

ROOT DISTRIBUTION OF 430 PLANTS IN TEMPERATE GRASSLAND OF NORTHERN CHINA

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Abstract. Plants in arid environments tend to have large, deep root systems, so plants living in different environments may have different root morphology. How many types of plant roots exist in the grassland? To answer this question, root morphology of each plant species should be observed, and then summarized. However, very limited data considering root distribution of each grassland species is available due to methods limitation. In this study, 430 plant species (including 542 observations) were selected. The study found that the majority of plant roots in grassland of northern China can be divided into six types: rhizome-rooted plant, fasciculate rooted plants, creeping rooted plants, fibrous rooted plants, tap-rooted plants, the bulb-corm-tuber rooted type. Based on the root types, the average root depth is 63.84 ± 5.96 cm for tap rooted, 49.89 ± 7.06 cm for creeping rooted, 32.03 ± 4.29 cm for fasciculate rooted, 23.72 ± 2.77 cm for rhizome rooted, 20.38 ± 3.83 cm for fibrous rooted, 15.79 ± 2.02 cm for bulb-corm-tuber rooted plants. The unilateral root spread is 44.58 ± 9.26 cm for tap rooted, 43.12 ± 7.64 cm for creeping rooted, 23.82 ± 2.79 cm for rhizome rooted, 21.00 ± 2.93 cm for fasciculate rooted, 13.86 ± 2.64 cm for fibrous rooted, 12.64 ± 2.44 cm for bulb-corm-tuber rooted plants. It was found that plants with deeper tap root and longer lateral roots are mainly distributed in sandy and desert habitats. Plants with shallow tap roots and short lateral roots are mainly distributed in humid meadows, marsh soil and meadow soil. In humid regions, some plants were found to have a very large root system and at the same time large aboveground biomass.

Keywords: *root depth, unilateral roots, steppe, root type, height*

Introduction

When compared with the research concerning aboveground plant parts, the research in plant roots and belowground organs are relatively lacking. Mainly, because it is relatively difficult to sample and observe the root buried in soil. We are aware, that complete root system can only be obtained through the excavation method, yet this method is laborious and time-consuming. Additionally, there are many kinds of plants distributed widely. Therefore, the current data on root morphology is limited to only some

species. Efforts to understand the root morphological characteristics of all the plants, should be made through worldwide and long-term cooperation of scientists.

On this account, professor Chen Shihuang, had been acquiring 430 kinds of plant roots and had been gathering observational data for the past 50 years. Because of the identical way of collecting, the results can be well compared. The collected data was analyzed and is summerized in this article.

Review of Literature

Drought tolerance and water use efficiency of plants are important because aridity in many areas of the world severely limits plant growth. Aridity is expected to become more severe, especially in arid and semi-arid areas of the world, such as in central and northern China (Zhang et al., 2016; Fu and Guo, 2008). The depth, lateral spread and degree of overlap of plant root systems are important for plant's adsorption of water and nutrients (Casper and Jackson, 1997). Plants in arid areas have particurally large belowground biomass. According to Ma and Fang (2006), belowground biomass of plants in Inner Mongolian grasslands is six to ten times greater than aboveground biomass. Studying the distribution of plant roots is useful to predict different responses of plants under future drought conditions, and in order to develop strategies to protect local ecological environment and maintain ecological functions in the grassland.

Study of the vertical and horizontal distribution of roots is of particular ecological significance. Most of plant root biomass occurs in the 0-50 cm soil layer, and only a small portion reaches deep soil (for a review see Canadell et al. (1996)). Therefore, it has commonly been assumed that study of plant roots in the 50 cm soil layer can allow to fully understand the function and structure of the root systems on the ecosystem level. However, more and more research has shown the significant role of deep roots, especially for water, carbon and nutrient cycling (Douglas, 2011; Philippot et al., 2009; Yu et al., 2015).

Elongation of lateral roots of adjacent plants can affect the amount of available resources in an ecosystem and thus determine the competitive advantage between plants (Jose et al., 2003; Ruta et al., 2010; Wang et al., 2002). Data on root depth and lateral root spread can help predicting functional differences between plants with different growth under future climate change scenarios. However, the absolute root depth or horizontal extension of roots may even be greater in humid environments, because plants shoots can be relatively large in these regions (Schenk and Jackson, 2002). Study of the vertical and horizontal distribution characteristics of plant roots can provide important reference values for plant root sampling techniques, and can be useful in building models related to roots; and in calculating the carbon retention rates in global grasslands.

Roots are buried in the soil, but soil is an opaque and heterogeneous composite medium containing a lot of gravel. This increases the difficulty of root sampling and research. Therefore, many scholars have tried to employ new methods to study root systems, including the excavation method, the profile method, the root window method, ground penetrating radar and isotope labeling methods.

Compared to other methods, the excavation method is the only method in which relatively intact roots can be obtained. The excavation method is suitable for sampling shallow roots of herbs, but is very laborious and time-consuming when applied to the sampling of shrub and tree roots. Despite the difficulty, inefficiency and labor requirements, we need to use the excavation method to see the full morphology of a root

system. The plant roots research team led by Chen Shihuang had accumulated abundant primary research data on plants' roots in grasslands over the past 50 years, including data on the basic morphology, depth and horizontal extension of roots in relation to the plants' habitat.

We analyzed the data in order to test some previously formed hypotheses: 1) plants have deeper or wider roots in water deficient environments, and also have deeper or wider roots under water-abundant conditions; 2) root morphology and root types are related to steppe habitats. The main root types in the steppe of northern China include tap roots, creeping roots, rhizome roots and fasciculate roots. This analysis aims to provide the basis for further study of belowground part of grassland ecosystem.

Materials and Methods

Plant roots were mostly sampled from Inner Mongolia Autonomous Region and northeast China, with some samples from Xinjiang Autonomous Region and Gansu Province (*Figure 1*, more details about the sites for each species can be acquired from supplements or from authors). Sampling was done at the beginning of August and at the end of July (which is the period of peak biomass). Typical plants were selected based on the growth of aboveground biomass, root samples were obtained using the excavation method. During the excavation process, it is necessary to obtain a root system, that is as complete as possible. The depth and horizontal distribution of roots and plant height were then measured in the field with a ruler, and the morphology of the roots was drawn on paper. A few observations of plant roots were collected from a special local sites, such as landslide area or a river bank. We analyzed 541 observations of plant roots, which covered 430 species of plants in different habitats. In some cases plants of the same species had different root morphology in different habitats.

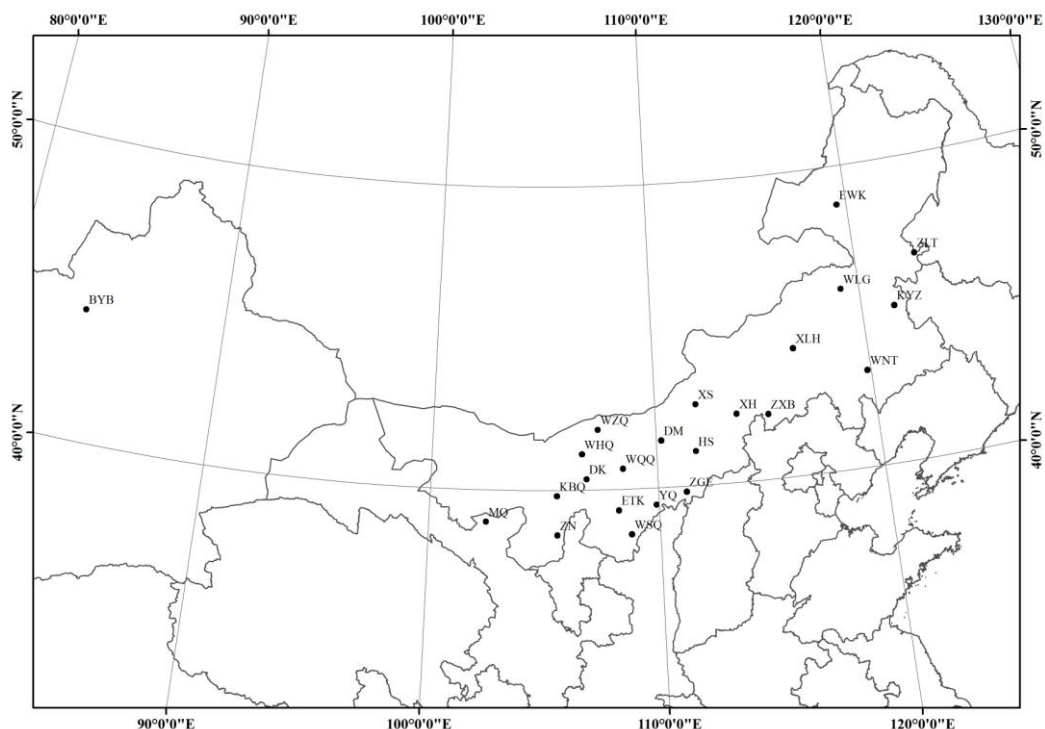


Figure 1. The sampling sites of the plant in this study

The plants were divided into six root types based on the root morphology. Rhizome-rooted plants have a subterranean stem (*Figure 2a*). Creeping rooted plants are characterized by a horizontal root with branches coming from the horizontal root (*Figure 2c*), while fasciculate rooted plants have many branches of the same size coming from both the root and shoots (*Figure 2b*). Fibrous rooted plants have a single long stem with many of thin roots of the same thickness (*Figure 2d*). Tap-rooted plants exhibit a significant difference between the diameter of the main root and lateral roots (*Figure 2e*). The bulb-corm-tuber rooted type refers to plants that have roots with abnormal organs such as tubers, corms or bulbs (*Figure 2f*). More details about the root classification can be found in Liu and Chen (2001) and Armstrong (2001).

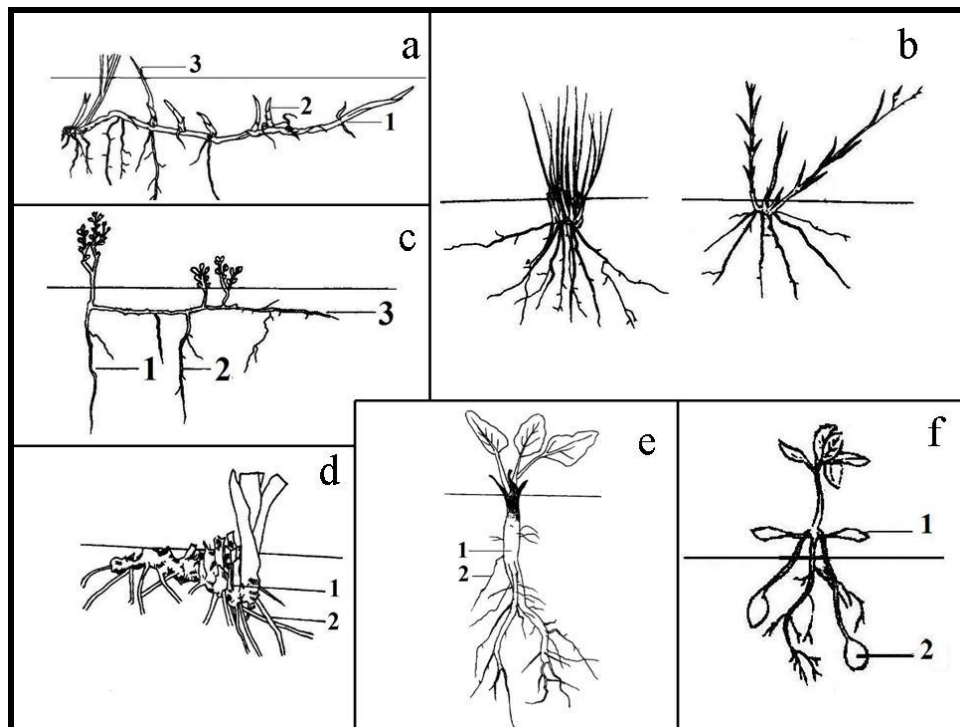


Figure 2. The different root types of plants found in grassland of northern China. note: a. Rhizome-rooted plant (1, subterranean stem; 2, bud; 3, shoot); b. Fasciculate rooted plants; c. Creeping rooted plants (1, main root; 2, vertical root; 3, horizontal root); d. Fibrous rooted plants; e. Tap-rooted plants (1, main root; 2, lateral roots); f. The bulb-corm-tuber rooted type (1, shoot; 2, abnormal organs)

Results

Root depth of grassland plants

The average root depth of different life forms is shown in *Figure 3*. The average root depth of shrubs is 140.03 ± 14.63 cm ($n = 38$), with *Caragana intermedia* Kuang. (620 cm) being the longest. The average root depth of semi-shrubs is 100.14 ± 25.86 cm ($n = 50$), the longest of which is *Alhagi sparsifolia* Shap. (12 m), which grows in the desert. The average root depth of perennial herbs is 38.01 ± 2.41 cm ($n = 367$), the longest of which is *Medicago sativa* L. (467 cm). The average root depth of annual herbs is 18.24 ± 1.98 cm ($n = 86$), the longest of which is *Dracocephalum moldavica* L. (96.67 cm), which grows in fixed sand.

