

Plant diversity and distribution patterns of *Populus pruinosa* Schrenk (Salicaceae) floodplain forests in Kazakhstan

Dimeyeva et al.

Supplementary materials

Table S1. Environmental variables used in modeling the ecological niche and identifying the most suitable sites for the restoration of *Populus pruinosa* floodplain forests.

№	Environment variable (unit)	Information source		
		WorldClim 1970–2000	WorldClim 2010–2018	State climate cadastre (norm) 1991–2020
		Optimal range		
1	Minimum temperature (°C) January	-17.6 – -4.6	-17.5 – -2.6	-16.7 – -3.1
2	Minimum temperature (°C) February	-16.9 – -3.1	-16.5 – -2.3	-13.3 – -3.1
3	Minimum temperature (°C) March	-9.2 – +3.1	-6.8 – +4.9	-4.4 – +4.2
4	Minimum temperature (°C) April	2.3 – 9.8	3.5 – 10.3	4.4 – 10.5
5	Minimum temperature (°C) May	8.3 – 15.1	8.6 – 16.7	10.1 – 16.2
6	Minimum temperature (°C) June	13.4 – 20.1	14.6 – 21.1	15.5 – 20.8
7	Minimum temperature (°C) July	16.5 – 22	16.7 – 22.8	17 – 22.5
8	Minimum temperature (°C) August	13.8 – 19.1	14.5 – 20.23	14.8 – 20.6
9	Minimum temperature (°C) September	7.9 – 13	8.4 – 14.11	8.1 – 14.7
10	Minimum temperature (°C) October	-0.1 – 6.1	0.5 – 7.2	1.5 – 8.5
11	Minimum temperature (°C) November	-7 – +0.8	-6.8 – +0.8	-5.8 – +2.5
12	Minimum temperature (°C) December	-13.5 – -2.4	-13.8 – -3.0	-13.1 – -1.9
13	Maximum temperature (°C) January	-7.1 – +3.3	-7.7 – +5.3	-6.2 – +3.7
14	Maximum temperature (°C) February	-5 – +6.6	-5.3 – +7.1	-2.3 – +6.8
15	Maximum temperature (°C) March	2 – 13.3	4.8 – 15.4	7.9 – 14.4
16	Maximum temperature (°C) April	15.5 – 21.6	16.7 – 22.3	19.3 – 22
17	Maximum temperature (°C) May	23 – 28.5	24.0 – 30.1	25.2 – 28.7
18	Maximum temperature (°C) June	29 – 34.6	30.5 – 35.4	30.6 – 34.4
19	Maximum temperature (°C) July	31.8 – 37.5	32.1 – 37.5	32.7 – 36.6
20	Maximum temperature (°C) August	30 – 35.6	30.8 – 36.61	31.6 – 35.1
21	Maximum temperature (°C) September	24 – 30	24.5 – 30.8	25 – 29.3
22	Maximum temperature (°C) October	15 – 22	15.2 – 21.8	16.7 – 21.6
23	Maximum temperature (°C) November	4 – 13	4.6 – 11.9	5.5 – 12.1
24	Maximum temperature (°C) December	-3.1 – +6	-3.8 – +5.6	-3.4 – +5
25	Average temperature (°C) January	-12.3 – -0.7		-11.8 – -0.2
26	Average temperature (°C) February	-10.9 – +1.7		-8.2 – +1.9
27	Average temperature (°C) March	-3.6 – +8.2		1.2 – 8.6
28	Average temperature (°C) April	8.9 – 15.9		11.8 – 15.6
29	Average temperature (°C) May	15.9 – 21.6		17.9 – 21.9
30	Average temperature (°C) June	21.6 – 27.2		23.1 – 27.2
31	Average temperature (°C) July	24.4 – 29.5		25.3 – 29.2
32	Average temperature (°C) August	22.4 – 27.3		23.3 – 27.4
33	Average temperature (°C) September	16 – 21.1		16.4 – 21.4
34	Average temperature (°C) October	7.4 – 13.8		8.5 – 14.3
35	Average temperature (°C) November	-1.1 – +6.8		-0.9 – +6.6
36	Average temperature (°C) December	-8.2 – +1.8		-8.5 – +1
37	Precipitation (mm) January	14 – 40	16.0 – 39.3	8 – 28
38	Precipitation (mm) February	12 – 41	13.6 – 42.8	8 – 37

