

THE COLD-WINTER SEMI-DESERT AND DESERT REGION

General Description

Semi-deserts and Deserts with cold winters occupy vast areas in the interior of the continents in the temperate region. On the plains of Central Asia and the plateaux of Tibet and Mongolia the prevailing cold dry winds of winter blow outward in wide circles round the region of high pressure in the mountainous heart of the continent, while the summer streams of air sucked in from the oceans lose their moisture as they cross the surrounding chains of mountains or highlands. In North America the semi-arid Great Basin is rimmed also by the ranges of the Rockies and the Sierra Nevada, and in the Southern hemisphere, the dry country of Patagonia is cut off from the continual westerly winds over the Pacific by the Andes.

The Semi-Deserts and Deserts of Russia and Central Asia

The interior of Central Asia between the Grass-steppes and the highlands of Iran, Tibet and western China, and stretching from the Russian plains west of the Caspian Sea to the borders of Manchuria, is occupied by various forms of cold-winter Semi-desert and Desert. The Tine Shan and other great mountain chains rise from these wastes, or stretch across them. On them the vegetation is richer and more varied, though on their driest flanks and heights the Semi-deserts and salt patches are still to be found.

The climate is an arid continental one of extremes, very hot in summer and very cold in winter, and usually windy. In the Semi-desert regions the snow and rainfall is under ten inches a year and is very irregular, in some years not much more than an inch falls. Most comes in winter and especially in spring, and usually none at all from midsummer to late autumn. The thin snow-cover is blown and drifted into sheltered hollows by the bitter winter storms. In the Desert regions very little rain or snow falls at any season, and that only in occasional chance snow storms, never any in summer or early autumn. Everywhere in summer the drying effect of the burning sun is intensified by strong hot winds which fill the air with dust. In winter, freezing and equally arid blasts sweep across from inner Asia.

The Caspian is a relic of a much bigger sea which once covered the lowlands around it and extended far across Central Asia. This ancient sea-bed is basically of calcareous heavy clay-loam, and is largely flat with only slight elevations rising from it. Over large areas it is so low that the water-table is not far below the surface, or even reaches it, to form lakes.

The soils which the dry and severe climate produces very sharply with the slightest hollow or elevation. Near the Grass-steppes, Blackearth is formed in the Semi-desert in deep and sheltered depressions where enough snow collects to water the soil to some depth. These patches, which support Grass-steppe, sometimes even with Steppe-shrubs, extend well into the Semi-desert, but die out towards the Desert. In shallower hollows where the water that collects is only enough to wet the upper layer, the alkaline Solonetz soils develop. They form temporary marshes or pools after the thaw, but soon dry up. They are common in the Semi-desert, but also disappear on approaching the Desert. Over most of the country of the Semi-desert, where the land is level or slightly sloping, and is watered only by what rain and snow falls upon it directly, the soils are various shades of light brown and chestnut. They have a thin layer with humus on the surface, much poorer than blackearth, and an accumulation of calcareous and other salts at the depth to which the water penetrates. Roots cannot live below their depth, so spread horizontally above it. The usual base is close textured or clayey. This is the soil of the typical Wormwood (*Artemisia*) Semi-desert, and is not a true saline soil. Patches of wet, very salty land do occur in the Semi-desert region but are characteristic of the Desert.

The Deserts of Russia and Central Asia are Salt-or Sand-deserts, but the poorest Wormwood "Hunger-steppes" or the Camel-plant (*Alhagi*) country of the Kizil Kum, both on clay, are very desert-like also.

Low flat clay plains and depressions where the ground-water is near the surface are Salt-desert, with here and there permanent salt lakes in their deepest hollows. The ground-water is continually sucked up and quickly evaporated during the long droughts, leaving its dissolved salts (mostly common salt and sodium sulphate) on the surface, or in a puffy layer just below. There is not enough rain to wash it down again, and it accumulates, often forming glistening white crusts. These Solonchak soils are damp not far down even in summer, and vary between intensely salty wet mud deserts, salty or brackish marshes, and gradual transitions to the dry Solonets soils. Among these salt-flats are slight rises on which poor and thin Wormwood steppe grows.