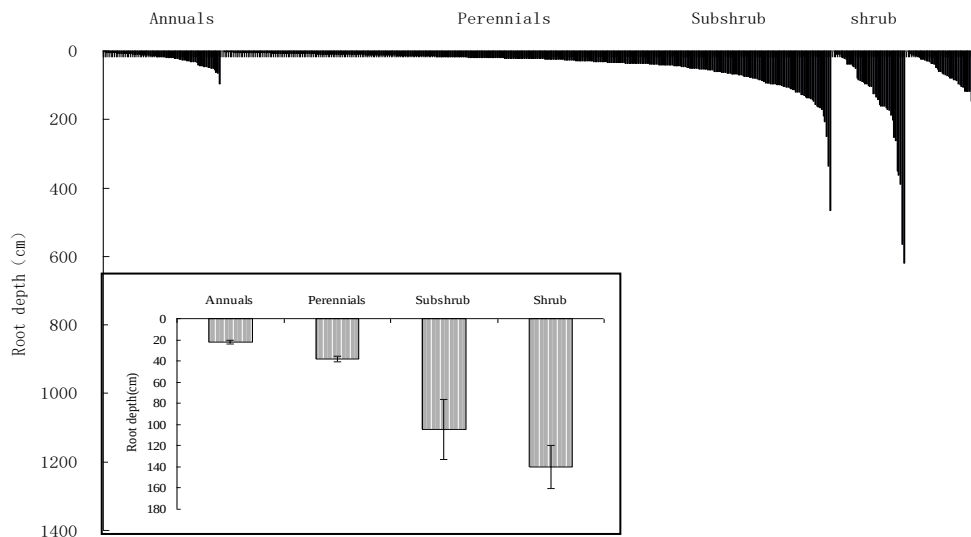


Figure 3. Root depth of plants with different life forms

In this study, a total of 541 observations of root depth were used. Most plant roots are distributed in the 0 to 50 cm soil layer, accounting for 72.09% of the total observations (Table 1). Sixty six observations of root data were distributed deeper than 100 cm. These observations came from 60 kinds of plants, including perennial herbs (27 species), shrubs (18 species), semi-shrubs (10 species), small shrubs (3), small trees (1) and biennial plants (1). Among these observations, 42 observations were sampled from sandy and arid soils, and 7 from salinized soil and wet meadow environments.

Table 1. Root distribution interval of 541 data observations used in this study

	Data observations (proportion %)								Sum
	0≤L* < 0.5	0.5≤L < 1	1≤L < 1.5	1.5≤L < 2	2≤L < 3	3≤L < 4	4≤L < 5	L > 5	
Depth (proportion)	390 (72.09%)	85 (15.71%)	35 (6.47%)	17 (3.14%)	5 (0.92%)	4 (0.74)	1 (0.18%)	4 (0.74)	541
Lateral root spread (proportion)	472 (87.41%)	40 (7.41%)	9 (1.67%)	7 (1.30%)	5 (0.93%)	2 (0.31)	1 (0.19%)	4 (0.74)	540

* “L” indicates length in meters.

The roots in 85 observations were distributed between 50-99 cm deep. These observations include data from 80 species: annual and biennial plants (7 species), perennials plants (53 species), and shrubs, semi-shrubs and dunga-runga (20 species). Of these 85 observations, 31 observations were from plants sampled in sandy soils.

There were 114 observations from a soil depth of 25-50 cm, including 105 species of annual and biennial plants (20 species), perennials plants (73 species), shrubs, semi-shrubs, undershrubs and sub-shrubs (12 species). Out of these, 46 observations came from sandy soils.

There were 276 observations from a root depth of 0-25 cm, including 243 species. Out of these observations, 136 were distributed in humid, aquatic or river bank environments.

The root depth of each root type is shown in *Figure 3*. The depth of tap rooted plants is 63.44 ± 5.97 cm ($n = 311$) on average, of which the root of *Alhagi sparsifolia* Shap. is the deepest. The average depth of creeping rooted plants is 52.56 ± 7.12 cm ($n = 55$), of which the root of *Thermopsis lanceolata* R. Br., growing in semi-fixed sand, is the deepest (248.89 cm). The average depth of fasciculate rooted plants is 32.03 ± 3.33 cm ($n = 51$), of which the root of *Stipa baicalensis* Roshev., which grows in dark chestnut soils, is the deepest (113.44 cm). The depth of rhizome rooted plants is 23.72 ± 2.77 cm ($n = 69$) on average, of which the root of *Psammochloa villosa* (Trin.), which is found growing in sand dunes, is the deepest (120 cm). The average depth of fibrous rooted plants is 20.38 ± 3.83 cm ($n = 30$), of which the root of *Asparagus gobicus* Ivan. ex Grub. is the deepest (116.84 cm). The depth of tuber-bulb rooted plants is 15.79 ± 2.02 cm ($n = 24$) on average, among which the root of *Allium ramosum* L., which grows in the litho soils found in hilly areas of meadow steppe, is the deepest (37.14 cm).

Unilateral root spread

Based on the life form (*Figure 4*), the average unilateral root spread of annual plants is 11.88 ± 1.07 cm, of which the root of *Melilotus officinalis* (Linn.) Pall. is the longest (48.89 cm). The lateral root spread of perennials is 19.94 ± 1.20 cm, of which *Glycyrrhiza uralensis* Fisch. (223.5 cm) and *Ephedra sinica* Stapf. (225 cm) have the longest horizontal extension. The lateral root spread of semi-shrubs is 71.20 ± 15.82 cm, of which the root of *Alhagi sparsifolia* Shap. growing in desert areas, extends the longest (6 m). The lateral root spread of shrubs is 186.49 ± 60.29 cm, of which the root of *Salix gordejvii* Y. L. Chang et Skv. extends the longest (20 m).

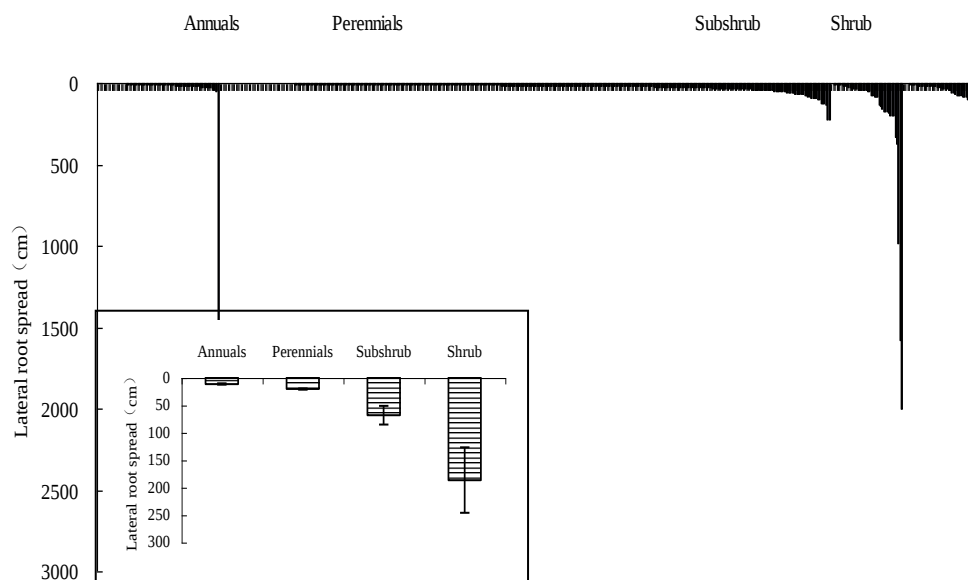


Figure 4. Lateral root spread of plants with different life form

There were 540 observation on lateral root spread. 472 observations were distributed between 0 to 50 cm, representing 87.41% of the total observations (*Table 1*). 28 observations of lateral root spread reached 100 cm, including 23 species of plants (4

observations for perennials, 10 observations for shrubs, 5 observations for subshrubs, 3 observations for undershrubs, 1 observation for dunga-runga), of which 25 observations were located in sandy and desert areas.

The lateral root spread of 40 observations was between 50 and 100 cm, including 40 species (22 perennial herbs, 5 shrubs, 11 semi-shrubs, 1 undershrub and 1 biennial plant). Out of the 40 observations, sandy, desert and brown soils contributed 16 observations, calcic soils, marsh and wetland soils, meadow soils and aquatic environments contributed 10 observations, light chestnut soils 9 observations, dark chestnut soils 4 observations, and a rocky hillside 1 observation.

The lateral root spread of 82 observations was between 25 and 50 cm, covering 79 species. Of these observations, 35 were distributed in sandy soils and desert, and 29 in wet or salty soils, meadow or dark chestnut soils, 6 in light chestnut soils, 5 in chestnut soils, 4 in light brown calcic soil, 1 in alpine meadow of Tibet. Categorized by plant type, 9 observations were from annuals, 52 from perennial grasses, and 18 from shrubs, semi-shrubs and subshrubs.

The lateral root spread of 390 observations was between 0 and 25 cm, covering 330 species, including 64 annual plants, 243 perennial herbs and 23 shrubs, semi-shrubs and undershrubs. Of the 390 observations, 186 observations were distributed in meadow or marsh soils and dark chestnut soils in meadow steppe and mountain areas, saline soil in river wetlands; 107 observations were from sandy soils, fixed dunes and desert areas; 49 observations from chestnut soils, light chestnut soils and dark chestnut soils; 18 observations from brown soils and 17 observations from stony soils and regosols.

The lateral root spread of roots categorized by root type is shown in Figure 5. The average lateral spread for tuber rooted plants is 23.82 ± 2.78 cm. The lateral root spread of *Alisma orientale* (G.Sam.) Juz. is the longest (57.10 cm). The average spread for fasciculate rooted plants is 20.99 ± 2.93 cm, of which *Achnatherum splendens* (Trin.) Nevski is the longest (95 cm). The average for rhizome rooted plants is 23.82 ± 2.78 cm, of which the lateral root spread of *Acorus calamus* L. is the longest (121.70 cm). The average lateral spread for tap rooted plants is 44.57 ± 9.26 cm, of which mature *Salix gordejvii* Y. L. Chang et Skv. is the longest (2 m). For creeping rooted plants, the average spread is 43.12 ± 7.64 cm, of which the lateral root spread of *Hedysarum fruticosum* Pall. Lignosum (Trautv.) Kitag. is the longest (257.14 cm).

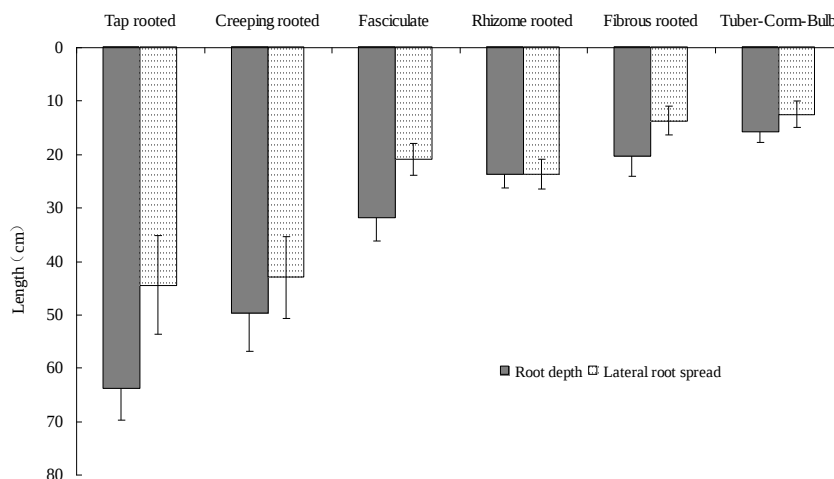


Figure 5. Depth and lateral root spread of plants with different root types

Discussion

Using excavation method to remove the surrounding soil, the complete root morphology of plants was exposed. Since this method requires a large amount of physical labour and time (Smit et al., 2000), adequate data for root studies can only be collected through patient and persistent long-term data accumulation. Although necessary precautions were taken when exposing the roots during sampling process, damage to the roots was still difficult to avoid. Therefore, it is likely that the actual root depth and lateral root spread of some plants is greater than reported.