39	Precipitation (mm) March	12 – 44	16.0 – 55.1	10 – 36
40	Precipitation (mm) April	16 – 44	19.2 – 50.2	11 – 36
41	Precipitation (mm) May	16 – 46	13.9 – 40.5	12 – 39
42	Precipitation (mm) June	5 – 37	6.7 – 35.4	6 – 32
43	Precipitation (mm) July	4 – 29	2.0 – 29.1	2 – 34
44	Precipitation (mm) August	1 – 18	2.2 – 21.5	1 – 15
45	Precipitation (mm) September	2 – 20	1.7 – 20.4	2 – 13
46	Precipitation (mm) October	8 – 34	8.7 – 47.7	8 – 25
47	Precipitation (mm) November	14 – 36	15.1 – 40.81	16 – 29
48	Precipitation (mm) December	16 – 48	17.8 – 40.81	10 – 31
49	Solar radiation (kJ m ⁻² day ⁻¹) January	5880 – 7404		
50	Solar radiation February	9203 – 10382		
51	Solar radiation March	13130 – 14281		
52	Solar radiation April	17995 – 18713		
53	Solar radiation May	21890 – 23942		
54	Solar radiation June	24236 – 27264		
55	Solar radiation July	23661 – 27324		
56	Solar radiation August	21259 – 24604		
57	Solar radiation September	16187 – 19401		
58	Solar radiation October	9927 – 12554		
59	Solar radiation November	6362 – 7994		
60	Solar radiation December	4683 – 6357		
61	Wind speed (m s ⁻¹) January	1.4 – 3.2		
62	Wind speed February	1.7 – 3.7		
63	Wind speed March	2.1 – 4		
64	Wind speed April	2.5 – 4.1		
65	Wind speed May	2.4 – 3.7		
66	Wind speed June	2.2 – 3.4		
67	Wind speed July	2.2 – 3.3		
68	Wind speed August	2 – 3.4		
69	Wind speed September	1.8 – 3.2		
70	Wind speed October	1.8 – 3		
71	Wind speed November	1.7 – 3.2		
72	Wind speed December	1.6 – 3.1		
73	Water vapor pressure March	0.36 – 0.67		
74	Water vapor pressure April	0.55 – 0.97		
75	Water vapor pressure May	0.81 – 1.16		
76	Water vapor pressure June	1 – 1.27		
77	Water vapor pressure July	1.13 – 1.42		
78	Water vapor pressure August	0.94 – 1.26		
BioClim 1970-2000				
79	Annual Mean Temperature		6.68 – 14.46	
80	Mean Diurnal Range (Mean of monthly (max temp - min temp))		12.3 – 13.7	
81	Isothermality (BIO2/BIO7) (×100)		26.5 – 31.43	
82	Temperature Seasonality (standard deviation ×100)		1063 – 1355	
83	Max Temperature of Warmest Month		31.9 – 37.3	
84	Min Temperature of Coldest Month		-17.6 – -4.6	
85	Temperature Annual Range (BIO5-BIO6)		41 – 49.8	
86	Mean Temperature of Wettest Quarter		-4.04 – 17.9	
87	Mean Temperature of Driest Quarter		-2.3 – 26.1	
88	Mean Temperature of Warmest Quarter		22.7 – 28	

89	Mean Temperature of Coldest Quarter	-10.6 – 1
90	Annual Precipitation	128 – 328
91	Precipitation of Wettest Month	17 – 48
92	Precipitation of Driest Month	1 – 17
93	Precipitation Seasonality (Coefficient of Variation)	30.05 – 66.3
94	Precipitation of Wettest Quarter	46 – 129
95	Precipitation of Driest Quarter	8 – 59
96	Precipitation of Warmest Quarter	12 – 83
97	Precipitation of Coldest Quarter	42 – 129
Other information sources		
98	Elevation (m) (height above sea level)	112 – 622 (SRTM) 79-717 m (GPS)
99	Soil (soil maps)	Floodplain meadow-forest soils
100	Normalized difference vegetation index (NDVI)	0.28 – 0.65 (Sentinel-2)
101	Distance to water (Sentinel-2)	0 – 17 km
102	Distance to settlements (Sentinel-2)	0.17 – 41.8 km

Table S2. List of vascular plants of *Populus pruinosa* communities in the Ili and in the Syr Darya river valleys.

Families / Species	Distribution	
	The Ili River Valley	The Syr Darya River Valley
Amaranthaceae Juss.		
<i>Amaranthus blitoides</i> S. Watson	+	-
<i>Anabasis salsa</i> (Ledeb.) Benth. ex Volkens	+	-
<i>Atriplex cana</i> Ledeb.	+	-
<i>Atriplex sagittata</i> Borkh.	-	+
<i>Atriplex tatarica</i> L.	+	+
<i>Bassia eriophora</i> (Schrader) Asch.	-	+
<i>Bassia hyssopifolia</i> (Pall.) Kuntze	+	-
<i>Bassia prostrata</i> (L.) Beck	+	+
<i>Bassia sedoides</i> Asch.	+	-
<i>Camphorosma monspeliaca</i> L.	+	-
<i>Ceratocarpus arenarius</i> L.	+	+
<i>Chenopodium album</i> L.	+	-
<i>Climacoptera lanata</i> (Pall.) Botsch.	+	+
<i>Climacoptera obtusifolia</i> (Schrenk) Botsch.	-	+
<i>Halostachys belangeriana</i> (Moq.) Botsch.	-	+
<i>Haloxylon ammodendron</i> (C.A.Mey.) Bunge ex Fenzl	+	+
<i>Kalidium foliatum</i> (Pall.) Moq.	+	-
<i>Krascheninnikovia ceratoides</i> (L.) Gueldenst.	+	-
<i>Petrosimonia sibirica</i> (Pall.) Bunge	+	+
<i>Salsola arbuscula</i> Pall	-	+
<i>Salsola arbusculiformis</i> Drobow	+	-
<i>Salsola kali</i> subsp. <i>tragus</i> (L.) Čelak.	-	+
<i>Salsola nitraria</i> Pall.	+	+
<i>Salsola paulsenii</i> Litv.	+	+
<i>Suaeda altissima</i> (L.) Pall.	-	+
<i>Suaeda linifolia</i> Pall.	-	+
<i>Suaeda microphylla</i> Pall.	+	+
Amaryllidaceae J.St.-Hil.		