Sand-deserts cover enormous areas, especially in Central Asia, and alternate with Salt-deserts west of the Caspian also. For ages the winds have torn up loose soil from between the very scattered vegetation on the dry elevations and from the sea and river beaches, and while spreading the fine dust far and wide as loess, have driven up the coarser particles into sand-hills. At the present time new low sand-hills grow where the blown sand is caught by the Wormwood and other bushes. The sand smothers them, gradually building up as it moves to as much as thirty feet high. These bare-topped moving sand-hills, or Barchans, differ from coastal dunes in that they reverse their direction with the prevailing winds in winter and summer, so vast areas are permanently

sand-covered. As it is mainly the tops of the Barchans which move, a few bushes and grasses can colonise their more stable valleys and slopes. In some regions, especially in the Caspian depression, the heavy clay plain with its high water-table is exposed between the Barchans, and pools and swamps, often salty, form in the valleys. Near the limits of the Sand-desert country, as the Barchans are blown further, their material is slowly sorted more thoroughly, the lighter being blown away and only the coarse sand left. The hills become more stable and lower, and are more thickly colonised by plants, eventually turning into sand-steppe or sandy semi-desert.

Several great rivers flow across these wastelands, bringing fresh water to irrigate their valleys. On the flood-land along them are the only stretches of lush green meadows, and even Poplar and Willow groves, in the barren country. In the estuaries of the rivers wide Reed swamps spread among the channels, and wet meadows which are flooded each spring. Low sandy rises, which are partly bush-covered, separate the channels and lagoons.

There are several forms or subspecies of the Sea Wormwood abundant in these semi-deserts closely resembling each other, of which *Artemisia maritime incana* is typical. It is a good and effective garden plant forming slowly spreading clumps of slim stems, about two feet high, densely clothed with finely divided aromatic foliage, the whole plant very pale grey. The panicles of little grey and yellow flowers are inconspicuous.

Various kinds of grey-white sub-shrubs of Wormwood or Vermouth (*Artemisia*) are the characteristic plants of the Semi-desert. They stand thinly, and only a third to half of the soil is covered by their stems and foliage, but their roots are wide-spreading and take up a good deal of the intervening spaces below ground.

Forms and relatives of the Sea Wormwood, *Artemisia maritima* (officially *A.M. incana*) with *A. Austriaca* less abundant, become common on the driest clays and loams in the region of the Southern Feather-grass Steppes. At last, travelling south and east, as the climate becomes more arid, they cover most of the country and the grasses cease to be conspicuous. These Wormwood Semi-deserts appear in patches in the south Ukraine, and stretch across the isthmus between the Crimea and the mainland. East of the Caucasian steppes they reappear in the Caspian depression reaching from the Volga to the foothills of Dagnestan, where *Artemisia taurica* becomes the predominant wormwood. Similar Semi-deserts, but with Transcaucasian Wormwoods and other plants, spread over the plain of the lower Kura and Araxes rivers between the Great Caucasus and the Armenian mountains.

The Wormwood steppes are predominantly silvery-grey and pale brown, and are dusty and windy. The low, rather straggly bushes grow dotted over the parched ground in monotonous similarity for long distances. Between them are tufts of low Fescues (*Festuca sulcata*), and wispy feather-grasses (*Stipa lessingiana*, *S. Ucrainicda*, and *S. Capillata*), with little shrublets of *Kochia prostrata*, pale grey-white like the Wormwoods, but often with their tufts of narrow leaves taking on a red colour. Their flowers are small, round and inconspicuous, and appear in autumn with those of the *Artemisias*. A few perennial flowering plants are sparsely scattered or grow in groups. Only for a short time in spring, when the melting snow wets the ground, does the land become green between the tattered grey bushes. Then countless ephemerals, very short-lived *plants*, shoot up and flower. Already the little grass *Poa bulbosa* is showing green everywhere, having sprouted in the previous autumn, and it is joined by other small temporary grasses, *Aegilops*, *Eragrostis* several Bromes (*Bromus Tectorum*, *B. Japonicus*, often in groups), and the Barley-grass *Hordeum Leporinum*, to form a thin and tufty turf.

Springing up with the grasses the other ephemerals grow fast and quickly come into flower. Common in so many waste places are the Chickweeds and Sandworts (*Cerastium* and *Arenaria*); the creeping blue-flowered Speedwells (*Veronica*); short-lived species of Clover (*Trifolium*) including the woolly-headed Hare's Foot Clover, *T. Arvense*; the Crucifers *Erophila* and *Erysimum*, and particularly conspicuous when setting their seed, the Flixweed Sisymbrium (*Descurainea*) Sophia, the Shepherds Purse *Capsella bursa-Pastoris*, and *Alyssum desertorum*. Species of *Androsace* and *Gypsophila* are also found. They set their new seed in a few weeks before they are burnt up by the sun and disappear.