The root depth and lateral root spread of plants with different life forms follow the order: annuals < perennial herb < subshrub < various shrubs. This is in agreement with reports Schenk and Jackson (2002) and Canadell et al. (1996).

In this study, we classified the plant roots into 6 types (Liu and Chen, 2001). Relatively speaking, tap rooted plants can reach very deep into the soil. Creeping rooted plants have a strong capability to spread roots horizontally. Creeping rooted plants are mainly distributed in the desert steppe and the eastern part of the temperate steppe-desert areas. Tap rooted plants are mainly distributed in forb-rich steppe and the western part of the desert steppe zone. The root depth of fasciculate rooted plants is greater than that of rhizome rooted plants, and smaller than tap rooted or creeping rooted plants. Fasciculate rooted plants are mainly distributed in typical steppe, while rhizome rooted types are mainly distributed in meadow steppe and typical steppe (Liu and Chen, 2001). Fibrous rooted and tuber-bulb rooted plants with subsidiary abnormal organs can store a lot of photosynthetic products, which can limit root growth vertically or horizontally.

Plant root depth and lateral root spread are related to habitat. In general, plants found in sandy and water-deficient environments have deeper roots. The deeper roots can absorb water from deep soils and increase plant's adaptation to drought (Yu et al., 2015). Sandy soils are aerated and loose, so roots can spread more easily. Though patterns of lateral root growth are species specific and habitat dependent, roots may be more likely to spread wider in sandy, nutrient-poor, and arid soils (Gour, 2006; Achten et al., 2008; Göttlicher et al., 2008).

Data on lateral root spread may be useful for estimation of belowground competition and the area over which plants interact with neighbours (Zamora et al., 2007; Christine et al., 2002). In this study, 87.41% of the total number of observations were distributed from 0 to 50 cm. Shrubs and trees have a stronger ability to spread lateral root than herbs (Table 1), and most shrubs and trees sampled are located in arid areas.

However, we also found that some plants in the meadow steppe or under other humid conditions have large root systems. Some of these plants have a root deeper than 1 m, such as the perennial plants *Stipa grandis* P. Smirn., *Saussurea amara* (L.) DC., *Stipa baicalensis* Roshev., *Oxytropis myriophylla* (Pall.) DC. and *Hedysarum gmelinii* Ledeb., *Erodium stephanianum* Willd., and *Medicago sativa* L. and shrubs such as *Kalidium foliatum* (Pall.) Moq., *Kochia prostrata* (L.) Schrad., *Caragana microphylla* Lam. and *Caragana microphylla* Lam. Var. *cinerea* Kom.. Some other plants, such as *Glycyrrhiza uralensis* Fisch., *Ceratoides arborescens* (Losinsk.) Tsien et C. G., *Acorus calamus* L., have lateral root spread of more than 100 cm.

The plant root to shoot ratio (R/S) is related to the plant's habitat. Typically, plants have a higher R/S in water deficient soils (Woo et al., 2007; Neumann and Cardon, 2012). In this study, we found that plants living in sandy soils and water deficient environments have large root systems and low plant height, although some plants have large aboveground and belowground parts (Figure 6), such as *Hedysarum fruticosum*

Pall. var. *mongolicum* Turcz. ex B. Fedtsch., *Calligonum mongolicum* Turcz., *Myricaria platyphylla* Maxim., *Astragalus melilotoides* Pall., *Medicago sativa* L., *Salix gordejvii* Y. L. Chang et Skv., *Caragana korshinskii* Kom., *Alhagi sparsifolia* Shap., and *Haloxylon ammodendron* (C. A. Mey.) Bunge. Most of these plants are trees and shrubs. Generally, R/S ratio and absolute maximum root depth of plants growing in arid regions are bigger than those of plants living in humid areas, although some studies have found the opposite (Schenk and Jackson, 2002; Mokany et al., 2006; Waring et al., 2017).

Regarding the plant root distribution pattern (Figure 6), one group of plants has very deep roots, while another group of plants has very long lateral roots, but no plants had both deep and long lateral roots. This may reflect two different survival strategies to obtain water, and thus seems reasonable from a resource allocation perspective.

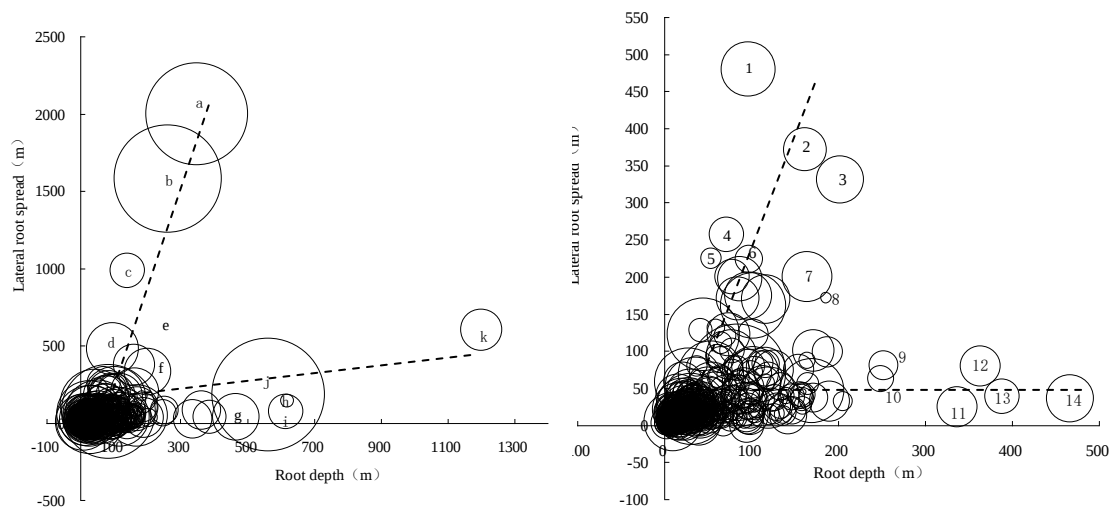


Figure 6. Height, depth and lateral root spread of plants

Right part: 1. *Hedysarum fruticosum* Pall. var. *mongolicum* Turcz. ex B. Fedtsch. 2. *Calligonum mongolicum* Turcz. 3. *Myricaria platyphylla* Maxim. 4. *Hedysarum fruticosum* Pall. *Lignosum* (Trautv.) Kitag 5. *Ephedra sinica* Stapf. 6. *Glycyrrhiza uralensis* Fisch. 7. *Hedysarum scoparium* Fisch. et Mey. 8. *Artemisia sphaerocephala* Krasch. 9. *Caragana pygmaea* (L.) DC. var. *angustissima* C. K. Schn. 10. *Thermopsis lanceolata* R.Br. 11. *Astragalus melilotoides* Pall. 14. *Medicago sativa* L.

Left part: a. *Salix gordejvii* Y. L. Chang et Skv. b. *Caragana korshinskii* Kom. c. *Salix gordejvii* Y. L. Chang et Skv. d. *Hedysarum fruticosum* Pall. var. *mongolicum* Turcz. ex B. Fedtsch. e. *Calligonum mongolicum* Turcz. f. *Myricaria platyphylla* Maxim. g. *Medicago sativa* L. h. *Caragana intermedia* Kuang. i. *Hedysarum fruticosum* Pall. var. *lignosum* (Trautv.) Kitag. j. *Haloxylon ammodendron* (C. A. Mey.) Bunge. k. *Alhagi sparsifolia* Shap.

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Appendix

Appendix 1. Rooting distribution by species with soil type or habitat

Latin name	Root depth	Lateral root spread	Root type	Soil and plant habitat
<i>Achillea millefolium</i> L.	4.90	4.00	Tap	Meadow chernozem
<i>Achnatherum sibiricum</i> (L.) Keng	28.20	32.40	Fasciculate	Steppe
<i>Achnatherum splendens</i> (Trin.) Nevski	77.50	95.00	Fasciculate	Meadow soil in Salinized soil
<i>Achyrophorus ciliatus</i> (Thunb.) Makino	21.23	17.31	Tap	Dark black soils in low wetland between dunes
<i>Acorus calamus</i> L.	45.28	121.70	Rhizome	Bog soils in riverside
<i>Adenophora gmelinii</i> (Spreng.) Fisch.	40.00	1.88	Tap	The gaps between the rocks in forest steppe
<i>Adenophora gmelinii</i> (Spreng.) Fisch. var. <i>coronopifolia</i> (Fisch.) Y. Z. Zhao.	24.67	4.00	Tap	Chernozems in shaded side of hills
<i>Adenophora stenanthina</i> (Ledeb.) Kitag.	11.43	12.57	Creeping	Aeolian soils
<i>Adenophora tetraphylla</i> (Thunb.) Fisch.	43.13	7.50	Tap	Dark Kastanozems in ground
<i>Adenophora trachelioides</i> Maxim.	17.00	14.00	Tap	Podzolic soils in hills
<i>Agriophyllum squarrosum</i> (L.) Moq.	16.86	10.00	Tap	Sand in windward slope
<i>Agriophyllum squarrosum</i> (L.) Moq.	21.75	9.50	Tap	Semi-fixed sand
<i>Agriophyllum squarrosum</i> (L.) Moq.	65.00	30.00	Tap	Light brown calcic soils
<i>Agropyron cristatum</i> (L.) Gaertn.	39.86	13.29	Fasciculate	Light Kastanozems
<i>Agropyron cristatum</i> (L.)	5.71	17.14	Rhizome	Black soils in slope