<i>Allium caesium</i> Schrenk	+	-
<i>Allium decipiens</i> Fisch. ex Schult. & Schult.f.	+	-
<i>Allium galanthum</i> Kar. & Kir.	+	-
<i>Allium lineare</i> L.	-	+
Apiaceae Lindl.		
<i>Elwendia setacea</i> (Schrenk) Pimenov & Kljuykov	+	-
<i>Ferula iliensis</i> Krasn. ex Korovin	+	-
<i>Ferula lehmannii</i> Boiss.	-	+
<i>Ferula ovina</i> (Boiss.) Boiss.	+	-
<i>Ferula songarica</i> Pall. ex Schult	+	-
<i>Ferula teterrima</i> Kar. & Kir.	+	-
<i>Oedibasis apiculata</i> (Kar. & Kir.) Koso-Pol.	+	-
<i>Prangos arenaria</i> Pimenov	+	-
Apocynaceae Juss.		
<i>Apocynum venetum</i> subsp. <i>lancifolium</i> (Russanov) ined.	+	+
<i>Cynanchum acutum</i> subsp. <i>sibiricum</i> (Willd.) Rech.f.	+	+
Asparagaceae Juss.		
<i>Asparagus brachyphyllus</i> Turcz	-	+
<i>Asparagus breslerianus</i> Schult. & Schult.f.	-	+
<i>Asparagus persicus</i> Baker	+	-
<i>Asparagus neglectus</i> Kar. & Kir.	+	-
Asteraceae Giseke		
<i>Amberboa turanica</i> Iljin	-	+
<i>Artemisia diffusa</i> Krasch. ex Poljakov	-	+
<i>Artemisia leucodes</i> Schrenk	+	-
<i>Artemisia pauciflora</i> Weber ex Stechm.	+	-
<i>Artemisia schrenkiana</i> Ledeb.	+	+
<i>Artemisia scoparia</i> Waldst. & Kit.	+	-
<i>Artemisia serotina</i> Bunge	+	-
<i>Artemisia sublessingiana</i> Krasch. ex Poljakov	+	-
<i>Artemisia terrae-albae</i> Krasch.	+	+
<i>Artemisia turanica</i> Krasch.	+	+
<i>Centaurea pseudosquarrosa</i> Mikheev ex Gabrieljan et Mikheev	+	-
<i>Centaurea pulchella</i> Ledeb.	+	+
<i>Cirsium arvense</i> (L.) Scop.	+	+
<i>Cousinia erectispina</i> Tscherneva	-	+
<i>Cousinia tenella</i> Fisch. & C. A. Mey.	+	+
<i>Epilasia acrolasia</i> (Bunge) Lipsch	-	+
<i>Erigeron canadensis</i> L.	-	+
<i>Galatella fastigiiformis</i> Novopokr.	+	-
<i>Karelinia caspia</i> (Pall.) Less.	+	+
<i>Koelpinia linearis</i> Pall.	-	+
<i>Lactuca serriola</i> L.	+	+
<i>Lactuca tatarica</i> C.A. Mey.	+	-
<i>Microcephala lamellata</i> (Bunge) Pobed.	-	+
<i>Onopordum acanthium</i> L.	+	-
<i>Pentanema caspicum</i> (F.K.Blum ex Ledeb.) G.V.Boiko, Korniy. & Mosyakin	-	+
<i>Rhaponticum repens</i> (L.) Hidalgo	+	+
<i>Senecio erucifolius</i> L.	-	+
<i>Seriphidium diffusum</i> (Krasch. ex Poljak.) Y.R. Ling	-	+

<i>Sonchus arvensis</i> L.	+	-
<i>Takhtajaniantha pusilla</i> (Pall.) Nazarova	-	+
<i>Taraxacum bessarabicum</i> (Hornem.) Hand.-Mazz.	-	+
<i>Taraxacum officinale</i> F.H. Wigg.	+	-
<i>Taraxacum glaucanthum</i> (Ledeb.) DC.	+	-
<i>Tragopogon ruber</i> S.G. Gmel.	+	-
<i>Tripolium pannonicum</i> (Jacq.) Dobrocz.	-	+
<i>Xanthium strumarium</i> L.	+	+
Berberidaceae Juss.		
<i>Berberis iliensis</i> Popov	+	-
Boraginaceae Juss.		
<i>Arnebia decumbens</i> (Vent.) Coss. & Kralik	+	-
<i>Asperugo procumbens</i> L.	+	+
<i>Heliotropium dasycarpum</i> Ledeb. ex Eichw.	-	+
<i>Pseudoheterocaryum szovitsianum</i> (Fisch. & C.A.Mey.) Kaz.Osaloo & Saadati	+	-
<i>Lappula marginata</i> (M.Bieb.) Gürke	+	-
<i>Lappula spinocarpos</i> (Forssk.) Asch. ex Kuntze	-	+
<i>Nonea caspica</i> (Willd.) G. Don	+	+
<i>Rochelia disperma</i> subsp. <i>retorta</i> (Pall.) Kotejowa	+	-
Brassicaceae Burnett		
<i>Alyssum dasycarpum</i> Stephan ex Willd.	-	+
<i>Alyssum desertorum</i> Stapf	+	-
<i>Alyssum stenostachyum</i> Botsch. & Vved.	+	-
<i>Arabidopsis thaliana</i> (L.) Heynh.	+	-
<i>Camelina microcarpa</i> Andr. ex DC.	+	-
<i>Chorispora tenella</i> (Pall.) DC.	-	+
<i>Descurainia sophia</i> (L.) Webb ex Prantl	+	+
<i>Goldbachia laevigata</i> (M. Bieb.) DC.	-	+
<i>Lepidium aucheri</i> Boiss.	-	+
<i>Lepidium draba</i> L.	+	-
<i>Lepidium latifolium</i> L.	+	-
<i>Lepidium obtusum</i> Basiner	-	+
<i>Lepidium perfoliatum</i> L.	+	-
<i>Leptaleum filifolium</i> (Willd.) DC.	-	+
<i>Malcolmia africana</i> (L.) R.Br.	+	+
<i>Meniocus linifolius</i> (Stephan ex Willd.) DC.	+	+
<i>Olimarabidopsis pumila</i> (Celak.) Al-Shehbaz, O'Kane & R.A. Price	-	+
<i>Strigosella brevipes</i> (Bunge) Botsch.	-	+
<i>Tauscheria lasiocarpa</i> Fisch. ex DC.	-	+
Cannabaceae Martinov		
<i>Cannabis sativa</i> L.	+	-
Caryophyllaceae Juss.		
<i>Acanthophyllum pungens</i> Boiss.	-	+
<i>Arenaria serpyllifolia</i> subsp. <i>leptoclados</i> (Rchb.) Nyman	+	-
<i>Gypsophila paniculata</i> L.	-	+
<i>Gypsophila perfoliata</i> L.	+	-
<i>Holosteum polygamum</i> K. Koch	+	-
Convolvulaceae Juss.		
<i>Calystegia sepium</i> (L.) R. Br.	+	-
<i>Cuscuta europaea</i> L.	-	+