At the same season, while the ground is moist, many bulbous and tuberous-rooted plants open their vivid blooms in colonies and patches across the plains. The grasses are in green leaf, but the prevailing wormwood bushes are always silvery-white. Not far from the areas of Grass-steppe grow the clumps of the Dwarf Iris *Iris Pumila*, opening their variously coloured blooms and pushing up their grey swords. The first bulbs to flower are the little stars of the species of *Gagea*, but soon the yellow Tulips *Tulipa Schrenkii* and *T. Biebersteiniana* are in bloom. They open their flowerers flat on fairly short stems between the scattered Wormwoods which are freshly white with new foliage.

Most of the perennial plants come into flower soon after the bulbs in late spring. They are commoner near the Grass-steppes and soon become rare in the driest regions. Here and there mats of Yarrows, *Achillea setacea* with its flat white heads and *A. Leptophylla* with its yellow ones, spread their feathery but tough leaves close to the ground. More common and widespread are the

low clumps of *Chrysanthemum (Pyrethrum) achilleifolium*, or its close relative *C. (P) millefoliatum* also with much-divided foliage and clusters of little yellow daisies. A handsome relative of the Wallflower, *Erysimum versicolor* is conspicuous with yellow and white blooms. The Composite *Jurinea multiflora*, rather like a Knapweed, grows in the less arid places. Several species of Sea-Lavender or Statice (*Limonium* especially *L. Sareptana* spread their sprays of small flowers with those of *Goniolimon rubellum*. Rather later, the Field Eryngo *Eringium campestre* shows its stiff and spiky grey heads. Characteristic of these semi-deserts, especially near the Caucasus and where the soil is sandier, are the upright, rather Rue-like plants of *Perganum Harmana*, with their thread-thin, blue-green foliage in which are scattered yellow flowers.

As the summer heat gets intense the ephemerals wither to dry seed-stalks, the perennial grasses turn yellow (the last to remain green being the Fescue) and most of the perennial plants die down. Only the grey-white Wormwoods and *Kochia* remain fresh and active.

A few species of tough annuals, characteristic of these arid regions, survive through the summer drought with deep strong roots to flower in the autumn. In spite of their abundance, few of these make any show, except the Larkspur *Delphinium consolida (Consolida paniculata)* whose dark blue flowers on stiff branching stems are very handsome. White and pink varieties as well as blue are popular in gardens. Most of the others belong to the button-flowered Goosefoot family *Chenopodiaceae*, so many of whose members are extremely resistant to drought and salt. Of these some have somewhat succulent foliage as do several of the Saltworts (*Salsola*) and Bassia (*Echinopsilon Sedoides*). Others have hard, small, awl-shaped leaves, such as *Polycnemon arvense*. A Knotgrass, *Polygonum patulum*, also with short, narrow and scanty foliage on stiff stems, produces little balls of pink. The late summer is also the season for the *Artemisias* to send up their panicles, and along the edges of the grass-steppe a few perennial herbs bloom. *Linosyris (Aster) villosa* shows its clusters of yellow tufts, and the small dull-pink flowers of the Knapweed *Centaurea diffusa* appear on their twiggy stems.

There is some variation in the Semi-desert lands according to levels and slopes, as well as the permeability of the soil. Where the earth is very dry and clayey even the Wormwoods are stunted and they are almost alone, forming "hunger-steppe" or Wormword desert. But here and there, especially near the Grass-steppe region, the monotony of the grey bushes is relieved by patches of grassland in valleys where snow piles up and blackearth develops. Here a rather impoverished form of steppe grows, with the little Fescue *Festuca sulcata* as the main plant, but with Feather-

grasses and flowering herbs as well. In the bottom of the valleys a few meadow plants may be found if the snowdrifts are deep enough to soak the ground.. The deepest gullies are even overgrown by Steppe-scrub, with *Spirea hypericifolia* particularly abundant.