Gaertn.var. <i>pectiniforme</i> (Roem.et Schult.) H. L. Yang				
<i>Agropyron desertorum</i> (Fisch.) Schult.	40.50	31.00	Rhizome	Semi-fixed dune
<i>Agropyron michnoi</i> Roshev.	7.33	14.67	Rhizome	Sandy Kastanozems
<i>Agropyron mongolicum</i> Keng	10.29	10.29	Rhizome	Aeolian soils in meadow steppe
<i>Agropyron mongolicum</i> Keng	33.14	18.29	Rhizome	Fixed dune
<i>Agropyron mongolicum</i> Keng	33.14	18.29	Rhizome	Light Kastanozems in overlying sand
<i>Agropyron mongolicum</i> Keng var. <i>villosum</i> H. .L. Yang	6.56	6.44	Rhizome	Sandy steppe
<i>Agrostis clavata</i> Trin.	5.00	6.00	Rhizome	Meadow
<i>Agrostis divaricatissima</i> Mez	5.33	4.17	Rhizome	Meadow in lowland flood plain
<i>Agrostis gigantea</i> Roth	4.86	6.57	Rhizome	Meadow in lowland flood plain
<i>Ajania achilleoides</i> (Turcz.) Poljak. ex Grub.	7.64	3.27	Tap	Stony brown calcic soils
<i>Ajania achilleoides</i> (Turcz.) Poljak. ex Grub.	19.27	11.82	Tap	Gravel sandy soil
<i>Aleuritopteris argentea</i> (Gme'l.) Fe'e	4.44	3.00	Fibrous	Under the shrub in shade
<i>Alhagi sparsifolia</i> Shap.	21.25	6.75	Tap	Semi-fixed dune
<i>Alhagi sparsifolia</i> Shap.	39.00	25.00	Tap	Gray-brown desert soil
<i>Alhagi sparsifolia</i> Shap.	85.00	170.00	Tap	Aeolian soils
<i>Alhagi sparsifolia</i> Shap.	155.00	75.00	Tap	Desert
<i>Alhagi sparsifolia</i> Shap.	1200.0 0	600.00	Tap	Desert (one year old)
<i>Alisma orientale</i> (G. Sam.) Juz.	28.06	57.10	Tuber	In river
<i>Allium condensatum</i> Turcz.	33.90	18.00	Tuber	Litho soils in slope
<i>Allium mongolicum</i> Regel.	5.67	4.17	Tuber	Desert steppe
<i>Allium polyrhizum</i> Turcz. ex Regel	19.04	8.09	Tuber	Brown calcic soils in desert steppe
<i>Allium ramosum</i> L.	37.14	31.43	Tuber	Litho soils in hills of meadow steppe
<i>Allium senescens</i> L	9.14	5.43	Tuber	Light Kastanozems in hills
<i>Allium senescens</i> L	14.20	12.60	Tuber	Dark Kastanozems in hills
<i>Allium tenuissimum</i> L.	11.20	9.20	Tuber	Steppe and sandy steppe
<i>Alopecurus brachystachyus</i> Marsh. –Bieb.	28.00	22.00	Rhizome	Meadow in lowland flood plain
<i>Amaranthus retroflexus</i> L.	26.63	7.50	Tap	Kastanozems
<i>Anabasis brevifolia</i> C.A. Mey.	48.00	35.50	Tap	Brown sandy soil in ground
<i>Anabasis brevifolia</i> C.A. Mey.	52.32	20.63	Tap	Light Kastanozems in ground between dunes
<i>Androsace longifolia</i> Turcz.	21.20	12.60	Tap	Dark Kastanozems between dunes
<i>Androsace mariae</i> Kanitz	5.04	4.32	Tap	Skeletol soils in hills
<i>Anemarrhena asphodeloides</i> Bunge	20.20	13.40	Fibrous	Meadow steppe
<i>Arctium lappa</i> L.	23.57	9.14	Tap	Forest steppe in hills
<i>Arenaria juncea</i> Bieb.	5.55	3.84	Tap	Light Kastanozems in hills
<i>Aristida adscensionis</i> L.	7.50	5.50	Fasciculate	Brown calcic soils in lowland of desert steppe
<i>Artemisia anethifolia</i> Web. ex Stechm.	28.91	7.64	Tap	Saline and Salinized soil
<i>Artemisia annua</i> L.	18.22	6.44	Tap	Brown earth soil in hills

<i>Artemisia annua</i> L.	18.46	6.92	Tap	Wetland of riverside in hills
<i>Artemisia annua</i> L.	32.00	25.60	Tap	Light Kastanozems in hills
<i>Artemisia annua</i> L.	54.17	10.42	Tap	Brown earth aeolian soil
<i>Artemisia blepharolepis</i> Bunge	33.50	17.50	Tap	Fixed sand
<i>Artemisia brachyloba</i> Franch.	65.49	87.68	Tap	Mountain
<i>Artemisia desertorum</i> Spreng.	94.80	13.20	Tap	Kastanozems in hills
<i>Artemisia dracunculus</i> Linn.	7.20	9.90	Tap	Light Kastanozems
<i>Artemisia frigida</i> Willd.	23	13.75	Tap	Sandy Kastanozems-in vegetation growth stage
<i>Artemisia frigida</i> Willd.	99	13.5	Tap	Sandy Kastanozems-in reproductive stage
<i>Artemisia halodendron</i> Turcz. ex Bess.	158.47	35.08	Tap	Semi-mobile sand
<i>Artemisia lavandulaefolia</i> D. C.	104.12	68.82	Creeping	Sand
<i>Artemisia mongolica</i> (Fisch. ex Bess.) Nakai.	6.58	5.25	Creeping	Kastanozems in meadow
<i>Artemisia ordosica</i> Krasch.	25.83	21.67	Tap	Sandy brown calcic soils
<i>Artemisia ordosica</i> Krasch.	117.14	78.57	Tap	Semi-fixed sand
<i>Artemisia oxycephala</i> Kitag.	37.50	43.75	Tap	Semi-fixed dune in meadow steppe
<i>Artemisia palustris</i> L.	31.38	16.00	Tap	Sand in forest steppe
<i>Artemisia pubescens</i> Ledeb.	13.80	6.00	Tap	Dry riverbed alluvial soils
<i>Artemisia sacrorum</i> Ledeb.	22.33	17.33	Creeping	Dark Kastanozems in hills
<i>Artemisia sacrorum</i> Ledeb. Var. <i>incana</i> (Barr.) Y. R. Ling	29.10	19.20	Creeping	Sandy dark Kastanozems
<i>Artemisia sieversiana</i>	35.00	25.00	Tap	Kastanozems in dump of coal mine in steppe
<i>Artemisia sphaerocephala</i> Krasch.	74.48	122.07	Tap	Semi-mobile sand
<i>Artemisia sphaerocephala</i> Krasch.	171.43	100.00	Tap	Dune
<i>Artemisia subulata</i> Nakai	16.89	14.89	Creeping	Alluvial soils in dry riverbed
<i>Artemisia tanacetifolia</i> L.	14.70	15.90	Creeping	Forest steppe
<i>Artemisia xerophytica</i> Krasch.	60.00	37.24	Tap	Light brown calcic soils in slope eroded by wind
<i>Artemisia xerophytica</i> Krasch.	73.45	40.34	Tap	Light brown calcic soils in high plains
<i>Arundinella anomala</i> Steud.	24.00	23.50	Rhizome	Aeolian soils
<i>Asparagus dauricus</i> Fisch.ex Link	40.83	17.50	Fibrous	Semi-fixed dune
<i>Asparagus gobicus</i> Ivan.ex Grub.	116.84	82.11	Fibrous	Stony steppe desert
<i>Asparagus oligoclonos</i> Maxim.	12.00	7.56	Fibrous	Litho soils in hills
<i>Aster alpinus</i> L.	21.67	18.00	Tap	Litho soils in hills
<i>Asterothamnus centrali-asiaticus</i> Novopokr.	23.00	9.00	Tap	Gravelly desert soil in desert steppe
<i>Asterothamnus centrali-asiaticus</i> Novopokr.	78.75	75.00	Tap	Brown calcic soils in desert steppe
<i>Astragalus adsurgens</i> Pall.	23.14	11.14	Tap	Fluvo-aquic soils between dunes
<i>Astragalus adsurgens</i> Pall.	55.45	43.64	Tap	Humid sandy soil
<i>Astragalus adsurgens</i> Pall.	205.33	32.00	Tap	Light and stony Kastanozems in slope
<i>Astragalus complanatus</i>	64.90	12.02	Tap	Meadow steppe and alkalization

Bunge				meadow
<i>Astragalus efoliolatus</i> Hand.-Mazz.	38.75	10.31	Tap	Desert steppe
<i>Astragalus galactites</i> Pall.	25.05	5.25	Tap	Light brown calcic soils
<i>Astragalus galactites</i> Pall.	40.53	10.00	Tap	Light Kastanozems
<i>Astragalus galactites</i> Pall.	106.97	21.52	Tap	Gravelly brown soil
<i>Astragalus melilotoides</i> Pall.	336.99	24.66	Tap	Fixed sand
<i>Astragalus miniatus</i> Bunge	16.55	10.55	Tap	Stony slope and Salinized lowland
<i>Astragalus scaberrimus</i> Bunge	53.89	28.33	Creeping	Kastanozems in stony slope
<i>Atraphaxis frutescens</i> (L.) Ewersm.	78.33	200.00	Tap	Flat sand
<i>Atraphaxis frutescens</i> (L.) Ewersm.	160.00	40.00	Tap	Sand in high plains
<i>Atraphaxis manshurica</i> Kitag.	156.65	41.77	Tap	Sand in plain
<i>Atraphaxis pungens</i> (Bieb.) Jaub. et Spach.	95.00	No data	Tap	Sandy chestnut soil
<i>Atriplex sibirica</i> L.	63.00	11.50	Tap	Salinized lowland
<i>Bassia dasyphylla</i> (Fsch.et Mey.). Kuntze	8.36	2.91	Tap	Fixed sand
<i>Bassia dasyphylla</i> (Fsch.et Mey.). Kuntze	16.17	11.67	Tap	Desert soil
<i>Bassia dasyphylla</i> (Fsch.et Mey.). Kuntze	31.13	25.50	Tap	Kastanozems in slope
<i>Beckmannia syzigachne</i> (Steud.) Fernald	7.69	2.23	Fasciculate	Swampy meadow and meadow
<i>Blysmus rufus</i> (Huds.) Link	6.20	7.80	Rhizome	Meadow soil in low wetland
<i>Bothriochloa ischamum</i> (L.) Keng	19.13	17.25	Rhizome	Skeletol soils in hills
<i>Bromus ciliatus</i> L. var. <i>richardsonii</i> (Link) Y.Q. Jiang	34.00	29.00	Rhizome	Dark Kastanozems
<i>Bromus inermis</i> Leyss.	21.75	58.50	Rhizome	Dark Kastanozems in hills of typical steppe
<i>Bupleurum bicaule</i> Helm	22.00	4.44	Tap	Dark Kastanozems
<i>Bupleurum chinense</i> D. C.	13.78	2.78	Tap	Kastanozems in hills
<i>Bupleurum scorzonrifolium</i> Willd.	29.60	6.40	Tap	Light Kastanozems in hills
<i>Butomus umbellatus</i> L.	17.86	20.71	Fibrous	Bog soils in riverside
<i>Calamagrostis epigeios</i> (L.) Roth	55.00	51.00	Rhizome	Meadow soil in salinized ground
<i>Calamagrostis pseudophragmites</i> (Hall.f) Koel	21.50	46.50	Rhizome	Fixed dune
<i>Calligonum mongolicum</i> Turcz.	162.00	372.00	Tap	Desert steppe sand
<i>Calystegia haderacea</i> Wall. Ex Roxb.	13.56	10.22	Creeping	Aeolian soil
<i>Caragana intermedia</i> Kuang.	620.00	142.11	Tap	Dry riverbed in desert steppe
<i>Caragana korshinskii</i> Kom.	262.77	1576.6	Tap	Aeolian soil
<i>Caragana microphylla</i> Lam.	363.64	79.55	Tap	Light Kastanozems in hills(typical steppe)
<i>Caragana microphylla</i> Lam.	388.89	38.89	Tap	Light Kastanozems in slope of hills(desert steppe)
<i>Caragana microphylla</i> Lam.	160.00	43.84	Tap	Typical steppe

