice poppy	Мак оранжевый	Grassy	Un
5	<i>Cerastium cerastoides</i> (L.) Britt.	Mountain chickweed	Ясколка ясколковидная	Grassy	Un
6	<i>Sibbaldia tetrandra</i> Bunge	Sibbaldia	Сиббальдия четырёхтычиночная	Grassy	Sol
7	<i>Gastrolychnis apetala</i> (L.). Tolm. Et Kozhanczиков	<i>Gastrolychnis apetala</i>	Гастролихнис безлепестный	Grassy	Un
8	<i>Erigeron</i> sp.	Fleabane	Мелколепестник	Grassy	Sol
9	<i>Veronica 2lalcate</i> Fisch.	Wild germander	Вероника реснитчатая	Grassy	Un
10	<i>Smelowskia calycina</i> (Steph.) C. A. Mey.	Smelowskia	Смеловския чашечная	Grassy	Un
11	<i>Carex stenocarpa</i> Turcz. ex V.Krecz.	Stenocarpous Sedge	Осока узкоплодная	Grassy	Sp
12	<i>Pyrethrum karelinii</i> Krasch.	<i>Pyrethrum karelinii</i>	Поповник Карелина	Grassy	Un
13	<i>Carex melanantha</i> C.A.Mey.	Black-flowered Sedge	Осока черноцветковая	Grassy	Sol
14	<i>Swertia marginata</i> Schrenk	<i>Swertia marginata</i>	Сверция окаймленная	Grassy	Un
15	<i>Gentiana 2lalcate</i> Turcz.	Gentian falcata	Горечавка серповидная	Grassy	Sol
16	<i>Primula algida</i> Adams	Primula	Первоцвет холодный	Grassy	Un
17	<i>Saussurea leucophylla</i> Schrenk	Sawwort <i>leucophylla</i>	Соссюрея серебристолистная	Grassy	Sol
18	<i>Leontopodium ochroleucum</i> Beauverd	Edelweiss	Эдельвейс бледно- желтый	Grassy	Un
19	<i>Stellaria brachypetala</i> Bunge	Chickweed <i>brachypetala</i>	Звездчатка коротколепестная	Grassy	Sp
20	<i>Androsace septentrionalis</i> L. s. l.	Rock jasmine <i>septentrionalis</i>	Проломник северный	Grassy	Sol
21	<i>Viola tianschanica</i> Maxim.	Violet <i>tianschanica</i>	Фиалка тяньшанская	Grassy	Sol
22	<i>Erigeron heterochaeta</i> (Benth. ex Clarke) Botsch.	Fleabane	Мелколепестник разнощетиный	Grassy	Sol
23	<i>Aconitum rotundifolium</i> Kar. et Kir.	Round-leaved Aconitum	Аконит круглолистный	Grassy	Un

24	<i>Ligularia alpigena</i> Pojark.	Alpine golden ray	Бузульник альпийский	Grassy	Un
<ul style="list-style-type: none"> Abundance of species has been determined based on Drude scale. <p>Cop₃ – very copiously (70–90% of plant stand volume) Cop₂ – copiously (50–70 %) Cop₁ – plenty (30–50 %) Sp – Sparsae sparsely (5–30 %) Sol – Solitaria very few (1-5 %) Un – only one plant</p>					

Coverage – 95 %

“Red Book” species: *absent*

Kyrgyzstan Endemic species: *absent*

Type of vegetation. Cushion plant

Site location: next to the pit.

26.08.2017

Altitude: 3828 m

Coordinates

N 41° 52' 27,7''

E 78° 10' 34,6''

Saxifrage formation (*Saxifraga hirculus*)