Wider areas are occupied by various alkaline soils, becoming especially common in the south and east. The main plants of the dry salty soils are dwarf, dull grey-green, twiggy bushes of the Goosefoot family (*Chenopodiaceae*), with a few species of Wormwood. They spread a low sparse vegetation in slightly hollowed stretches on the plains where salt and soda (sodium sulphate) accumulate a short way below the surface, and which are very arid for most of the year but wet in spring (Solonetz soils). There are no perennial grasses in these areas. *Camphorosma monspeliacum* is a little woody, hairy plant with a strong aromatic smell. It has groups of small, sharp-pointed, hard leaves, and produces its tiny grey-green flowers in autumn. *Kochia prostrata* takes an equally important place, as do the small grey bushlets of *Artemisia pauciflora*.

Where the dry salty soils border onto true salt deserts of the flat lowlands the little *Nanophytum erinaceum* is the characteristic plant.

On the bare earth between these shrublets, which is muddy when the snows melt but soon dries, ephemerals, whose roots do not reach the saline layer, quickly appear in the spring and make a show of green for a short time. The pale Buttercup *Ceratocephalus orthoceras* and its relative the Mousetail *Myosurus minimus*, with small yellow flowers in a spike line a Plantain, are only a few inches tall. The grass *Colpodium humile* is a little larger. More conspicuous are the Crucifers *Alyssum desertorum* and the white-flowered Cresses *Lepidium perfoliatum* and *L. Ruderale*. Groups of bulbs bloom here and there at this season, *Gagea bulbifera*, and the quiet-coloured but beautiful Tulip *Tulipa biflora* with heads of several small white flowers having black and gold eyes and green backs. The long-rooted late summer flowering annuals, *Salsola*, *Bassia (echinopsilon)* and *Polygonum patulum* bring some new life before winter. Several Lichens are common on these arid soils, not firmly rooted, but blown about, dry and shrivelled in the droughts, forming "manna". They absorb moisture and grow where they lie after showers.

Intermixed in the Wormwood steppe, these stretches where the grasses disappear form part of a mosaic of plant communities of the Semi-desert region. Patches of Grass-steppe, Wormwood

Semi-desert, and dry salt lands may alternate with each other in close proximity, with sharp and well marked boundaries or may extend over many miles of country and blend into one another.

Plants of the Semi-Deserts of Chestnut-Coloured Soils of Russia and Central Asia

The Semi-deserts are not uniform but consist of wide areas of Artemisia and Artemisia-grass country, varied by areas of alkaline soils (Solonets), or in the north, deeper hollows which collect the snow and are occupied by poor grass steppe.

The Artemisia-Festuca Semi-deserts

The raised parts of the ground, which collect no water, are dominated by the grey subshrubs of several species of Artemisia, which vary according to the regions. Tufts of grass are scattered, and the few other perennials are also uncommon on the bare ground, on which small annuals grow in the spring. Lichens are also widespread.

The Semi-deserts lie along the southern limit of the grass steppes in north Crimea and the neighbouring shores of the Black and Azov Seas (the main Wormwood here is *Artemisia maritime*); from the Daghestan foothills north through the mid course of the River Terek (*Artemisia taurica*) from the Volga bend at Volgograd through Turgay and Pavlodar in Kazakhstan to Semipalatinsk in the east (*Artemisia lerchiana*), which is also very common on the Betpak Dala and the north shores of Lake Balkhash. It shares dominance with *Artemisia sublessingiana* on the hills around the upper Sary Su River from 1450 up to 2450 feet, and Lake Tengiz at 985 to 1640 ft. Also on the Tarbagatai and Dzhungarian Ala Tau mountains at 1640 to 2460 ft and up to 4125 ft on the south slopes of the Dzhungarian Ala Tau.

The Semi-deserts pass southward on the Ustyurt plateau between the Caspian and Aral Seas, and east of the Aral to Lake Balkhash into salt and alkali deserts, or deserts of blown sand.

Artemisia maritime Sea Wormwood. Low spreading, white-downy subshrub, much pinnately cut lvs, terminal branched head of many small button-fls. Most of the other Wormwoods resemble it. Dominant on the coasts of the Black Azov and the north-western Caspian Seas

Artemisia taurica North Crimea and Kerch peninsula, Daghestan foothills to River Terek

Artemisia lerchiana (*Maritima incana*) Widespread and dominant from the Volga across Kazakhstan to Semi palatinsk on the upper Irtysh River, the Goldodnaya steppe (Betpak Dala), and north shores of Lake Balkhash