Var. <i>cinerea</i> Kom.				
<i>Caragana pygmaea</i> (L.) D. C. var. <i>angustissima</i> C. K. Schn.	252.71	80.62	Tap	Light Kastanozems in slope of hills(Desert steppe)
<i>Caragana stenophylla</i> Pojark.	172.17	36.52	Creeping	Sandy soil in desert steppe
<i>Caragana tibetica</i> Kom.	133.75	25.00	Tap	Steppe Desert
<i>Carex duriuscula</i> C. A. Mey.	7.89	15.79	Rhizome	Fixed sand
<i>Carex duriuscula</i> C. A. Mey.	97.06	79.41	Rhizome	Light Kastanozems of gentle slope in hills
<i>Carex gotoi</i> Ohwi.	3.67	3.67	Rhizome	Meadow soil in between dunes
<i>Carex gotoi</i> Ohwi.	5.44	14.25	Rhizome	Meadow soil in wetland
<i>Carex kobomugi</i> Ohwi.	14.67	23.33	Rhizome	Riverside sandy soil
<i>Carex lithophila</i> Turcz.	6.25	1.25	Rhizome	Meadow soil in forest steppe
<i>Carex raddei</i> kukenth.	54.00	69.00	Rhizome	Meadow soil in valley
<i>Carex rigescens</i> (Franch.) V. Krecz.	18.86	16.57	Rhizome	Sandybrown calcic soils in typical steppe
<i>Carex stenophylloides</i> V. Krecz.	12.25	16.50	Rhizome	Bog soils in riverside
<i>Carex stenophylloides</i> V. Krecz.	35.00	36.50	Rhizome	Fluvo-aquic soils in lowland of Hills
<i>Caryopteris mongholica</i> Bunge	117.27	169.09	Tap	Light Kastanozems between dunes
<i>Centaurea pulchellum</i> (Swartz) Druce var. <i>altacum</i> (Griseb.) Krtag.	9.56	1.78	Tap	Meadow between dunes in mobile sand
<i>Ceratoides arborescens</i> (Losinsk.) Tsien et C. G. Ma	187.69	98.46	Tap	Light Kastanozems in meadow
<i>Ceratoides lateens</i> (J. F. Gmel.) Reveal et Holmgren.	61.11	64.44	Tap	Brown calcic soils in steppe desert
<i>Ceratoides lateens</i> (J. F. Gmel.) Reveal et Holmgren.	84.55	31.36	Tap	Light Kastanozems in hills of steppe desert
<i>Chamaenerion angustifolium</i> (L.) Scop.	14.67	16.67	Tap	Black soils in hills
<i>Chamaerhodos altaica</i> (Laxm.) Bge.	45.00	32.63	Tap	Litho soils in hills
<i>Chamaerhodos canescens</i> Krause	16.00	9.33	Tap	Dark Kastanozems in hills
<i>Chamaerhodos erecta</i> (L.) Bge.	32.00	6.29	Tap	Sandy brown soil in slope
<i>Chamaerhodos erecta</i> (L.) Bge.	45.43	12.43	Tap	Stony Kastanozems in slope
<i>Chamaerhodos trifida</i> Ldb.	21.20	5.60	Tap	Litho soils in hills
<i>Chenopodium album</i> L.	10.00	5.00	Tap	Mesophytic weed
<i>Chenopodium acuminatum</i> Willd.	9.30	6.60	Tap	Light Salinized soil in low wetland
<i>Chenopodium acuminatum</i> Willd.	13.83	9.33	Tap	Sandy Kastanozems in hills
<i>Chenopodium aristatum</i> L.	48.21	22.14	Tap	Fixed sand
<i>Chenopodium glaucum</i> L.	5.92	5.67	Tap	Sand between dunes
<i>Chloris virgata</i> Swartz.	20.00	27.78	Fasciculate	Fluvo-aquic soils in lowland
<i>Chloris virgata</i> Swartz.	26.67	14.67	Fasciculate	Light brown calcic soils
<i>Cirsium segetum</i> (Willd.) M B.	10.00	8.17	Creeping	Alluvial soils
<i>Cistanche salsa</i> (C. A. Mey) G. Beck.	38.73	19.91	Fibrous	Saline-alkali soil in lake basin of desert steppe
<i>Cleistogenes polyphylla</i> Keng.	7.30	4.40	Fasciculate	Stony Kastanozems in typical steppe

<i>Cleistogenes polyphylla</i> Keng.	12.00	4.50	Fasciculate	Aeolian sand in hills
<i>Cleistogenes songorica</i> (Roshev.) Ohwi.	23.11	9.78	Fasciculate	Light brown calcic soils in desert steppe
<i>Cleistogenes squarrosa</i> (Trin.) Keng.	10.13	7.25	Fasciculate	Sandy Kastanozems in typical steppe
<i>Clematis aethusifolia</i> Turcz.	38.33	11.11	Tap	Sandy light Kastanozems
<i>Clematis canescens</i> (Turcz.) W. T. Wanget M.C. Chang.	49.44	20.00	Tap	Fixed sand
<i>Clematis hexapetala</i> Pall.	43.13	20.00	Tap	Dark meadow soil in valley
<i>Cnidium dahuricum</i> (Jacq.) Turcz. ex Fisch. et Mey.	5.58	2.00	Tap	Light salined meadow soil
<i>Codonopsis pilosula</i> (Franch.) Nannf.	18.57	10.86	Tap	Shrub in forest edge of hills
<i>Convolvulus ammannii</i> Desr.	12.52	3.52	Tap	Sandy light Kastanozems
<i>Convolvulus ammannii</i> Desr.	18.58	2.71	Tap	Saline soil in meadow
<i>Convolvulus ammannii</i> Desr.	36.57	6.57	Tap	Light brown calcic soils in hills
<i>Convolvulus ammannii</i> Desr.	55.56	10.00	Tap	Brown calcic soils
<i>Convolvulus arvensis</i> L.	9.25	8.50	Creeping	Light Kastanozems
<i>Corispermum puberulum</i> Iljin	46.64	14.73	Tap	Sand in steppe
<i>Corispermum mongolicum</i> Iljin.	21.20	10.40	Tap	Sandy Kastanozems in hills
<i>Corsipermum declinatum</i> var. <i>tylocarp</i> Um (Hance) Tsien et C.G. Ma.	24.50	11.00	Tap	Semi-fixed sand
<i>Corsipermum declinatum</i> var. <i>tylocarp</i> Um (Hance) Tsien et C. G. Ma.	45.00	13.13	Tap	Light brown calcic soils
<i>Crepis crocea</i> (Lam.) Babcock.	51.00	28.50	Creeping	Skeleton chernozems
<i>Crypsis aculeata</i> (L.) Art.	10.13	9.47	Fasciculate	SalinizedSalinized meadow or humid saline in riverside of desert steppe
<i>Cymbaria dahurica</i> L.	10.00	29.00	Tap	Salinized Kastanozems
<i>Cymbaria dahurica</i> L.	21.33	24.67	Tap	Light Kastanozems
<i>Cynanchum chinense</i> R. Br.	61.00	31.90	Creeping	Salinized sand
<i>Cynanchum komarovii</i> Al. Iljinski.	29.20	9.60	Fibrous	Sand(two years old)
<i>Cynanchum thesioides</i> (Frey) K. Schum.	70.00	120.00	Creeping	Semi-fixed sand
<i>Cynomorium songaricum</i> Rupr.	31.14	14.86	Fibrous	Lowland between dunes in desert
<i>Datura metel</i> L.	16.40	13.00	Tap	Kastanozems
<i>Delphinium grandiflorum</i> L.	4.00	3.78	Tap	Dark Kastanozems in hills
<i>Dendranthema zawadskii</i> (Herb.) Tzvel.	15.60	15.00	Creeping	Skeleton dark Kastanozems
<i>Deyeuxia langsдорffii</i> (Link) Kunth.	31.25	21.25	Rhizome	Dark Kastanozems
<i>Digitalis ischaemum</i> (Schreb.) Schreb.	13.27	11.45	Fasciculate	Humid areas and sandy
<i>Dianthus chinensis</i> L.var. <i>subulifolius</i> (kitag) Y. c.Ma.	34.33	6.67	Tap	Skeletol soils in hills
<i>Dianthus chinensis</i> L.	25.33	2.67	Tap	Skeletol soils in hills
<i>Dictamnus dasycarpus</i> Turcz.	19.50	10.50	Tap	Chernozems
<i>Dontostemon crassifolius</i> (Bunge) Maxim.	28.24	44.12	Creeping	Light brown calcic soils in overlying sand
<i>Dontostemon eglandulosus</i>	5.80	1.80	Tap	Light Kastanozems in hills

(D. C.) Ledeb.				
<i>Dontostemon integrifolius</i> (L.) Ledeb.	14.00	20.67	Creeping	Light Kastanozems
<i>Dracocephalum heterophyllum</i> Benth.	51.50	7.50	Tap	Light Kastanozems in ground of hills
<i>Dracocephalum moldavica</i> L.	29.63	12.75	Tap	Gravel and sandy brown calcic soils in slope
<i>Dracocephalum moldavica</i> L.	96.67	25.56	Tap	Fixed sand
<i>Echinochloa crusgalli</i> (L.) Beauv.	17.50	10.50	Fasciculate	Humid areas
<i>Echinops gmelini</i> Turcz.	17.67	4.00	Tap	Sandy Kastanozems in high plains
<i>Echinops gmelini</i> Turcz.	19.00	2.67	Tap	Wet saline soil
<i>Eleocharis intersita</i> Zinserl.	9.60	7.60	Rhizome	Wetlands in riverside
<i>Elymus dahuricus</i> Turcz.	53.33	33.33	Fasciculate	Meadow or mountain meadow steppe
<i>Elymus excelsus</i> Turcz.	10.09	4.36	Fasciculate	Mountain meadow or meadow steppe
<i>Elymus purpuraristatus</i> C. P. Wang et H. L. Yang.	7.75	5.00	Rhizome	Chernozems
<i>Elymus sibiricus</i> L.	8.67	4.25	Fasciculate	Meadow or meadow steppe
<i>Enneapogon borealis</i> (Griseb.) Honda.	6.22	3.33	Fasciculate	Desert and Desert steppe
<i>Ephedra przewalskii</i> Stapf.	125.77	73.85	Creeping	Sand
<i>Ephedra sinica</i> Stapf.	53.75	225.00	Creeping	Sandy soil in fixed sand
<i>Equisetum fluviatile</i> L.	32.57	7.71	Rhizome	Swampy or swampy grassland in forest steppe
<i>Equisetum pratense</i> Ehrh.	9.80	12.00	Rhizome	Sandy meadow soil in wetland
<i>Equisetum sylvaticum</i> L.	10.63	7.25	Rhizome	Low-lying land in riverside
<i>Eragrostis minor</i> Host.	24.67	26.67	Fasciculate	Sandy brown calcic soils in slope of hills
<i>Eragrostis pilosa</i> (L.) Beauv.	4.11	1.67	Fasciculate	Meadow
<i>Eragrostis pilosa</i> (L.) Beauv. var. <i>imbenbis</i> Franch.	19.33	20.00	Fasciculate	Semi-fixed sand
<i>Erodium stephanianum</i> Willd.	142.50	12.50	Tap	Low wetland in riverside
<i>Euphorbia esula</i> L.	17.20	1.90	Creeping	Brown earth types of sandy soil
<i>Euphorbia esula</i> L.	36.00	34.29	Creeping	Fixed sand
<i>Euphorbia esula</i> L.	61.50	93.00	Creeping	Semi-fixed sand
<i>Euphorbia esula</i> L.	73.60	16.40	Creeping	Kastanozems
<i>Euphorbia fischeriana</i> Steud.	30.50	25.00	Tap	Dark Kastanozems
<i>Euphorbia humifusa</i> Willd. ex Schlecht.	5.00	3.75	Tap	Aeolian sand in slope
<i>Euphorbia humifusa</i> Willd. ex Schlecht.	16.25	5.63	Tap	Aeolian soils in flat ground
<i>Ferula bungeana</i> Kitag.	137.42	13.55	Tap	Aeolian soil
<i>Festuca ovina</i> L.	7.00	5.09	Fasciculate	Dark Kastanozems
<i>Festuca rubra</i> L.	7.63	7.00	Rhizome	Dark Kastanozems in hills
<i>Filifolium sibiricum</i> (L.) Kitam.	24.75	18.50	Tap	Litho soils in hills
<i>Filifolium sibiricum</i> (L.) Kitam.	43.00	19.00	Tap	Kastanozems in hills
<i>Galium verum</i> L.	61.71	16.00	Tap	Loamy and sandy typical Kastanozems
<i>Garex pediformis</i> C. A. .Mey.	12.00	5.43	Rhizome	Dark Kastanozems of sunny slope in hills (Meadow steppe)