9. Saxifrage association (*Saxifraga hirculus* + *S. oppositifolia*) (Photo 9).

Photo 9. Saxifrage association



Table 9. Floristic composition of Saxifrage association

No	Plant			Life form	Abundance
	Latin name	English name	Russian name		
1	<i>Saxifraga hirculus</i> L.	Yellow marsh saxifrage	Камнеломка болотная	Grassy	Sp
2	<i>S. oppositifolia</i> L.	Mountain saxifrage	Камнеломка супротивнолистная	Grassy	Sp
3	<i>Poa litvinoviana</i> Ovcz.	Bluegrass <i>litvinoviana</i>	Мятлик Литвинова	Grassy	Sp
4	<i>Festuca coelestis</i> (St.-Yves) V.Krecz. et Bobrov	Fescue <i>coelestis</i>	Овсяница поднебесная	Grassy	Sol
5	<i>Papaver croceum</i> Ledeb.	Ice poppy	Мак оранжевый	Grassy	Un
6	<i>Cerastium cerastoides</i> (L.) Britt.	Mountain chickweed	Ясколка ясколковидная	Grassy	Sol
7	<i>Sibbaldia tetrandra</i> Bunge	Sibbaldia	Сиббальдия четырехтычиночная	Grassy	Sp
8	<i>Gastrolychnis apetala</i> (L.) Tolm. et Kozhanczikov	<i>Gastrolychnis apetala</i>	Гастролихнис безлепестный	Grassy	Un
9	<i>Erigeron</i> sp.	Fleabane	Мелколепестник	Grassy	Un
10	<i>Veronica ciliata</i> Fisch.	Wild germander	Вероника реснитчатая	Grassy	Un
11	<i>Smelowskia calycina</i> (Steph.) C. A. Mey.	Smelowskia	Смеловская чашечная	Grassy	Sol
12	<i>Pyrethrum karelinii</i> Krasch.	<i>Pyrethrum karelinii</i>	Поповник Карелина	Grassy	Sol
13	<i>Carex melanantha</i> C.A.Mey.	Black-flowered Sedge	Осока черноцветковая	Grassy	Sol
14	<i>Swertia marginata</i> Schrenk	<i>Swertia marginata</i>	Сверция окаймленная	Grassy	Un
15	<i>Gentiana falcata</i> Turcz.	<i>Gentiana falcata</i>	Горечавка серповидная	Grassy	Sol
16	<i>Primula algida</i> Adams	Primula	Первоцвет холодный	Grassy	
17	<i>Saussurea leucophylla</i> Schrenk	Sawwort <i>leucophylla</i>	Сосюрея серебристолистная	Grassy	Sol
18	<i>Leontopodium ochroleucum</i> Beauverd	Edelweiss	Эдельвейс бледно-желтый	Grassy	Un
19	<i>Stellaria brachypetala</i> Bunge	Chickweed <i>brachypetala</i>	Звездчатка коротколепестная	Grassy	Un
20	<i>Androsace septentrionalis</i> L. s. l.	Rock jasmine <i>septentrionalis</i>	Проломник северный	Grassy	Un
21	<i>Viola tianschanica</i> Maxim.	Tien Shan Violet	Фиалка тьяншанская	Grassy	Un
22	<i>Oxygraphis glacialis</i> (Fisch.) Bunge	<i>Oxygraphis glacialis</i>	Оксиграфис ледниковый	Grassy	Sol

23	<i>Primula turkestanica</i> (Haage et Schmidt) E. A. White	Primrose <i>turkestanica</i>	Первоцвет туркестанский	Grassy	Un
<ul style="list-style-type: none"> Abundance of species has been determined based on Drude scale. <p>Cop₃ – very copiously (70–90% of plant stand volume) Cop₂ – copiously (50–70 %) Cop₁ – plenty (30–50 %) Sp – Sparsae sparsely (5–30 %) Sol – Solitaria very few (1-5 %) Un – only one plant</p>					

Coverage – 50 %

“Red Book” species: *absent*

Kyrgyzstan Endemic species: *absent*

Type of vegetation. Cushion plant

Site location: Next to the pit.

Date of observation: 26.08.2017

Altitude: 3807 m

Coordinates

N 41° 52' 28,7''

E 78° 10' 21,4''

Formation of *Sibbaldia tetrandrous* (*Sibbaldia tetrandra*)

10. *Sibbaldia-Fescue* association (*Sibbaldia tetrandra* + *Festuca coelerescens*) (Photo 10).

Photo 10. Sibbaldia-Fescue association



Table 10. Floristic composition of Sibbaldia-Fescue association

No	Plant			Life form	Abundance
	Latin name	English name	Russian name		
1	<i>Potentilla stanjukoviczii</i> Ovcz. et KGCzk.	Bloodroot <i>stanjukoviczii</i>	Лапчатка Станюковича	Grassy	Sol
2	<i>Poa litvinoviana</i> Ovcz.	Litvinov's Bluegrass	Мятлик Литвинова	Grassy	Sp
3	<i>Festuca coelestis</i> (St.- Yves) V.Krecz. et Bobrov	Fescue coelestis	Овсяница поднебесная	Grassy	Sp
4	<i>Trisetum spicatum</i> (L.) K. Richt.	Bristle grass	Трищети́нник колосистый	Grassy	Sol
5	<i>Cerastium pusillum</i> Ser.	<i>Cerastium pusillum</i>	Ясколка маленькая	Grassy	Sol
6	<i>Oxytropis chionobia</i> Bunge	Locoweed	Остролодочник приснежный	Grassy	Sol
7	<i>Draba oreades</i> Schrenk	Whitlow grass	Крупка горная	Grassy	Un
8	<i>Taraxacum syrtorum</i> Dshanaeva	Syrt Dandelion	Одуванчик сыртовый	Grassy	Un