Cynomoriaceae Endl. ex Lindl.		
<i>Cynomorium coccineum</i> subsp. <i>songaricum</i> (Rupr.) J.Léonard	+	-
Cyperaceae Juss.		
<i>Bolboschoenus maritimus</i> (L.) Palla	-	+
<i>Bolboschoenus planiculmis</i> (F.Schmidt) T.V.Egorova	+	-
<i>Carex diluta</i> M. Bieb.	+	-
<i>Carex pachystylis</i> J. Gay	+	-
<i>Carex saxatilis</i> L.	-	+
<i>Schoenoplectus litoralis</i> (Schrad.) Palla	+	-
Elaeagnaceae Juss.		
<i>Elaeagnus angustifolia</i> L.	+	+
Ephedraceae Dumort.		
<i>Ephedra distachya</i> L.	+	-
<i>Ephedra equisetina</i> Bunge	+	-
<i>Ephedra lomatolepis</i> Schrenk	+	-
Euphorbiaceae Juss.		
<i>Euphorbia esula</i> L.	+	+
<i>Euphorbia seguieriana</i> Neck.	-	+
<i>Euphorbia soongarica</i> Boiss.	+	-
<i>Euphorbia turczaninowii</i> Kar. & Kir.	-	+
Fabaceae Juss.		
<i>Alhagi kirghisorum</i> Schrenk	+	-
<i>Alhagi pseudalhagi</i> (M. Bieb.) Desv. ex B. Keller & Shap.	+	+
<i>Caragana halodendron</i> (Pall.) Dum.Cours.	+	+
<i>Astragalus campylorrhynchus</i> Fisch. & C.A.Mey.	-	+
<i>Astragalus orbiculatus</i> Ledeb.	-	+
<i>Glycyrrhiza glabra</i> L.	+	+
<i>Glycyrrhiza uralensis</i> Fisch.	+	-
<i>Sophora alopecuroides</i> L.	+	+
<i>Sphaerophysa salsula</i> (Pall.) DC.	+	-
<i>Medicago medicaginoides</i> (Retz.) E.Small	+	-
<i>Medicago orthoceras</i> (Kar. & Kir.) Trautv	+	-
<i>Vicia cracca</i> L.	+	-
Geraniaceae Juss.		
<i>Erodium oxyrhinchum</i> M.Bieb.	+	-
Iridaceae Juss.		
<i>Iris halophila</i> var. <i>sogdiana</i> (Bunge) Grubov	+	-
<i>Iris tenuifolia</i> Pall.	-	+
Juncaceae Juss.		
<i>Juncus gerardii</i> Loisel.	-	+
Lamiaceae Martinov		
<i>Marrubium anisodon</i> K.Koch	+	-
<i>Ziziphora tenuior</i> L.	+	-
Liliaceae Juss.		
<i>Gagea bergii</i> Litv.	-	+
<i>Gagea bulbifera</i> (Pall.) Salisb.	+	-
<i>Gagea setifolia</i> Baker	+	-
<i>Tulipa behmiana</i> Regel	+	-
<i>Tulipa biflora</i> Pall.	+	+
<i>Tulipa borszczowii</i> Regel	-	+
<i>Tulipa kolpakowskiana</i> Regel	+	-