<i>Gentiana dahurica</i> Fisch.	51.00	15.00	Tap	Light Kastanozems in high plains
<i>Gentiana macrophylla</i> Pall.	16.57	6.57	Tap	Meadow soil in riverside
<i>Geranium sibiricum</i> L.	22.78	21.67	Fibrous	Meadow soil in riverside
<i>Glaux maritime</i> L.	20.20	8.40	Fibrous	Bog soils in fluvial sand of riverside
<i>Glycine soja</i> Sieb. et Zucc.	12.29	10.00	Tap	Flood plain
<i>Glycyrrhiza uralensis</i> Fisch.	97.50	223.50	Creeping	Typical steppe
<i>Goldbachia iaevigata</i> (M. Bieb.) D. C.	50.00	13.18	Tap	Light Kastanozems
<i>Gueldenstaedtia gansuensis</i> H. P. Tsui.	35.33	12.00	Tap	Semi-fixed dune
<i>Gueldenstaedtia stenophylla</i> Bunge	37.00	3.75	Tap	Sandy steppe
<i>Gymnadenia conopsea</i> (L.) R. Br.	15.20	11.20	Tuber	Dark Kastanozems in low wetland
<i>Gypsophila licentiana</i> -Mazz.	25.14	11.43	Tap	Litho soils in hills
<i>Gysophila desertorum</i> (BLlrIge) Fenzl.	92.73	6.36	Tap	Sandy light Kastanozems
<i>Halenia comiculata</i> (L.) Comaz.	5.00	2.00	Tap	Meadow soil
<i>Halerpestes ruthenica</i> (Jacq.) Ovez.	6.62	6.92	Fibrous	Low wetland in steppe and desert steppe
<i>Haloxylon a mmodendron</i> (C.A.Mey.) Bunge.	97.14	174.29	Tap	Sand (three years old)
<i>Haloxylon a mmodendron</i> (C. A. Mey.) Bunge.	170.00	46.25	Tap	Dune (ten years old)
<i>Haloxylon a mmodendron</i> (C. A. Mey.) Bunge	563.64	181.82	Tap	Salinized fixed dune (six years old)
<i>Haloxylon persicum</i> Bge. ex Boiss. et Buhse.	87.69	40.00	Tap	Sandy desert in grassland
<i>Haplophyllum dauricum</i> (L.) G. Don.	12.57	4.86	Tap	Kastanozems type of litho soils
<i>Haplophyllum dauricum</i> (L.) G. Don.	25.43	18.29	Tap	Kastanozems
<i>Hedysarum brachypterum</i> Bunge	66.55	17.45	Tap	Typical steppe and desert steppe sandy brown calcic soils
<i>Hedysarum fruticosum</i> Pall.	65.71	110.48	Creeping	Fixed dune
<i>Hedysarum fruticosum</i> Pall. Lignosum (Trautv.) Kitag.	71.43	257.14	Creeping	Semi-mobile dune in Kubuqi desert (three years old)
<i>Hedysarum fruticosum</i> Pall. Lignosum (Trautv.) Kitag.	102.63	121.58	Creeping	Semi-fixed sand (six years old)
<i>Hedysarum fruticosum</i> Pall. var. lignosum (Trautv.) Kitag.	615.60	72.00	Tap	Semi-mobiles sand
<i>Hedysarum fruticosum</i> Pall. var. mongolicum Turcz. ex B. Fedtsch.	97.14	480.00	Tap	Kubuqi desert
<i>Hedysarum gmelinii</i> Ledeb.	97.14	8.57	Tap	Light Kastanozems
<i>Hedysarum gmelinii</i> Ledeb.	137.14	17.14	Tap	Typical steppe Kastanozems
<i>Hedysarum scoparium</i> Fisch.et Mey.	87.10	197.42	Tap	Kubuqi Desert
<i>Hedysarum scoparium</i> Fisch.et Mey.	164.71	200.00	Tap	Tenggeli Desert (three years old)
<i>Helianthemum songaricum</i> Schrenk.	8.88	11.25	Tap	Gravelly brown calcic soils in the foot of a mountain
<i>Helictotrichon schellianum</i> (Hack.) Kitag.	37.00	10.00	Fasciculate	Mountain meadow steppe and mountain steppe

<i>Hemarthria altissima</i> (Poir.) Stapf et C. E. Hubb.	11.50	5.25	Rhizome	Sandy meadow soil
<i>Hemerocallis minor</i> Mill	18.00	12.43	Fibrous	Dark Kastanozems
<i>Herminium monorchis</i> (L.) R. Br.	3.00	1.75	Tuber	Meadow soil in low wetland
<i>Herminium monorchis</i> (L.) R. Br.	4.17	3.00	Tuber	Meadow soil in reiverside
<i>Heteropappus altaicus</i> (Willd.) Novopokr.	8.10	8.20	Tap	Eutrie fluvisio in dry riverbed of steppe desert
<i>Heteropappus altaicus</i> (Willd.) Novopokr.	8.64	2.91	Tap	Light Kastanozems in desert steppe
<i>Heteropappus altaicus</i> (Willd.) Novopokr.	8.70	18.60	Tap	Eroded slope by wind
<i>Heteropappus meyerendorffii</i> (Reg. et Maack) Komar. et Klob. –Alis.	12.00	17.33	Tap	Aeolian soil in fixed sand
<i>Hierochloe glabra</i> Trin.	3.63	13.38	Rhizome	Meadow Kastanozems
<i>Hippolytia trifida</i> (Turcz.) Poljak.	18.00	13.40	Tap	Light brown calcic soils between dunes
<i>Hippolytia trifida</i> (Turcz.) Poljak.	31.82	21.36	Tap	Light Kastanozems in sandy high plains
<i>Hippolytia trifida</i> (Turcz.) Poljak.	35.91	20.00	Tap	Sandy light brown calcic soils
<i>Hippolytia trifida</i> (Turcz.) Poljak.	70.63	35.00	Tap	Light Kastanozems in desert steppe
<i>Hordeum brevisubulatum</i> (Trin.) Link.	33.13	30.00	Rhizome	Salinized meadow in valley
<i>Hypocoum erectum</i> L.	40.63	19.38	Tap	Fixed sand
<i>Hylotelephium purpureum</i> (L.) Holub.	9.27	7.91	Tuber	Dark Kastanozems
<i>Incarvillea sinensis</i> Lam.	8.22	5.33	Tap	Lowland of fixed sand
<i>Inula britanica</i> L.	5.00	5.00	Tap	Low wetland between dunes
<i>Inula britanica</i> L.	11.55	8.36	Tap	Flood plain
<i>Inula britanica</i> L.var. <i>Japonica</i> (Thunb.) Franch.	10.67	16.67	Tap	Fluvo-aquic soils between dunes
<i>Inula lineariifolia</i> Turcz.	22.64	11.73	Tap	Meadow
<i>Inula salsoloides</i> (Turcz.) Ostenf.	9.88	17.25	Creeping	Aeolian soil
<i>Inula salsoloides</i> (Turcz.) Ostenf.	120.88	14.12	Tap	Fixed sand
<i>Iris bungei</i> Maxim.	111.43	83.57	Fasciculate	Light Kastanozems
<i>Iris dichotoma</i> Pall.	12.40	6.40	Fibrous	Sandy soil in riverside of seasonal river
<i>Iris dichotoma</i> Pall.	18.25	7.00	Fibrous	Dark Kastanozems
<i>Iris lactea</i> Pall. var. <i>chinensis</i> (Fisch.) Koidz.	80.00	35.56	Fasciculate	Meadow soil
<i>Iris tenuifolia</i> Pall.	15.78	7.56	Fasciculate	Desert steppe
<i>Iris tigridia</i> Bunge.	8.00	5.67	Fasciculate	Upland meadow
<i>Ixeridium chinense</i> (Thunb.) Tzvel.	6.14	10.43	Creeping	Humid sandy soil
<i>Ixeridium graminifolium</i> (Ledeb.) Tzvel.	45.00	4.55	Tap	Fixed sand
<i>Juncellus serotinus</i> (Rottb.) C. B. Clarke.	20.00	28.75	Rhizome	Bog soils
<i>Juncus bufonius</i> L.	4.38	3.25	Rhizome	Bog soils in riverside
<i>Juncus effusus</i> Linn.	7.29	2.57	Rhizome	Bog soils of lowland between

				dunes
<i>Juncus gracilicaulis</i> A. Camus.	32.50	18.75	Rhizome	Swampy Meadow between dunes
<i>Kalidium cuspidatum</i> (Ung.-Sternb.) Grub.	86.25	53.75	Tap	Salinized Sandy soil between dunes
<i>Kalidium foliatum</i> (Pall.) Moq.	17.25	9.25	Tap	Salinized meadow soil in steppe and desert
<i>Kalidium foliatum</i> (Pall.) Moq.	100.00	71.11	Tap	Saline soil of lowland
<i>Kalidium gracile</i> Fenzl.	17.40	18.00	Tap	Sandy soil between dunes
<i>Kalidium gracile</i> Fenzl.	124.00	34.00	Tap	Saline soil
<i>Kochia prostrata</i> (L.) Schrad.	147.50	20.00	Tap	Meadow steppe
<i>Kochia scoparia</i> (L.) Schrad. var. <i>Sieversiana</i> (Pall.) Ulbr.ex Aschers.et Graebn.	42.75	15.00	Tap	Kastanozems in base of hills
<i>Kochia scoparia</i> (L.) Schrad. var. <i>Sieversiana</i> (Pall.) Ulbr.ex Aschers.et Graebn.	54.38	10.00	Tap	Salinized sand
<i>Koeleria cristata</i> (L.) Pers.	25.45	23.27	Fasciculate	Light Kastanozems in gentle slope of hills
<i>Kummerowia striata</i> (Thunb.) Schindl.	6.92	4.46	Tap	Fixed sand
<i>Lagochilus ilicifolius</i> Bunge.	21.43	25.00	Tap	Sandy light Kastanozems
<i>Lathyrus quinquenervius</i> (Miq.) Litv.et Kom.	7.64	6.82	Creeping	Meadow soil in riverside
<i>Lathyrus quinquenervius</i> (Miq.) Litv.et Kom.	16.20	38.40	Creeping	Meadow soil in terrace of riverside
<i>Latuca tataricum</i> (L.) D. C.	25.56	32.22	Creeping	Fluvo-aquic soils in lowland between dunes
<i>Leontopodium leontopodioides</i> (Willd.) Beauv.	7.27	7.27	Fibrous	Meadow bog soils
<i>Leontopodium leontopodioides</i> (Willd.) Beauv.	10.33	7.00	Fibrous	Sandy meadow soil
<i>Leonurus sibiricus</i> L.	28.50	38.50	Tap	Sandy Kastanozems in hills
<i>Lepidium apetalum</i> Willd.	20.00	11.09	Tap	Light Kastanozems in hills
<i>Lepidium cartilagineum</i> (J. May.) Thell.	11.20	8.60	Creeping	Saline soil in steppe
<i>Lespedeza bicolor</i> Turcz.	102.56	35.90	Tap	Light Kastanozems
<i>Lespedeza davurica</i> (Laxm.) Schindl.	67.64	28.36	Tap	Slope in hills of typical steppe
<i>Lespedeza juncea</i> (Linn. f.) Pers.	14.50	4.25	Tap	Dark Kastanozems in meadow steppe
<i>Lespedeza potaninii</i> Vass.	7.86	4.29	Tap	Aeolian sand
<i>Lespedeza potaninii</i> Vass.	116.84	56.84	Tap	Semi-fixed sand
<i>Leymus chinensis</i> (Trin.) Tzvel.	72.50	41.67	Rhizome	Meadow steppe
<i>Leymus secalinus</i> (Georgi) Tzvel.	21.00	13.50	Rhizome	Alluvial soils
<i>Leymus secalinus</i> (Georgi) Tzvel.	26.11	18.33	Rhizome	Aeolian soil in dry riverbed terraces
<i>Leymus secalinus</i> (Georgi) Tzvel.	43.33	37.33	Rhizome	Loamy and sandy Kastanozems
<i>Ligularia mongolica</i> (Turcz.) D C.	21.82	20.00	Fibrous	Dark Kastanozems