9	<i>Oxytropis platysema</i> Schrenk	Locoweed	Остролодочник плоскопарусный	Grassy	Un
10	<i>Papaver croceum</i> Ledeb.	Ice poppy	Мак оранжевый	Grassy	Un
11	<i>Cerastium cerastoides</i> (L.) Britt.	Mountain <i>chickweed</i>	Ясколка ясколковидная	Grassy	Un
12	<i>Sibbaldia tetrandra</i> Bunge	Sibbaldia	Сиббальдия четырёхтычиноч ная	Grassy	Sp
13	<i>Eutrema edwardsii</i> R. Br.	<i>Eutrema edwardsii</i>	Эвтрема Эдвардса	Grassy	Un
14	<i>Saxifraga macrocalyx</i> Tolm.	Saxifrage <i>macrocalyx</i>	Камнеломка крупночашечная	Grassy	Sol
15	<i>Smelowskia calycina</i> (Steph.) C. A. Mey.	Smelowskia	Смеловския чашечная	Grassy	Un
16	<i>Gentiana falcata</i> Turcz.	<i>Gentiana falcata</i>	Горечавка серповидная	Grassy	Sol
17	<i>Leontopodium ochroleucum</i> Beauverd	Edelweiss	Эдельвейс бледно-желтый	Grassy	Sol
18	<i>Viola tianschanica</i> Maxim.	Tien Shan Violet	Фиалка тяньшанская	Grassy	Un
19	<i>Oxygraphis glacialis</i> (Fisch.) Bunge	<i>Oxygraphis glacialis</i>	Оксиграфис ледниковый	Grassy	Sp

- Abundance of species has been determined based on Drude scale.

Cop₃ – very copiously (70–90% of plant stand volume)

Cop₂ – copiously (50–70 %)

Cop₁ – plenty (30–50 %)

Sp – Sparsae sparsely (5–30 %)

Sol – Solitaria very few (1-5 %)

Un – only one plant

Coverage – 50 %

“Red Book” species: *absent*

Kyrgyzstan Endemic species: *absent*

Type of vegetation: Cryolito phyton

Site location: Moraine of Petrov Lake.

Date of observation: 26.08.2017

Altitude: 3685 m

Coordinates

N 41° 53' 46,9''

E 78° 13' 29,3''

Formation of Chimgan lyme grass (*Elymus tschimganicus*)

11. Lyme grass-mixed herbs association (*Elymus tschimganicus* + *Poa litvinoviana* + *Leontopodium ochroleucum*) (Photo 11).

Photo 11. Lyme grass-mixed herbs association



Table 11. Floristic composition of Lyme grass-mixed herbs association

No	Plant			Life form	Abundance
	Latin name	English name	Russian name		
1	<i>Elymus tschimganicus</i> (Drob.) Tzvel.	Lyme grass	Колосняк чимганский	Grassy	Sp
2	<i>Poa litvinoviana</i> Ovcz.	Bluegrass	Мятлик Литвинова	Grassy	Sp
3	<i>Festuca coelestis</i> (St.-Yves) V.Krecz. et Bobrov	Fescue	Овсяница поднебесная	Grassy	Sol
4	<i>Trisetum spicatum</i> (L.) K. Richt.	Bristle grass	Трищети́нник колосистый	Grassy	Sol
5	<i>Cerastium pusillum</i> Ser.	<i>Cerastium pusillum</i>	Ясколка маленькая	Grassy	Un
6	<i>Oxytropis chionobia</i> Bunge	Locoweed	Остролодочник приснежный	Grassy	Un
7	<i>Draba oreades</i> Schrenk	Whitlow grass	Крупка горная	Grassy	Un
8	<i>Astragalus kuschakewiczi</i> B. Fedtsch.	Locoweed	Астрагал Кушакевича	Grassy	Un
9	<i>Erigeron heterochaeta</i> (Benth. ex Clarke) Botsch.	<i>Oregon heterochaeta</i>	Мелколепестник разнощети́нный	Grassy	Sol
10	<i>Ephedra regeliana</i> Florin	<i>Ephedra regeliana</i>	Эфедра Регеля	Grassy	Un
11	<i>Saussurea gnaphalodes</i> (Royle) Sch. Bip.	<i>Saussurea gnaphalodes</i>	Горькуша сушеницевидная	Grassy	Sol
12	<i>S. glacialis</i> Herd.	<i>Saussurea glacialis</i>	Горькуша ледниковая	Grassy	Un