Mazaceae Reveal		
<i>Dodartia orientalis</i> L.	+	+
Nitrariaceae Lindl.		
<i>Nitraria schoberi</i> L.	+	+
<i>Nitraria sibirica</i> Pall.	+	-
<i>Peganum harmala</i> L.	-	+
Orobanchaceae Vent.		
<i>Cistanche salsa</i> (C.A. Mey.) Beck	-	+
Papaveraceae Juss.		
<i>Corydalis schanginii</i> (Pall.) B. Fedtsch.	-	+
<i>Hypecoum pendulum</i> L.	+	+
<i>Papaver pavoninum</i> C. A. Mey.	+	+
Phyllanthaceae Martinov		
<i>Andrachne telephioides</i> L.	+	-
Plantaginaceae Juss.		
<i>Veronica campylopoda</i> Boiss.	+	+
Plumbaginaceae Juss.		
<i>Limonium gmelinii</i> (Willd.) Kuntze	+	-
<i>Limonium otolepis</i> Kuntze	+	+
Poaceae Barnhart		
<i>Aegilops cylindrica</i> Host	+	-
<i>Aegilops tauschii</i> Coss.	+	-
<i>Aeluropus littoralis</i> (Gouan) Parl.	+	+
<i>Agropyron desertorum</i> (Fisch. ex Link) Schult	+	-
<i>Apera interrupta</i> (L.) P. Beauv.	+	-
<i>Bromus tectorum</i> L.	+	-
<i>Bromus squarrosus</i> L.	+	+
<i>Calamagrostis epigejos</i> (L.) Roth	+	+
<i>Elymus repens</i> (L.) Gould	+	+
<i>Elymus schrenkianus</i> (Fisch. & C.A.Mey.) Tzvelev	+	-
<i>Eremopyrum bonaepartis</i> (Spreng.) Nevski	+	+
<i>Eremopyrum orientale</i> (L.) Jaub. & Spach	+	+
<i>Eremopyrum triticeum</i> (Gaertn.) Nevski	+	+
<i>Leymus angustus</i> (Trin.) Pilg.	+	-
<i>Leymus multicaulis</i> (Kar. & Kir.) Tzvelev	+	+
<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	+	+
<i>Poa bulbosa</i> L.	+	-
<i>Stipa arabica</i> Trin. & Rupr.	+	-
<i>Stipa orientalis</i> Trin. ex Ledeb.	+	-
<i>Neotrinia splendens</i> (Trin.) M.Nobis, P.D.Gudkova & A.Nowak	+	-
Polygonaceae Juss.		
<i>Atraphaxis compacta</i> Ledeb.	+	-
<i>Atraphaxis spinosa</i> L.	+	-
<i>Calligonum aphyllum</i> Gürke	-	+
<i>Calligonum leucocladum</i> (Schrenk) Bunge	+	-
<i>Persicaria hydropiper</i> (L.) Delarbre	-	+
<i>Polygonum aviculare</i> L.	+	+
<i>Polygonum patulum</i> M. Bieb.	+	-
Primulaceae Batsch ex Borkh.		
<i>Androsace maxima</i> L.	+	-
Ranunculaceae Juss.		

<i>Ceratocephala testiculata</i> (Crantz) Besser	+	+
<i>Clematis orientalis</i> L.	+	+
Rosaceae Juss.		
<i>Rosa beggeriana</i> Schrenk ex Fisch. & C.A. Mey.	+	-
<i>Spiraea crenata</i> L.	+	-
<i>Spiraea hypericifolia</i> L.	+	-
Rubiaceae Juss.		
<i>Galium aparine</i> L.	+	-
<i>Galium spurium</i> L.	-	+
<i>Galium verum</i> subsp. <i>verum</i> L.	+	-
Rutaceae Juss.		
<i>Haplophyllum perforatum</i> Kar. & Kir.	+	-
<i>Haplophyllum lasianthum</i> Bunge	-	+
Salicaceae Mirb.		
<i>Populus euphratica</i> Oliv.	+	+
<i>Populus pruinosa</i> Schrenk	+	+
<i>Salix alba</i> L.	-	+
<i>Salix songarica</i> Andersson	+	+
<i>Salix wilhelmsiana</i> M. Bieb.	-	+
Solanaceae Adans.		
<i>Hyoscyamus niger</i> L.	+	-
<i>Lycium dasystemum</i> Pojark.	+	+
<i>Lycium ruthenicum</i> Murr.	+	+
<i>Solanum dulcamara</i> L.	+	+
Tamaricaceae Link		
<i>Tamarix elongata</i> Ledeb.	-	+
<i>Tamarix hispida</i> Willd.	+	-
<i>Tamarix laxa</i> Willd.	+	+
<i>Tamarix ramosissima</i> Ledeb.	+	+
Thymelaeaceae Juss.		
<i>Diarthron vesiculosum</i> (Fisch. & C.A.Mey.) C.A. Mey.	+	-
Zygophyllaceae R.Br.		
<i>Zygophyllum brachypterum</i> Kar. & Kir.	+	-
<i>Zygophyllum fabago</i> L.	+	+

Table S3. Forestry characteristics of turanga communities in the Ili and the Syr Darya River Valleys.

Parameter	Location			
	The Ili River Valley			
Coordinates, height above sea level	N 45°03' E 75°17' 329 m	N 43°52' E 78°23' 573 m	N 43°54' E 78°33' 715 m	N 43°47' E 78°24' 418 m
Relief	above – floodplain terrace		foothill undulating plain	above – floodplain terrace
Soils	floodplain meadow-forest		forest-meadow	floodplain meadow- forest
Plant community	forb-shrub-turanga	tall-grass- turanga	forb-shrub- turanga	grass-turanga