<i>Ligularia sibirica</i> (L.) Cass.	20.71	20.00	Rhizome	Meadow soil
<i>Lilium pumilum</i> D. C.	20.20	8.00	Tuber	Gravelly dark Kastanozems in slope
<i>Limonium aureum</i> (L.) Hill.	80.63	21.25	Tap	Salinized meadow soil
<i>Linaria vulgaris</i> mill. subsp. <i>sinensis</i> (Bebeaux) Hong.	4.80	1.50	Tap	Chernozems
<i>Linaria vulgaris</i> mill. subsp. <i>sinensis</i> (Bebeaux) Hong.	6.40	1.40	Tap	Sandy Kastanozems in flood land
<i>Linum perenne</i> L.	9.91	2.00	Tap	Stony chestnut soils in hills
<i>Lolium perenne</i> L.	12.22	15.56	Fasciculate	Artificial grassland
<i>Lomatogonium rotatum</i> (L.) Fries ex Num.	2.91	1.64	Tap	Meadow soil
<i>Lysimachia barystachys</i> Brnqe.	33.13	22.50	Tap	Dark Kastanozems between dunes
<i>Lysimachia thyrsiflora</i> L.	20.00	29.50	Rhizome	Bog soils
<i>Malva uerticillata</i> L.	42.22	12.22	Tap	Skeletal soils
<i>Medicago falcata</i> L.	36.50	48.00	Tap	Aeolian soil in Drains
<i>Medicago falcata</i> L.	69.17	66.67	Tap	Riverside
<i>Medicago lupulina</i> L.	2.00	2.00	Tap	Meadow soil in riverside
<i>Medicago lupulina</i> L.	9.00	2.30	Tap	Dark Kastanozems in hill
<i>Medicago sativa</i> L.	467.00	35.67	Tap	Bog soils in meadow
<i>Medicago varia</i> Martyn.	7.50	4.88	Tap	Dark Kastanozems in meadow steppe
<i>Melilotoides ruthenica</i> (L.) Sojak.	30.00	19.88	Tap	Aeolian sand in hills
<i>Melilotoides ruthenica</i> (L.) Sojak.	47.00	13.50	Tap	Light Kastanozems
<i>Melilotoides ruthenica</i> (L.) Sojak.	83.03	9.66	Tap	Light Kastanozems
<i>Melilotoides ruthenica</i> (L.) Sojak.	96.00	23.00	Tap	Kastanozems in typical steppe
<i>Melilotoides ruthenica</i> (L.) Sojak.	105.00	24.75	Tap	Sandy Kastanozems
<i>Melilotus dentata</i> (Waldst. et Kit.) Pers.	12.00	15.43	Tap	Meadow soil in steppe
<i>Melilotus dentata</i> (Waldst. et Kit.) Pers.	36.67	50.00	Tap	Floodland in meadow soil
<i>Melilotus officinalis</i> (Linn.) Pall.	51.11	48.89	Tap	Fluvo-aquic soils in lowland between dunes of meadow
<i>Mentha haplocalyx</i> Briq.	1.79	1.47	Tap	Sandy Kastanozems
<i>Mentha haplocalyx</i> Briq.	16.86	9.71	Tap	Low wetland near river
<i>Messerschmidia sibirica</i> L. var. <i>angustior</i> (D. C.) W. T. Wang.	75.00	18.89	Creeping	Meadow soil in low wetland
<i>Myricaria platyphylla</i> Maxim	202.78	330.56	Tap	Mobile dune in desert steppe and steppe desert
<i>Neopallasia pectinata</i> (Pall.) Poljak.	5.68	3.64	Tap	Litho soils in hills
<i>Neopallasia pectinata</i> (Pall.) Poljak.	10.93	1.71	Tap	Light Kastanozems in slope
<i>Nitraria tangutorum</i> Bobr.	186.43	171.43	Tap	Aeolian soils
<i>Nitraria sibirica</i> Pall.	37.94	79.41	Tap	Aeolian soils in sub-fixed sand
<i>Olgaea leucophylla</i> (Turcz.) Iljin.	40.00	12.67	Tap	Fixed sand
<i>Olgaea lomonossowii</i> (Trautv.) Iljin.	68.62	2.19	Tap	Brown calcic soils in overlying sand

<i>Orobanche coerulescens</i> Steph.	37.50	24.75	Fibrous	Dune in steppe
<i>Orobanche pycnostachya</i> Hance	7.20	3.00	Fibrous	Dune in steppe
<i>Orostachys fimbriatus</i> (Turcz.) Berger	4.11	4.67	Tap	Dark Kastanozems in hills
<i>Orostachys malacophyllus</i> (Pall.) Fisch.	8.22	9.56	Tap	Dark Kastanozems between dunes
<i>Oxytropis aciphylla</i> Ledeb.	105.75	16.50	Tap	Gravelly Kastanozems in desert steppe
<i>Oxytropis bicolor</i> Bunge	20.00	12.67	Tap	Gravelly sand in arid high plains
<i>Oxytropis bicolor</i> Bunge	126.36	14.55	Tap	Sandy steppe sand
<i>Oxytropis filiformis</i> D. C.	78.75	15.00	Tap	Gravelly sand in hills of forest or typical steppe
<i>Oxytropis glabra</i> (Lam.) D. C.	68.18	34.09	Tap	Low wetland in desert steppe
<i>Oxytropis grandiflora</i> (Pall.) D. C.	51.88	43.13	Tap	Meadow steppe in hills
<i>Oxytropis leptophylla</i> (Pall.) D. C.	62.73	17.73	Tap	Gravelly sand in hills of forest or typical steppe
<i>Oxytropis myriophylla</i> (Pall.) D. C.	36.88	9.38	Tap	Sandy
<i>Oxytropis myriophylla</i> (Pall.) D. C.	133.85	51.92	Tap	Dark Kastanozems in meadow steppe
<i>Oxytropis racemosa</i> Turcz.	140.00	39.12	Tap	Semi-fixed sand
<i>Oxytropis racemosa</i> Turcz.	160.00	26.67	Tap	Mobile dune
<i>Oxytropis squammulosa</i> D. C.	165.52	55.86	Tap	Brown calcic soils in desert steppe
<i>Oxytropis subfalcata</i> Hance	19.33	8.33	Tap	Sandy Kastanozems in high plains
<i>Paeonia lachfiona</i> Pall.	30.86	11.14	Tap	Aeolian sandy soils
<i>Papaver nudicaule</i> L.	51.60	10.20	Tap	Low wetland in riverside
<i>Parnassia palustris</i> L.	2.00	2.00	Fibrous	Bog soils in riverside
<i>Patrinia rupestris</i> (Pall.) Juss. Subsp. <i>scabra</i> (Bunge) H. J. Wang	18.33	4.67	Tap	Aeolian sandy soils
<i>Pcnzeria alaschanica</i> Kupr.	20.25	2.81	Tap	Sandy brown calcic soils in dry riverbed
<i>Pcnzeria alaschanica</i> Kupr.	96.00	33.00	Tap	Fixed sand
<i>Pedicularis striata</i> Pall.	31.50	22.00	Tap	Dark Kastanozems in hills
<i>Pedicularis venusta</i> Schangan ex Bunge	15.00	15.71	Creeping	Dark meadow soil in riverside
<i>Pedicularis verticillata</i> L.	5.63	2.13	Tap	Meadow soil in riverside
<i>Peganum multisectum</i> (Maxim.) Bobr.	60.00	131.05	Creeping	Semi-fixed sand
<i>Peganum nigellastrum</i> Bunge	157.14	38.57	Creeping	Sandy brown calcic soils
<i>Pennisetum centrasiaticum</i> Tzvel.	21.38	15.38	Rhizome	Sandy meadow in fixed sand
<i>Phalaris arundinacea</i> L.	8.33	7.67	Rhizome	Swampy meadow in hills
<i>Phlomis tuberosa</i> L.	26.80	4.40	Tuber	Skeletal soils in hills
<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	23.00	32.00	Rhizome	Wetlands
<i>Plantago asiatica</i> L.	19.64	20.00	Fibrous	Meadow soil
<i>Plantago depressa</i> Willd.	7.40	1.80	Tap	Meadow soil
<i>Plantago lessingii</i> Fisch. et Mey.	7.38	7.50	Tap	Brown calcic soils in hills
<i>Plantago lessingii</i> Fisch. et Mey.	25.50	2.25	Tap	Light Kastanozems

<i>Plantago minuta</i> Pall.	48.13	12.50	Tap	Halophytic meadow in desert steppe
<i>Platycodon grandiflorus</i> (Jacq.) A. D C.	34.44	21.11	Tap	Meadow dark Kastanozems between dunes
<i>Poa botryoides</i> (Griseb.) Roshev	39.17	18.33	Fasciculate	Lowland in Between dunes
<i>Poa nemoralis</i> L.	5.75	8.25	Rhizome	Woodland
<i>Poa pratensis</i> L.	9.75	12.25	Rhizome	Meadow steppe
<i>Poa sphondylodes</i> Trin,ex Bunge	23.40	16.20	Fasciculate	Dark Kastanozems in meadow steppe
<i>Poa sphondylodes</i> Trin,ex Bunge	44.80	30.40	Fasciculate	Kastanozems
<i>Poa subfastigiata</i> Trin.	10.80	13.20	Rhizome	Meadow in valley
<i>Polygala tenuifolia</i> I, Willd.	7.18	1.09	Tap	Aeolian soils
<i>Polygala tenuifolia</i> I, Willd.	11.50	1.80	Tap	Desert
<i>Polygala tenuifolia</i> I, Willd.	18.00	10.00	Tap	Skeletol soils in hills
<i>Polygonatum sibiricum</i> Delar.ex Recdoute	30.00	43.13	Rhizome	Dark Kastanozems
<i>Polygonum alopecuroides</i> Tuecz. ex Besser	10.00	7.67	Fibrous	Meadow
<i>Polygonum aviculare</i> L.	9.54	2.31	Tap	Meadow soil in low wetland of riverside
<i>Polygonum divaricatum</i> L.	20.50	5.50	Tap	Aeolian sand
<i>Polygonum sibiricum</i> Laxm.	32.25	48.75	Rhizome	Meadow soil in riverside Salinized
<i>Portulaca oleracea</i> L.	6.70	1.20	Tap	Kastanozems
<i>Potamogeton panormitanus</i> Biv.	14.25	5.25	Rhizome	Swampy land
<i>Potania mongolica</i> Marim.	42.27	128.18	Tap	Grey brown desert soil
<i>Potentilla verticillaris</i> ex Willd .	8.60	15.60	Tap	Sandy black soils in slope
<i>Potentilla verticillaris</i> ex Willd .	18.30	21.30	Tap	Kastanozems litho soils
<i>Potentilla betonicifolia</i> Poir.	21.25	19.25	Tap	Litho soils in hills
<i>Potentilla acaulis</i> L.	11.56	6.44	Creeping	Chernozems
<i>Potentilla acaulis</i> L.	24.44	12.00	Creeping	Brown earth type of Kastanozems
<i>Potentilla anserina</i> L.	15.64	7.82	Tuber	Low wetland in riverside
<i>Potentilla anserina</i> L.	19.88	15.00	Tuber	Bog soils in meadow
<i>Potentilla anserina</i> L.	22.00	26.00	Tuber	Aeolian sand indry riverbed
<i>Potentilla bifurca</i> L.	21.75	6.00	Creeping	Loamy and sandy typical Kastanozems in vally
<i>Potentilla bifurca</i> L. var. major Ledeb.	164.29	87.14	Creeping	Light Kastanozems
<i>Potentilla flagellaris</i> Willd.ex Schlecht	10.64	6.27	Fibrous	Brown soil between dunes in hills
<i>Potentilla parvifolia</i> Fisch.ap. Lehm.	19.33	15.11	Tap	Litho soils in hills
<i>Potentilla tanacetifolia</i> Willd. ex Schlecht	32.67	13.00	Tap	Light Kastanozems in slope
<i>Potentilla tanacetifolia</i> Willd. ex Schlecht	40.80	6.40	Tap	Light saline soil in low wetland
<i>Potentilla strigosa</i> Pall. ex Pursh	15.40	17.60	Tap	Litho soils in hills
<i>Psammochloa villosa</i> (Trin.) Bor	120.00	36.36	Rhizome	Mobile dune