- Artemisia sublessingiana* A dominant in east Kazakhstan on the highland from around Lake Tengiz and the upper Sary Su River to the foothills of the Tarbagatai and Dzhungarian Ala Tau mountains
- Artemisia lessingiana* Dominant on the Mugodzhary hills south of the Ural mountains
- Artemisia austriaca* Widespread in south Ukraine and Daghestan and from the Volga, Ural and Emba rivers east through Turgay
- Artemisia semiarida* Common in north Turan from the north Caspian shores east to Betpak Dala and the Karatau mountain
- Artemisia dracunculus* Tarragon. On highlands from around Lake Tengiz east to the foothills of the Tarbagatai and Dzhungarian Ala Tau
- Artemisia frigid* On highlands from around Lake Tengiz to the Tarbagatai foothills. Also in North American prairies
- Artemisia transiliensis* On hills between the Chu and Ili Rivers west of Lake Balkhash from 3250 to 4125 feet
- Artemisia arenaria*
- Artemisia astrachanica*
- Artemisia terraealbae*
- Artemisia other species* On sandy soil north-west of the Caspian, east to Karaganda. Often with Eurotia
- Festuca sulcata* Widespread and very common grass from Ukraine to the Altai forming low fine-leaved tussocks among the Wormwoods and in grassy hollows.
- Koeleria gracilis* Crested Hair-grass. Also low, not so common, scattered from Ukraine and the Caucasus to Kazakhstan
- Stipa lessingiana* Widespread and common small-tufted Feather-grass. South Ukraine, Daghestan and Volga, east to the Altai foothills or both lowlands and hills
- Stipa capillata* Also very widespread from Ukraine across the plains of Kazakhstan to the Altai, and from Mugodzhary on highlands to the Tarbagatai
- Stipa ucrainica* South-west Ukraine, north Crimea, Caucasus
- Stipa sareptana* With *Artemisia lercheana* and *A. lessingiana* across Kazakhstan on lowlands, and on highlands from Mugodzhary east to Tarbagatai
- Stipa rubens* From the Volga east across Kazakhstan to Altai foothills
- Stipa orientalis* On highlands around Lake Tengiz, upper Sary Su River, Tarbagatai and Dzhungarian Ala Tau, East Kazakhstan
- Stipa kirghisorum* With *Stipa orientalis* on highlands of Kazakhstan
- Stipa other species*

Agropyron pectiniforme Poker-headed grass allied to Couch (*A. repens*). Often with *Artemisia taurica*, south Ukraine, Azov, Daghestan, or with *Artemisia lercheana* in the basins of the rivers Volga, Ural and Emba, and Turgay

Agropyron desertorum From the Volga across Kazakhstan to Karaganda and the Altai foothills (with *Artemisia lercheana*)

Agropyron sibiricum Allied to *A. desertorum*. Often with *Artemisia sub-lessingiana* on highlands of Kazakhstan

Agropyron other species

Aneurolepidium (Elymus) ramosum Scattered, Kerch Daghestan, Volga across Kazakhstan to Altai foothills

Achillea setacan Very close to Yarrow (*A. millifolium*). Karch, Daghestan to Terek River

Achillea nobilis Oval greyish lvs much cut into groups of leaflets, rounded heads of small yellow-white fls. Grassy hollows, basins of Volga, Emba, Ural rivers to Turgay

Astragalus testiculatus Pinnate lvs oblong heads of pea-fls. From Volga to Turgay, Irtysh, Pavlodar and Altai foothills, Emba and Ural river basins

Astragalus brachylobus Grassy hollows, Basins of Volga, Ural, Emba rivers to Turgay

Allium paniculatum Narrow channelled lvs, umbels of many nodding rosy-purple fls. Grassy hollows, Ural and Emba river basins to east of Kazakhstan

Allium inderiense With *A. paniculatum*

Allium oakasu On hills and highlands of east Kazakhstan from Tengis to Tarbagatai

Allium polyrrhizum East Kazakh highlands

Berteroa spathulata (Cruciferae) Allied to *Alyssum* but with white fls. On highland from Tengis, Upper Sary Su to Tarbagatai

Chrysanthemum (Pyrethrum) millefoliatum achilleifolium Much cut lvs, yellow daisies, low growth. Widespread in dry soil, sometimes rather salty. Volga, Turgay east to Irtysh and Altai foothills, also on highlands of east Kazakhstan

Chrysanthemum (Pyrethrum) millefoliatum North Crimea, Daghestan, Terek basin.