Total projective coverage, %	70	90 – 95	70	90 – 100
Size of the test site, m	20 × 20	80 × 45	50 × 10	50 × 10
Tree layer: height (h), m, average diameter (d), cm	h = 9 – 12, d = 39	h = 12 – 14, d = 27	h = 12 – 13, d = 25	h = 10 – 12, d = 29
Composition of the stand	<i>Populus pruinosa</i>	<i>Populus pruinosa</i> , <i>Elaeagnus angustifolia</i>	<i>Populus pruinosa</i> , <i>Elaeagnus angustifolia</i>	<i>Populus pruinosa</i> , <i>Elaeagnus angustifolia</i>
Closeness of the stand	0.6	0.3	0.5	0.3-0.4
Bonitet, age (years)	II (III) 50 – 60	IV – V 40 – 50	III – IV 40 – 50	IV 40 – 50
Number of trees, pcs.	16	52	23	37
Number of undergrowth, pcs.	5	10	-	7
Vitality according to Sukachev and Zonn	1 – the species develops normally, reaches its normal size, goes through the entire cycle of its development, form fruit			
Shrub / semishrub layer: height (h), m projective coverage (pc, %)	h = 0.5 – 3.5 pc = 10 – 15	h = 1 – 2.3 pc = 10	h = 0.5 – 5 pc = 20	h = 0.5 – 3.5 pc = 5
Composition of shrub / semishrub layer	<i>Caragana halodendron</i> , <i>Nitraria schoberi</i> , <i>Tamarix ramosissima</i>	<i>Caragana halodendron</i> , <i>Berberis iliensis</i> , <i>Krascheninnikovi a ceratoides</i> , <i>Nitraria sibirica</i> , <i>Haloxylon ammodendron</i> , <i>Suaeda microphylla</i>	<i>Caragana halodendron</i> , <i>Berberis iliensis</i> , <i>Clematis orientalis</i> , <i>Tamarix ramosissima</i> , <i>Calligonum leucocladum</i> , <i>Lycium dasystemum</i> , <i>Atraphaxis spinosa</i>	<i>Caragana halodendron</i> , <i>Berberis iliensis</i> , <i>Tamarix hispida</i> , <i>Tamarix laxa</i> , <i>Kalidium foliatum</i>
Composition of herbal layer, projective coverage (pc, %)	<i>Eremopyrum bonaepartis</i> , <i>Leymus multicaulis</i> , <i>Lappula semiglabra</i> , <i>Tragopogon ruber</i> , <i>Taraxacum officinale</i> , <i>Cynanchum sibiricum</i> , <i>Cardaria draba</i> , <i>Sophora alopecuroides</i> pc = 60 – 70	<i>Phragmites australis</i> , <i>Glycyrrhiza uralensis</i> , <i>Bolboschoenus planiculmis</i> , <i>Cynanchum acutum</i> subsp. <i>sibiricum</i> , <i>Asparagus persicus</i> , <i>Sophora alopecuroides</i> , <i>Lactuca serriola</i> , <i>Artemisia schrenkiana</i> , <i>Atriplex tatarica</i> , <i>Cynomorium</i>	<i>Neotrinia splendens</i> , <i>Phragmites australis</i> , <i>Leymus angustus</i> , <i>Elymus schrenkianus</i> , <i>Acroptilon australis</i> , <i>Ferula iliensis</i> , <i>Dodartia orientalis</i> , <i>Euphorbia soongarica</i> , <i>Artemisia schrenkiana</i> , <i>Glycyrrhiza uralensis</i> , <i>Lepidium</i>	<i>Calamagrostis epigeios</i> , <i>Phragmites australis</i> , <i>Artemisia schrenkiana</i> , <i>Glycyrrhiza glabra</i> , <i>Alhagi kirghisorum</i> , <i>Asparagus persicus</i> pc = 90 – 100

		<i>coccineum</i> subsp. <i>songaricum</i> , <i>Chenopodium</i> <i>album</i> , <i>Leymus</i> <i>multicaulis</i> pc = 90	<i>latifolium</i> , <i>Hyoscyamus</i> <i>niger</i> , <i>Anabasis</i> <i>aphylla</i> , <i>Cynanchum</i> <i>acutum</i> subsp. <i>sibiricum</i> , <i>Galium</i> <i>aparine</i> , <i>Vicia</i> <i>cracca</i> , <i>Bunium</i> <i>setaceum</i> , <i>Andrachne</i> <i>telephioides</i> pc = 70	
Species richness	5.0	5.6	9.7	4.7
Factors and degree of anthropogenic disturbance	background, weak zoogenic influence (rodent burrows)	week	week	grazing / medium
The Syr Darya River Valley				
Coordinates, height above sea level	N 44°14' E 66°37' 105 m	N 44°14' E 66°33' 104 m	N 44°14' E 66°32' 100 m	N 44°14' E 66°31' 107 m
Relief	above-floodplain terrace, riverine ramparts			
Soils	floodplain meadow-forest			
Plant community	forb-grass-turanga			forb-grass-turanga with shrubs
Total projective coverage, %	90-100	90-100	90-100	90
Size of the test site, m	30 × 30	30 × 30	30 × 30	30 × 30
Tree layer: height (h), m, average diameter (d), cm	h = 10 – 20, d = 7	h = 5, d = 12	h = 7 – 10, d = 14	h = 4, d = 4
Composition of the stand	<i>Populus pruinosa</i>	<i>Populus pruinosa</i>	<i>Populus pruinosa</i> , <i>Elaeagnus angustifolia</i>	<i>Populus pruinosa</i>
Closeness of the stand	0.8 – 1.0	0.7 – 0.9	0.8 – 0.9	0.7 – 0.8
Bonitet, age (years)	IV – V 40 – 50	IV (V – Va – Vb) 40 – 50	V – Va – Vb 50 – 55	V – Va – Vb 10 – 15 (30)
Number of trees, pcs.	88	88	66	46
Number of undergrowth, pcs.	-	21	-	-
Vitality according to Sukachev and Zonn	2 – weakening with insufficient vegetative development and not passing the entire large life cycle	1 – the species develops normally, reaches its normal size, goes through the entire cycle of its development	2 – the species goes through all stages of its development, but does not reach its normal size	2 – the species goes through all stages of its development, but does not reach its normal size
Shrub / semishrub layer: height (h), m	h = 1 – 1.5 pc = 10	h = 1 pc = 10	h = 1.5 pc = 40	h = 1 – 1.7 pc = 15 – 30