<i>Ptilotrichum conescens</i> (DC.) C. A. Mev.	36.86	2.57	Tap	Saline soil in meadow
<i>Puccinellia distans</i> (Jacq.) Parl.	3.27	2.45	Fasciculate	Salinized meadow or water area in riverside
<i>Puccinellia hauptiana</i> (Trin.) Krecz	11.08	14.46	Rhizome	Swampy meadow in riverside sand
<i>Puccinellia tenuiflora</i> (Turcz.) Scribn. et Merr.	14.40	6.60	Fasciculate	Fluvo-aquic soils in low wetland saline
<i>Puccinellia tenuiflora</i> (Turcz.) Scribn. et Merr.	31.36	21.82	Fasciculate	Fluvo-aquic soils in lowland between dunes
<i>Puccinellia tenuiflora</i> (Turcz.) Scribn. et Merr.	36.67	23.89	Fasciculate	Salinized sandy
<i>Pugionium cornutum</i> (L.) Gaertn.	127.78	36.67	Tap	Dune
<i>Pulsatilla turczaninowii</i> Kryl. et Serg.	12.86	12.57	Tap	Typical light Kastanozems in hills
<i>Pycreus globosus</i> (All.) Reichb.	5.65	3.53	Rhizome	Meadow soil between dunes
<i>Reaumuria songarica</i> (Pall.) Maxim.	14.13	6.00	Tap	Brown calcic soils
<i>Rheum undulatum</i> L.	15.78	4.89	Tap	Stony slope in hills
<i>Rheum uninerve</i> Maxim.	17.25	8.25	Tuber	Sandy and gray desert soils in high plains
<i>Rorippa islandica</i> (Oed.) Borb	51.50	7.50	Tap	Fluvo-quic soil in low wetland
<i>Rubia cordifolia</i> L.	61.00	22.00	Tap	Between dunes Low wetland meadow soil
<i>Rumex acetosella</i> L.	190.00	32.00	Tap	Sand in meadow steppe
<i>Sagittaria trifolia</i> L.	9.86	16.29	Tuber	Bog soils in riverside
<i>Salicornia europaea</i> L.	9.00	4.00	Tap	Lowland of Fixed dune between dunes
<i>Salix gordejvii</i> Y. L. Chang et Skv.	142.86	985.71	Tap	Semi-fixed dune in steppe
<i>Salix gordejvii</i> Y. L. Chang et Skv.	350.0	2000.0	Tap	Semi-fixed dune in steppe
<i>Salix psammophila</i> C. Wang et Ch. Y. Yang	24.83	7.00	Tap	Fixed sand
<i>Salsola collina</i> Pall.	19.43	10.00	Tap	Light Kastanozems in hills
<i>Salsola laricifolia</i> Turcz. ex Litv.	83.75	76.25	Tap	Light brown calcic soils in hills
<i>Salsola passerina</i> Bunge	29.11	14.89	Tap	Litho soils in hills
<i>Salsola passerina</i> Bunge	37.50	17.50	Tap	Brown calcic soils in ground between dunes
<i>Salsola passerina</i> Bunge	80.00	80.00	Tap	Saline soil
<i>Sanguisorba officinalis</i> L.	13.25	11.25	Tap	Meadow soil in riverside
<i>Saposhnikovia divaricata</i> (Turcz.) Schischk.	130.00	24.00	Tap	Typical Kastanozems in loamy and sandy ground
<i>Sarcozygium xanthoxylon</i> Bunge	37.86	41.43	Tap	Desert soil
<i>Saussurea amara</i> (L.) D. C.	65.00	63.75	Tap	Light Kastanozems
<i>Saussurea amara</i> (L.) D. C.	105.00	16.20	Tap	Typical Kastanozems
<i>Saussurea japonica</i> (Thunb.) D. C.	40.67	16.67	Tap	Light Kastanozems
<i>Saussurea salsa</i> (Pall.) Spreng.	10.36	7.27	Tap	Meadow soil in Salinized sand
<i>Scabiosa comosa</i> Fisch. ex	20.63	8.25	Tap	Fixeds and

Roem.et Schult.				
<i>Scabiosa comosa</i> fisch. ex Roem.et Schult.	24.89	4.44	Tap	Aeolian soils
<i>Scabiosa comosa</i> fisch. ex Roem.et Schult.	29.57	19.71	Tap	Sand at the base of fixed dune
<i>Scirpus planiculmis</i> Fr. Schmidt	9.00	17.50	Tuber	Bog soils in riverside
<i>Scirpus tabernaemontani</i> Gmel.	84.55	70.91	Rhizome	Bog soils
<i>Scorzonera albicaulis</i> Bunge	60.00	38.75	Tap	Dark Kastanozems
<i>Scorzonera muriculata</i> Chang	17.00	14.00	Creeping	Light brown calcic soils in overlying sand
<i>Scorzonera muriculata</i> Chang	18.80	2.20	Creeping	Kastanozems
<i>Scutellaria baicalensis</i> Georgi	15.14	18.86	Creeping	Typical Kastanozems in hills
<i>Scutellaria scordifolia</i> Fisch. ex Schrank	2.86	4.43	Creeping	Kastanozems
<i>Scutellaria viscidula</i> Bunge	14.00	19.50	Creeping	Kastanozems between duned
<i>Sedum aizoon</i> L.	14.89	6.22	Tap	Podzolic soils in hills
<i>Sedum aizoon</i> L.f. <i>angusifolium</i> Franch.	8.63	2.50	Tap	Kastanozems in high plains
<i>Senecio argunensis</i> Turcz.	21.67	15.00	Fibrous	Fixed dune
<i>Serratula polycephala</i> Iljin	98.00	32.00	Tap	Steppe
<i>Setaria glauca</i> (L.) Beauv.	14.86	11.43	Fasciculate	Dark Kastanozems
<i>Setaria viridis</i> (L.) Beauv.	11.43	15.71	Fasciculate	Dark Kastanozems
<i>Setaria viridis</i> (L.) Beauv.	30.56	23.33	Fasciculate	Fixed sand
<i>Silene jensisensis</i> Willd.	36.43	20.57	Tap	Skeletol soils in hills
<i>Silene repens</i> Patr.	113.33	33.33	Tap	Base of mobile dune
<i>Solanum septemlobum</i> Bunge	120.00	66.00	Tap	Sub-fixed sand
<i>Sonchus arvensis</i> L.	37.08	13.33	Creeping	Salinized and sandy lowland
<i>Sophora alopecuroides</i> L.	21.86	33.86	Creeping	Desert and steppe desert
<i>Sophora flavescens</i> Soland	42.00	4.00	Tap	Steppe or Sandy steppe
<i>Sparganium simplex</i> Huds.	28.75	22.50	Rhizome	Bog soils
<i>Sparganium stoloniferum</i> (Graebn.) Buch.	3.13	9.38	Tuber	Bog soils
<i>Sphaerophysa salsula</i> (Pall.) D. C.	20.75	25.00	Creeping	Meadow soil in low wetland
<i>Spiraea pubescens</i> Turcz.	10.67	11.83	Tap	Podzolic soils
<i>Spiranthes sinensis</i> (Pers.) Ames	7.17	3.33	Tuber	Wetland in forest
<i>Stellaria dichotoma</i> L. var. <i>lanceolata</i> Bunge	14.50	7.25	Tap	Semi-fixed dune
<i>Stellaria dichotoma</i> L. var <i>lanceolata</i> Bunge	77.00	10.50	Tap	Sand in windward slope
<i>Stellaria discolor</i> Turcz.	5.80	1.80	Tap	Kastanozems in hills
<i>Stellaria discolor</i> Turcz.	7.00	2.60	Tap	Chernozems
<i>Stellera chomaejasme</i> L.	68.18	16.82	Tap	Salinized Kastanozems
<i>Stellera chomaejasme</i> L.	93.08	27.69	Tap	Dark Kastanozems
<i>Stemmacantha uniflora</i> (L.) D. C. Dittrich	34.91	16.09	Tap	Litho soils in hills
<i>Stipa baicalensis</i> Roshev.	113.44	55.31	Fasciculate	Dark Kastanozems
<i>Stipa breviflora</i> Griseb.	4.80	6.50	Fasciculate	Desert steppe
<i>Stipa bungeana</i> Trin.	14.29	9.39	Fasciculate	Typical steppe
<i>Stipa glareosa</i> P. Smirn.	50.00	27.78	Fasciculate	Gritty brown calcic soils in high plains
<i>Stipa grandis</i> P. Smirn.	11.25	8.88	Fasciculate	Kastanozems

<i>Stipa grandis</i> P. Smirn.	102.67	70.67	Fasciculate	Dark Kastanozems
<i>Stipa purpurea</i> Griseb.	88.50	48.00	Fasciculate	Meadow soils in alpine steppe
<i>Stipa sareptana</i> Becker var. <i>krylovii</i> (Roshev.) P. C. Kuo et Y. H. Sun	42.18	16.00	Fasciculate	Typical steppe
<i>Stipa tianschanica</i> Roshev. Var. <i>gobica</i> (Roshev.) P. C. Kuo et Y. H. Sun	101.11	42.22	Fasciculate	Sandy brown calcic soils
<i>Stipa tianschanica</i> Roshev. var. <i>klemenzi</i> (Roshev.) Norl.	30.00	12.55	Fasciculate	Sandy Kastanozems
<i>Stipa tianschanica</i> Roshev. var. <i>klemenzi</i> (Roshev.) Norl.	87.10	61.94	Fasciculate	Light Kastanozems in desert steppe and typical steppe
<i>Suaeda glauca</i> (Bunge) Bunge	12.11	8.33	Tap	Desert soil
<i>Tamarix ramosissima</i> Ledeb.	102.78	161.11	Tap	Salinized soil in desert
<i>Tamarix chinensis</i> Lour.	92.00	50.00	Tap	Sub-fixeds
<i>Taraxacum asiaticum</i> Dahlst.	98.92	11.35	Tap	Base of dune
<i>Taraxacum borealisinense</i> Kitam.	26.09	5.22	Tap	Sandy meadow soil
<i>Taraxacum borealisinense</i> Kitam.	67.17	11.09	Tap	Salinized meadow soil
<i>Taraxacum ohwianum</i> Kitam.	7.44	3.60	Tap	Low wetland
<i>Thalictrum petaloideum</i> L.	14.67	48.67	Rhizome	Light Kastanozems in desert steppe
<i>Thalictrum petaloideum</i> L.	15.50	13.75	Rhizome	Aeolian sandy soils
<i>Thalictrum petaloideum</i> L. var. <i>supradecompositum</i> (Nakai) Kitag.	21.43	19.29	Fibrous	Dark Kastanozems in hills
<i>Thalictrum simplex</i> L.	4.38	5.75	Fibrous	Dark Kastanozems
<i>Thalictrum squarrosum</i> staph. ex Willd.	15.14	16.00	Rhizome	Meadow soil
<i>Thalictrum squarrosum</i> staph. ex Willd.	78.32	99.79	Rhizome	Light Kastanozems
<i>Thermopsis lanceolata</i> R. Br.	146.67	37.78	Creeping	Dark Kastanozems
<i>Thermopsis lanceolata</i> R. Br.	248.89	62.22	Creeping	Semi-fixed sand
<i>Thymus mongolicus</i> Ronn.	11.14	6.71	Tap	Dark Kastanozems between dunes
<i>Thymus mongolicus</i> Ronn.	12.33	19.00	Tap	Semi-fixed sand
<i>Tragus racemosus</i> (L.) Ail.	14.00	13.50	Fasciculate	Sandy Kastanozems in slope of hills
<i>Tribulus terrestris</i> L.	21.40	9.60	Tap	Kastanozems in hills
<i>Trifolium lupinaster</i> L.	8.67	3.33	Tap	Swampy meadow soil in meadow steppe
<i>Triglochin palustre</i> L.	8.73	9.55	Rhizome	Meadow-riverside bog soils
<i>Tugarinovia mongolica</i> Iljin	59.21	17.37	Tap	Stony light Kastanozems
<i>Urtica cannabina</i> L.	36.00	15.00	Tap	Stony and gravelly slope in forest steppe
<i>Veratrum nigrum</i> L.	7.40	3.80	Tuber	Under the shrub in meadow
<i>Veratrum nigrum</i> L.	30.67	13.78	Tuber	Low wetland in meadow
<i>Veronica dahurica</i> Stev.	8.50	6.83	Fibrous	Chernozems in hills
<i>Veronica incana</i> L.	6.56	3.44	Fibrous	Meadow chernozems in valley
<i>Veronica linariifolia</i> Pall. ex Link	13.00	16.00	Fibrous	Skeletal soils
<i>Vicia amoena</i> Fisch. ex D. C.	17.78	10.44	Creeping	Chernozems in meadow steppe

<i>Vicia amoena</i> Fisch. var. <i>Oblongifolia</i> Regel.	47.78	23.33	Creeping	Meadow steppe and meadow
<i>Viola yedoensis</i> Makino	14.50	2.00	Tap	Kastanozems in alluvial plain
<i>Xanthium sibiricum</i> Patrín ex Widder	16.00	14.00	Tap	Meadow soil
<i>Youngia tenuicaulis</i> (Babcock et Stebbins) Czer.	19.64	7.82	Tap	Litho soils in hills