13	<i>Papaver croceum</i> Ledeb.	Ice poppy	Мак оранжевый	Grassy	Un
14	<i>Cerastium cerastoides</i> (L.) Britt.	Mountain chickweed	Ясколка ясколковидная	Grassy	Un
<ul style="list-style-type: none"> Abundance of species has been determined based on Drude scale. <p>Cop₃ – very copiously (70–90% of plant stand volume) Cop₂ – copiously (50–70 %) Cop₁ – plenty (30–50 %) Sp – Sparsae sparsely (5–30 %) Sol – Solitaria very few (1-5 %) Un – only one plant</p>					

Coverage – 45 %

“Red Book” species: *absent*

Kyrgyzstan Endemic species: *absent*

Type of vegetation: steppe

Site location. Site. Near the tailing dam.

Date of observation: 25.08.2017

Altitude: 3672 m

Coordinates

N 41°55'59"

E 78°8'54"

Formation of Alatau fescue (*Festuca alataavica*)

12. Fescue-Calamagrostis association (*Festuca alataavica* + *Calamagrostis tianschanicai*) (Photo 2).

Photo 12. Fescue-Calamagrostis association



Table 12. Floristic composition of Fescue-Calamagrostis association

No	Plant			Life form	Abundance
	Latin name	English name	Russian name		
1	<i>Poa lipskyi</i> Roshev.	Bluegrass <i>lipskyi</i>	Мятлик Липского	Grassy	Sp.
2	<i>Festuca alata</i> (St.-Yves) Roshev.	Alatau Fescue	Овсяница алатавская	Grassy	Cop ₁
3	<i>Trisetum spicatum</i> (L.) K. Richt.	Bristle grass	Трищетинник колосистый	Grassy	Sol
4	<i>Calamagrostis tianschanica</i> Rupr.	Woodreed <i>tianschanica</i>	Вейник тяньшанский	Grassy	Sp
5	<i>Viola tianschanica</i> Maxim.	Violet <i>tianschanica</i>	Фиалка тяньшанская	Grassy	Un
6	<i>Saussurea leucophylla</i> Schrenk	<i>Saussurea leucophylla</i>	Горькуша серебристолистная	Grassy	Sol
7	<i>Kobresia capilliformis</i> Ivanova	Hair-like Bog-Sedge	Кобрезия волосовидная	Grassy	Sol
8	<i>Smelowskia calycina</i> (Steph.) C. A. Mey.	<i>Smelowskia ovalis</i>	Смеловския чашечная	Grassy	Un
9	<i>Poa litvinoviana</i> Ovcz.	Bluegrass <i>litvinoviana</i>	Мятлик Литвинова	Grassy	Sol
10	<i>Festuca coelestis</i> (St.-Yves) V.Krecz. et Bobrov	<i>Fescue coelestis</i>	Овсяница поднебесная	Grassy	Sol
11	<i>Primula algida</i> Adams	Primrose <i>algida</i>	Примула холодная	Grassy	Un
12	<i>Cerastium pusillum</i> Ser.	<i>Cerastium pusillum</i>	Ясколка маленькая	Grassy	Un
13	<i>Oxytropis chionobia</i> Bunge	Locoweed <i>chionobia</i>	Остролодочник приснежный	Grassy	Sol
14	<i>Gentiana karelinii</i> Griseb.	Karelina Gentian	Горечавка Карелина	Grassy	Un

• Abundance of species has been determined based on Drude scale.

Cop₃ – very copiously (70–90% of plant stand volume)
 Cop₂ – copiously (50–70 %)
 Cop₁ – plenty (30–50 %)
 Sp – Sparsae sparsely (5–30 %)
 Sol – Solitaria very few (1-5 %)
 Un – only one plant

Coverage – 50 %

“Red Book” species: *absent*Kyrgyzstan Endemic species: *absent*

Type of vegetation: Cushion plant

Site location: Upper Diversion Ditch

Date of observation: 25.08.2017

Altitude: 3672 m

Coordinates

N 41.93299 41°55'58.764"

E 78.14827 78°8'53.772"

Formation of *Sibbaldia* tetrandrous (*Sibbaldia tetrandra*)

13. *Sibbaldia*-mixed herbs association (*Sibbaldia tetrandra* + *Festuca coelerescens* + *Poa lipskyi*) (Photo 13).