projective coverage (pc, %)				
Composition of shrub / semishrub layer	<i>Caragana halodendron</i> , <i>Tamarix ramosissima</i>	<i>Caragana halodendron</i> , <i>Tamarix ramosissima</i>	<i>Caragana halodendron</i> , <i>Tamarix ramosissima</i> , <i>Halostachys belangeriana</i>	<i>Caragana halodendron</i> , <i>Halostachys belangeriana</i>
Composition of herbal layer, projective coverage (pc, %)	<i>Leymus multicaulis</i> , <i>Aeluropus littoralis</i> , <i>Atriplex sagittata</i> , <i>Limonium otolepis</i> , <i>Petrosimonia sibirica</i> , <i>Suaeda altissima</i> , <i>Climacoptera lanata</i> , <i>Glycyrrhiza glabra</i> , <i>Pseudosophora alopecuroides</i> , <i>Taraxacum bessarabicum</i> , <i>Artemisia schrenkiana</i> , <i>Karelinia caspia</i> pc = 70 – 80	<i>Leymus multicaulis</i> , <i>Atriplex sagittata</i> , <i>Petrosimonia sibirica</i> , <i>Suaeda microphylla</i> , <i>Climacoptera lanata</i> , <i>Limonium otolepis</i> , <i>Glycyrrhiza glabra</i> , <i>Karelinia caspia</i> , <i>Polygonum aviculare</i> pc = 50 – 60	<i>Leymus multicaulis</i> , <i>Aeluropus littoralis</i> , <i>Atriplex sagittata</i> , <i>A. tatarica</i> , <i>Petrosimonia sibirica</i> , <i>Suaeda altissima</i> , <i>Climacoptera lanata</i> , <i>Taraxacum bessarabicum</i> , <i>Limonium otolepis</i> , <i>Zygophyllum fabago</i> , <i>Sophora alopecuroides</i> , <i>Artemisia schrenkiana</i> , <i>Glycyrrhiza glabra</i> , <i>Karelinia caspia</i> , <i>Asparagus breslerianus</i> , <i>Polygonum aviculare</i> , <i>Clematis orientalis</i> pc = 50 – 60	<i>Leymus multicaulis</i> , <i>Aeluropus littoralis</i> , <i>Atriplex sagittata</i> , <i>Limonium otolepis</i> , <i>Petrosimonia sibirica</i> , <i>Suaeda altissima</i> , <i>Climacoptera lanata</i> , <i>Zygophyllum fabago</i> , <i>Asparagus breslerianus</i> , <i>Saussurea salsa</i> pc = 30 – 40
Species richness	5.1	4.1	7.5	4.4
Factors and degree of anthropogenic disturbance	grazing / weak, medium	grazing / medium	grazing / medium	grazing / medium



Figure S1. *Populus pruinosa* Schrenk

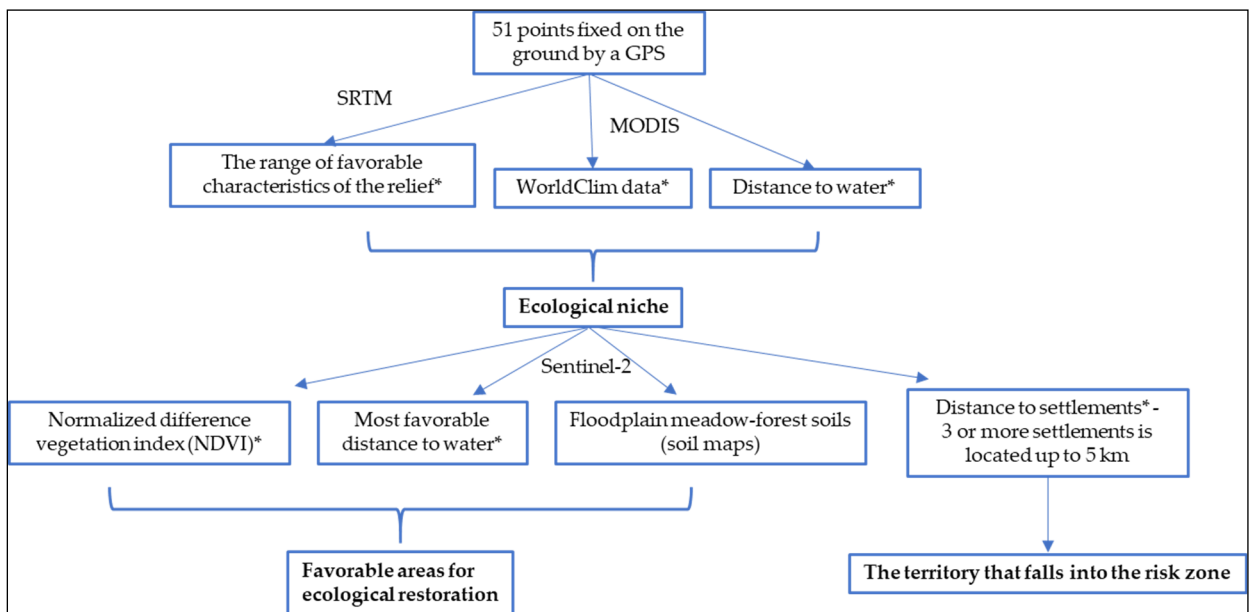


Figure S2. Flow charts of calculations for ecological niche mapping, detection of favorable areas for ecological restoration and the territory that falls into the risk zone.