Photo 13. *Sibbaldia*-mixed herbs association



Table 13. Floristic composition of *Sibbaldia*-mixed herbs association

No	Plants			Life form	Abundance
	Latin name	English name	Russian name		
1	<i>Poa lipskyi</i> Roshev.	Bluegrass <i>lipskyi</i>	Мятлик Липского	Grassy	Sol
2	Bunge (<i>Dryadanthe tetrandra</i> (Bunge) Juz.)	<i>Sibbaldia-Fescue</i>	Сиббалдия четырехтычиночная	Grassy	Сор ₁
3	<i>Trisetum spicatum</i> (L.) K. Richt.	Bristle grass	Трищетинник колосистый	Grassy	Sol
4	<i>Calamagrostis tianschanica</i> Rupr.	Woodreed <i>tianschanica</i>	Вейник тьяншанский	Grassy	Sol
5	<i>Viola tianschanica</i> Maxim.	Violet <i>tianschanica</i>	Фиалка тьяншанская	Grassy	Un
6	<i>Saussurea leucophylla</i> Schrenk	<i>Saussurea leucophylla</i>	Горькуша серебристолистная	Grassy	Un

7	<i>Kobresia capilliformis</i> Ivanova	Hair-like Bog- Sedge	Кобрезия волосовидная	Grassy	Sol
8	<i>Poa litvinoviana</i> Ovcz.	Bluegrass <i>litvinoviana</i>	Мятлик Литвинова	Grassy	Sp
9	<i>Festuca coelestis</i> (St.- Yves) V.Krecz. et Bobrov	<i>Fescue coelestis</i>	Овсяница поднебесная	Grassy	Sp
10	<i>Primula algida</i> Adams	Primrose <i>algida</i>	Примула холодная	Grassy	Un
11	<i>Cerastium pusillum</i> Ser.	<i>Cerastium pusillum</i>	Ясколка маленькая	Grassy	Un
12	<i>Oxytropis chionobia</i> Bunge	Locoweed <i>chionobia</i>	Остролодочник приснежный	Grassy	Un
13	<i>Gentiana karelinii</i> Griseb.	Karelina Gentian	Горечавка Карелина	Grassy	Un
14	<i>Taraxacum syrtorum</i> Dshanaeva	Syrt Dandelion	Одуванчик сыртовый	Grassy	Un
Лишайники / Lichens					
1	<i>Aspicilia</i> sp.	<i>Aspicilia</i>	Аспицилия		
<ul style="list-style-type: none"> Abundance of species has been determined based on Drude scale. <p>Cop₃ – very copiously (70–90% of plant stand volume) Cop₂ – copiously (50–70 %) Cop₁ – plenty (30–50 %) Sp – Sparsae sparsely (5–30 %) Sol – Solitaria very few (1-5 %) Un – only one plant</p>					

Coverage – 45 %

“Red Book” species: *absent*

Kyrgyzstan Endemic species: *absent*

Kinds from the “Red Book”: *absent*

Endemic for Kyrgyzstan kinds: *Taraxacum syrtorum* Dshanaeva

Type of vegetation. Sazs

Site location: Near the Upper Diversion Ditch

Date of observation: 25.08.2017

Altitude: 3669 m

Coordinates

N 41.93029 41°55'49"

E 78.14993 78°9'0"

Formation of black flowers Carex (*Carex melanantha*)

14. Carex association (*Carex melanantha* + *C. stenocarpa*) (Photo 14).

Photo 14. Carex association



Table 14. Floristic composition of Carex association

No	Plant			Life form	Abundance
	Latin name	English name	Russian name		
1	<i>Carex melanantha</i> C.A.Mey.	Black-flowered Sedge	Осока черноцветковая	Grassy	Cop ₁
2	<i>Carex stenocarpa</i> Turcz. ex V.Krecz.	Stenocarpous Sedge	Осока узкоплодная	Grassy	Cop ₁
3	<i>Gentiana algida</i> Pall.	Algid Gentian	Горечавка холодная	Grassy	Un
4	<i>Carex aterrima</i> Hoppe	Sedge <i>aterrima</i>	Осока темная	Grassy	Sol
5	<i>Kobresia capilliformis</i> Ivanova	Hair-like Bog-Sedge	Кобрезия волосовидная	Grassy	Sol
6	<i>Primula algida</i> Adams	Primrose <i>algida</i>	Примула холодная	Grassy	Un
7	<i>Saxifraga macrocalyx</i> Tolm.	Saxifrage <i>macrocalyx</i>	Камнеломка крупночашечная	Grassy	Un
8	<i>Poa lipskyi</i> Roshev.	Bluegrass <i>lipskyi</i>	Мятлик Липского	Grassy	Sol
9	<i>Festuca alataevica</i> (St.- Yves) Roshev.	Alatau Fescue	Овсяница алатавская	Grassy	Sol
10	<i>Trisetum spicatum</i> (L.) K. Richt.	Bristle grass	Трищетинник колосистый	Grassy	Un
11	<i>Calamagrostis tianschanica</i> Rupr.	Woodreed <i>tianschanica</i>	Вейник тяньшанский	Grassy	Sol
12	<i>Viola tianschanica</i> Maxim.	Violet <i>tianschanica</i>	Фиалка тяньшанская	Grassy	Un
13	<i>Saussurea leucophylla</i> Schrenk	<i>Saussurea leucophylla</i>	Горькуша серебристолистная	Grassy	Sol

14	<i>Kobresia capilliformis</i> Ivanova	Hair-like Bog-Sedge	Кобрезия волосовидная	Grassy	Sol
15	<i>Smelowskia calycina</i> (Steph.) C. A. Mey.	<i>Smelowskia ovalis</i>	Смеловския чашечная	Grassy	Un
16	<i>Poa litvinoviana</i> Ovcz.	Bluegrass <i>litvinoviana</i>	Мятлик Литвинова	Grassy	Sol
17	<i>Festuca coelestis</i> (St.- Yves) V.Krecz. et Bobrov	<i>Fescue coelestis</i>	Овсяница поднебесная	Grassy	Sol
18	<i>Primula algida</i> Adams	Primrose <i>algida</i>	Примула холодная	Grassy	Un
19	<i>Cerastium pusillum</i> Ser.	<i>Cerastium pusillum</i>	Ясколка маленькая	Grassy	Un
20	<i>Oxytropis chionobia</i> Bunge	Locoweed <i>chionobia</i>	Остролодочник приснежный	Grassy	Un
21	<i>Gentiana karelinii</i> Griseb.	Karelina Gentian	Горечавка Карелина	Grassy	Un

- Abundance of species has been determined based on Drude scale.

Cop₃ – very copiously (70–90% of plant stand volume)

Cop₂ – copiously (50–70 %)

Cop₁ – plenty (30–50 %)

Sp – Sparsae sparsely (5–30 %)

Sol – Solitaria very few (1-5 %)

Un – only one plant

Coverage – 100%

“Red Book” species: *absent*

Kyrgyzstan Endemic species: *absent*

There is no need to provide again the list of species that were found within the mine site since it is pretty much the same as the list from 1993, with the exception of species that were previously found on adjacent sites and neighboring the mine site, which were not taken into consideration in this research. Within the mine site, in addition to the list, a new species for the region was found - *Stellaria irrigua* Bunge, which was missed in the course of initial examination (Photo 15). One lichen was also identified, which is referred to the genus *Aspicillia*, but could not be determined to species.

Photo 15. *Stellaria irrigable*, a new speies for this area



4. Impact of KGC production activity on vegetation cover in Barskaun Valley

The main influence on vegetation cover is the result of exposure to dust. However, as the subsequent section shows, this impact is not critical, especially since this influence is mitigated by the regular moistening of the route.

The greatest impact on the vegetation cover is exerted by the almost uncontrolled and constant grazing of cattle. During the observation period, at the end of July, most of the plants, including those that are usually not consumed, were reduced to a height of about 3 cm or even less (see site photos). Some uneaten plants are preserved only in thickets of bushes or in the forest. The result is a practical lack of seed reproduction in most plant species.

Another factor that affects vegetation cover is recreational activity. In the valley there are places that are quite popular with visitors, such as the Barskaun Falls, as well as the quite rare forests and large glades which are favorable locations for recreation. In the valley there are a lot of yurts that are rented for recreation. As a result of uncontrolled recreational activities, rubbish is scattered around the forest or is collected in spontaneous landfills, most of which are located in forested areas. I found several such landfills, although only a small portion of the forest was surveyed (Photo 16).

Photo 16. Landfill in the forest.



Vegetation is destroyed directly under the landfill, but such dumps are also extremely unaesthetic and reduce the recreational appeal of the gorge. Another challenge is deforestation for firewood and household needs (Photo 17). This practice does not seem to be of a general nature, but cut down trees also create an untidy view of forest massifs. However, these factors do not have any relation to KGC production activities.

Photo 17. Cut-down tree.



5. Impact of KGC production activity on mine vegetation cover

In the zone of production, vegetation cover is destroyed as a result of production operations that are necessary for development of the deposit. However, outside the production zone, but even in close proximity to roads, structures and the mine itself, the vegetation cover is not significantly affected. The evidence for this is the favorable condition of the vegetation, which does not differ from that on sites beyond the deposit area, and in many cases is in an even better condition. All movements of people and vehicles within the mine site are carried out on existing roads. The vegetation cover within territory is subject to grazing only by wild animals (Photo 18), since grazing of domestic animals is not allowed on mine site territory, while outside this area grazing is taking place.