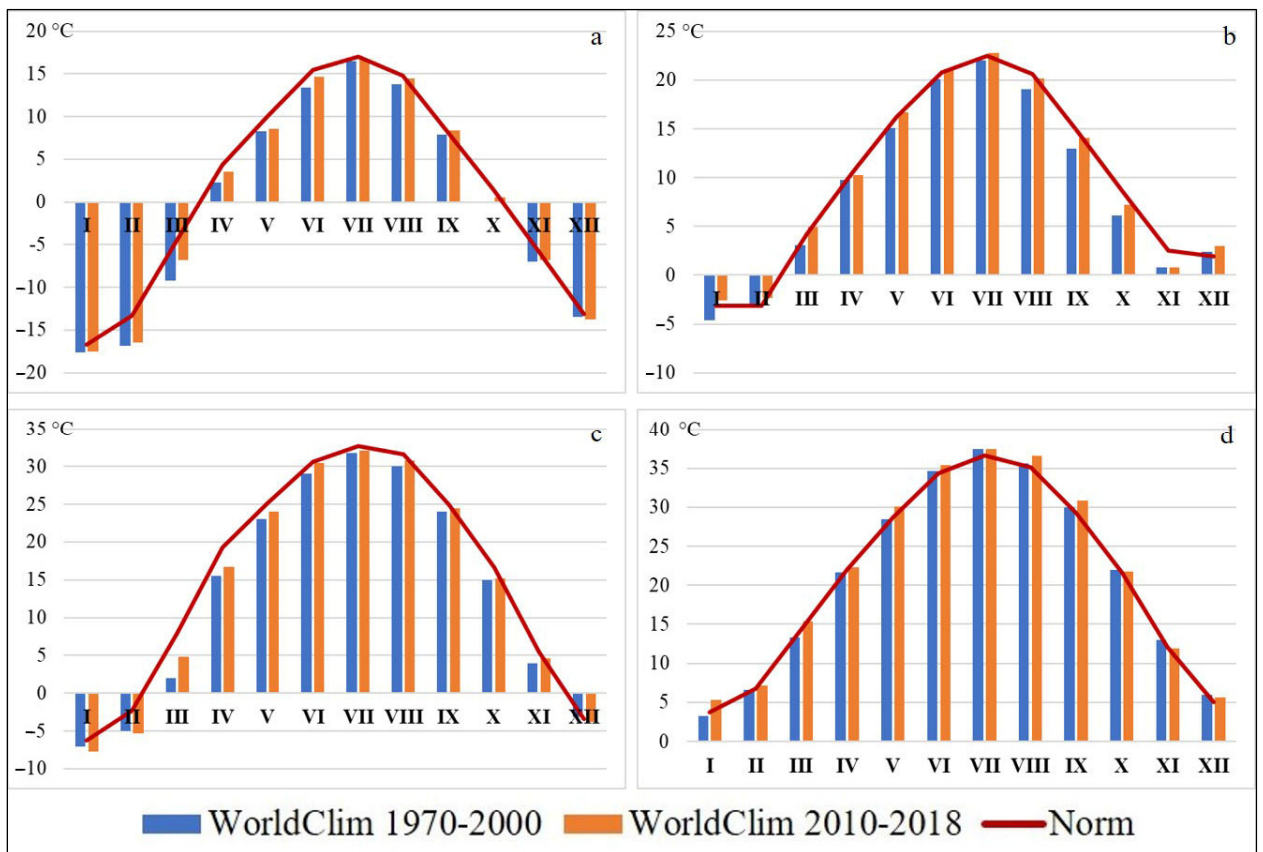


Figure S3. Correlation between temperature: [a] Lower limits for minimum temperatures; [b] Upper limits for minimum temperatures; [c] Lower limits for maximum temperatures; [d] Upper limits for maximum temperatures. I–XII – months.

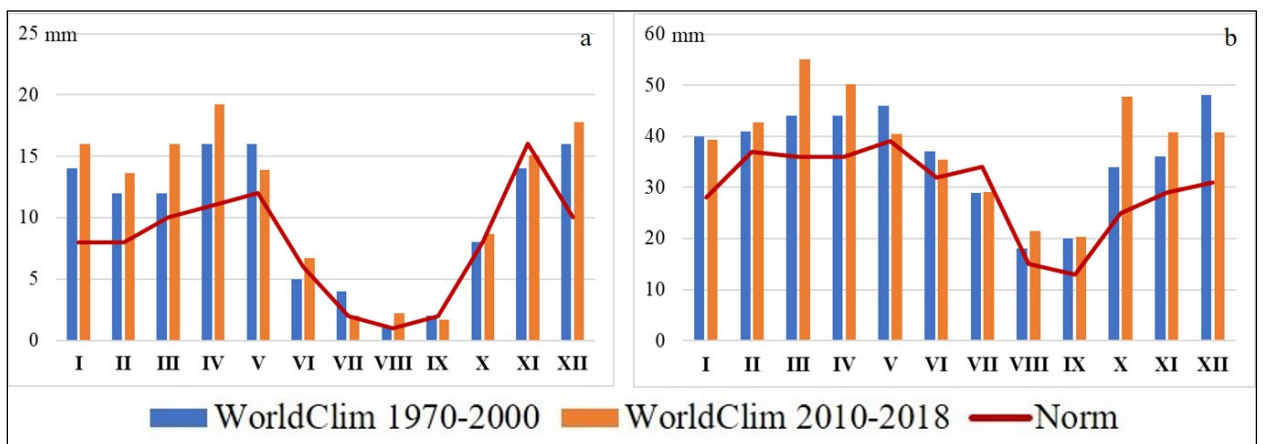


Figure S4. Correlation between precipitation: [a] Lower limits of precipitation; [b] Upper limits of precipitation. I–XII – months.