Photo 18. Pasturing sheeps at the KGC mine territory



List of species that were found in the vicinity of Kumtor mine fairly large amount of cattle (Photo 19).

Photo 19. Live-stock grazing on the territory bordering with the KGC territory



6. The impact of dust on vegetation of Barskaun Valley

The road going from Barskaun village is used by KGC's transport, as well as by those traveling to Atbashi village through Suek Passage and Dzhetimi Range, as well as by border guard services. It is also used to transport cattle to summer pastures and back, and by citizens visiting the Barskaun Valley for recreational purposes. It is notable that the use of this road by individuals not related to KGC production activities is quite significant. During the survey, dust deposits on plants in Chichkan River canyon were noted. Leaves, visually covered with dust, were detected only on plants standing directly by the road. Apparently, the dust falls directly from the wheels of passing motor vehicles. On plants that are more than 1 meter away from the road, no dusting formations were observed. Probably this is facilitated both by the quite significant amount of precipitations in this gorge, and measures taken by KGC to reduce the amount of dust produced on the road. Plants growing right next to the road take on the main quantity of dust, while protecting the rest of plants from it. However, observations have shown that even plants standing directly along the road, judging by their appearance, do not experience a special influence of dustiness (Photo 20).

Photo 20. The absence of dust on spruce needles, standing directly on the road.



In the canyon, yellowing of needles of some spruce trees was observed. However, these plants grow in areas flooded by the river. Yellowing of needles on trees standing far from the road is caused by a fungal disease called red rust or spruce shoot curl (*Chrysomyxa deformans* (Dietr.) Jasz.). This spruce disease is widespread throughout Kyrgyzstan and is not associated with dust. Despite the fact that local residents point to the damage caused by dust produced as the result of passing transport vehicles, the amount of dust does not seem to cause any real harm. This is evidenced by the fact that the entire lower part of the gorge along the roadside is currently fenced. Within

fenced areas, locals are growing different crops and mow hay. The gorge is visited by numerous tourists and holidaymakers. In the gorge there is intensive grazing of cattle, and vegetation is subject to considerable impact. Given all these activities, the amount of dust present does not appear to be harmful. As shown above, plants also do not react to this amount of dust.

Measures that are being taken by KGC to reduce the amount of generated dust (daily wetting of the road surface) seem to be sufficient to ensure preservation of the surrounding vegetation. However, for even greater protection from generated dust, it is possible to recommend planting of some native plants for protection against dust. These plants must meet the following requirements - to be sufficiently fast-growing, suitable for local conditions and to provide sufficient protection against dust. Of the entire set of species of arboreal and shrubby plants growing in the gorge, only different species of willows (*Salix* spp.) are suitable for this purpose. As an additional under-row of plants to block the space between willows, sea buckthorn (*Hippophae turkestanica* (Rousi) Tzvelev.) can be used. Planting of such or similar hedges is already being practiced by local residents in the lower part of the gorge (Photo 21). Willows are well rooted, undemanding to soil composition and need only sufficient amount of watering, which is relatively easy to provide.

Photo 21 – Local people using osiers and buckthorns for fence building purposes.



7. The impact of KGC on rare and endemic plants

Within the mine site and its surrounding areas, there are 2 species of plants listed in the “Red Book of the Kyrgyz Republic” - *Allium semenovii* Regel (Photo 22) and *Tulipa tetraphylla* Regel (Photo 23), as well as a conditional endemic of Kyrgyzstan - *Taraxacum syrtorum* Dzan (Photo 24).

Photo 22. *Allium semenovii*



The Red Book of the Kyrgyz Republic does not include data on numbers of the plants. High-altitude sites are specified as their habitat, where few people live, but human economic activities are listed as impacting factors, including spring grazing, collection of flowers, and digging out of plant bulbs. It is absolutely clear that grazing is not carried out at highlands in spring time. And collection of flowers and digging out of plant bulbs where people do not practically live is unlikely. It is said that *Allium semenovii* is found in the Inner and Central Tien Shan, but there is only one point on the Red Data Book range map, placed somewhere near Naryn city. According to our data, the species is widespread in the Issyk-Kul region of Kyrgyzstan, and it also occurs in adjacent areas of Kazakhstan and China. Because of its growth in the highlands, there is no real threat from man. Despite all of the above, the species is included in the "Red Book of the Kyrgyz Republic". However, within the KGC production site it was found only in the mountains along the left side of Kumtor River, flowing out of the lake, where there is no real KGC production activity going on. Therefore, there is no threat to this species in the zone influenced by KGC production.

Photo 23. *Tulipa tetraphylla*



Like the previous species, *Tulipa tetraphylla* is included in the "Red Book of the Kyrgyz Republic", despite the fact that authors of the Red Book did not have data on its population. Similarly, human economic activity is listed as a limiting factor, including spring grazing, collection of flowers, and digging out of plant bulbs. This tulip is not particularly decorative, so collection of flowers and digging out of bulbs is unlikely. The Red Book says that this species is an endemic of Inner Tien Shan, but there is only one point on the range map, placed somewhere in the vicinity of Naryn city. According to our data, the species is widely distributed in Issyk-Kul basin and in Inner Tien Shan, and in the west its distribution extends to Ferghana and Susamyr ranges, Susamyr Valley (Lazkov, Umralina, 2015), and also occurs in adjacent areas of Kazakhstan. Within its range, the species is abundant enough, and considering that it is not particularly decorative, there is no real threat to it on part of the man. Despite all of the above, the species is included in the "Red Book of the Kyrgyz Republic". However, within the KGC production site, it was found by A.K. Usupbaev only in the gorge forest belt. However, his report on research carried out within the framework of deputy commission activities in 2011 is very questionable (in particular, areas of damping off of vegetation in Arabel-Su valley, the presence of landslides and many other natural phenomena have been declared the result of KGC's activities). No real threat to this species in the Barskaun gorge exists, as it grows away from the road. Usupbaev does not write about any threats to this species, except for

discoloration of the ends of the petals as a result of dust impact. However, this discoloration may be caused by late frosts. This assumption can not be verified, since the date of the tulip photograph and the presence of local frosts at that time are unknown. A similar effect can also be caused to the buds by cattle urine (such damage to various plants were repeatedly observed by us). In any case, such damage does not affect the viability of the species, especially since the tulip grows in spring with a high amount of precipitation, when dust is quickly washed away.

Photo 24. *Taraxacum syrtorum*



Is referred to the conditional endemic species of Kyrgyzstan. The high-mountainous areas adjacent to China have been little studied and this species is likely to be found there, because it is widespread in the highlands of Kyrgyzstan, including the areas of Chatyr-Kul Lake, Aksai, Arpa and Son-Kul (everywhere it is quite abundant). This species grows mainly on clay soils in communities of cryophylic cushions, including in the area of KGC production activities, whereat it is quite common. Unfortunately, it is not possible to take any measures to protect it. However, even with complete destruction of this species at KGC's production area (which is very unlikely, since most plants are concentrated on sites outside the zone of active production activity), this species will continue to grow in many other regions of Kyrgyzstan.

8. Conclusion

1. Kumtor's mine site flora composition (in 1993, 2013 years) includes approximately 180 species, and with consideration of neighboring areas, 208 species of higher plants, those referred to 33 families.
2. The survey conducted in 2017 has not revealed any substantial differences in flora composition. The flora has been supplemented with 1 species - *Stellaria irrigua* Bunge, which was missed in the initial surveys. One species of lichen was also identified, referred to the genus *Aspicillia*.

3. Upon examination of sites adjacent to the road gorge, 70 kinds of vascular plants were identified. For a complete examination of the Barskaun gorge flora it is necessary to make repeated visits in different flowering periods.
4. No significant influence of KGC production activities onto Barskaun gorge vegetation cover was detected. Much higher influence is exerted by unregulated cattle grazing and recreational impact.
5. Influence of dust on vegetation cover is being mitigated as a result of regular road wetting.
6. To protect against formation of dust it is recommended to plant of various species of willows (*Salix* spp.). As an under-row, additional plants to overlap the area between willow trees, sea buckthorn bushes (*Hippophae turkestanica* (Rousi) Tzvelev.) can be used.
7. Beyond the production area within the Kumtor mine site territory, the vegetation cover does not suffer from significant impact.
8. The flora of the mine site and surrounding territories includes 2 species of plants listed in the “Red Book of the Kyrgyz Republic” - *Allium semenovii* Regel and *Tulipa tetraphylla* Regel, as well as a provisional endemic of Kyrgyzstan – *Taraxacum syrtorum* Dzan.
9. No impact of KGC production on *Allium semenovii* Regel and *Tulipa tetraphylla* Regel has been identified and they do not require special protection measures. *Taraxacum syrtorum* Dzan. is being exposed to certain impact, however, but the principal places of inhabitation of this species within the site boundaries are located outside the territory of active production activity.

9. References

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