Centaurea diffusa Biennial 8-24", pinnate lvs, heads of many small white thistle-fls in spiny bracts, North Crimea, Daghestan

Cachrys odontalgica (Umbelliferae) Very finely cut lvs, yellow umbels. Dry places, Volga Turgay to Irtysh, Pavlodar, Altai foothills

Chamaerhodos erecta Highlands of east Kazakhstan

Cirsium ignarium A Thistle. Highlands of east Kazakhstan

Convolvulus tragacanthoides Evergreen thorny low bush. Highlands of east Kazakhstan

Dianthus leptopetalus 6", smooth stiff narrow lvs, solitary pale yellow fls greyish outside. Valleys of the Ural and Emba Rivers

Dianthus guttatus South Ukraine, Azov, north Crimea, north Caucasus, Daghestan

Dianthus lanceolatus North Crimea, Daghestan

Eryngium campestre 1-2', ternate prickly lvs, small heads of pale blue fls from spiky ruff of narrow bracts. South Ukraine, Azov,

Eurotia ceratoides (Chenopodiaceae) Sprawling deciduous shrub of 3-4', grey-white downy, very small lvs, groups of woolly button-fls in short spikes forming panicle. On dry highlands and on sands with *Artemisia arenaria* and *Agropyron sibiricum* widespread from Volga to north Caspian, east to Karaganda and Lake Balkhash

Eurotia ewersmanniana Dry uplands of east Kazakhstan

Ephedra distachya (Gnetaceae) Sprawling bush of many dark green Rush-like branches, red fruits. On dry highlands from south Urals across Kazakhstan to Tarbagatai foothills

Ephedra intermedia Sprawling, dense yellowish or grey-green branches. Highlands of east Kazakhstan

Ephedra equisetina Dry uplands of east Kazakhstan, Tengiz to Tarbagatai

Ferula caspica (Umbelliferae) Finely cut lvs, yellow umbels. Volga and Turgay to Altai foothills

Ferula tatarica In dry places south of the Urals, on highlands east to Tarbagatai

Gypsophila patrinii Highlands of east Kazakhstan

Gagea szovitzii Kerch, Daghestan to Terek River

Gallium ruthenicum (*Verum ruthenicum*) Upright velvety stems, whorled lvs, narrow pyramidal heads of yellow fls. South Ukraine, Kerch, Daghestan, highlands of east Kazakhstan, Tengiz to Tarbagatai. In grassy hollows in the south.

Hypericum perforatum Common St Johns-wort. South Ukraine, Daghestan in grassy hollows

Helicrysum arenarium 4-12", grey-silky spatula lvs heads of many small yellow thistle fls. Highlands of east Kazakhstan, Tengis to Tarbagatai

Helianthemum soongoricum Highlands of east Kazakhstan, Tengis to Tarbagatai

Iris Pumila South Ukraine, Asov, Daghestan, in grassy hollows

Ixiolirion tataricum (montanum) Strap-lvs, 12-18" stems, heads of dark blue trumpet-fls. Highlands of east Kazakhstan to Tarbagatai

Jurinea multiflora Low, Thistle-like. Daghestan to River Terek, grassy places in highlands of Kazakhstan

Kochia prostrate (Chenopodiaceae) South Ukraine, Azov, Daghestan to Volga, east to Turgay, Irtysh, foothills of Altai in dry, sometimes salty places

- Limonium (Goniolimon) rubellum* Daghestan to River Terek, Kerch
- Limonium meyeri* South Ukraine, Azov
- Limonium sareptana* Volga, east to Turgay, Irtysh, Altai foothills
- Limonium chrysocomum* Highlands of east Kazakhstan, Tengiz to Tarbagatai
- Lamium paczoskianum* Kerch Dagestan, Grassy hollows
- Asterlinosyria villosa* 1-2', very narrow lvs, flat heads of small ray-less yellow fls. West Kazakhstan, Volga to Turgay
- Aster (Galatella) linosyris tatarica* Ural and Emba river basins in grassy places often with *Stipa sareptana*
- Medicago flacata* Stickle Medick. Trifoliate lvs, round heads of yellow pea-fls. In grassy hollows, west Kazakhstan, Volga, Turgay
- Lychnis viscaria (Melandrium viscosum or Viscosa vulgaris)* 6-12", narrow lvs, stems with sticky patch, oblong heads of deep pink fls. In grassy hollows, west Kazakhstan, Volga, Turgay
- Onosma simplicissimum* Highlands of east Kazakhstan, Tengiz to Tarbagatai
- Phlomis pungens* Steppes and Semi-deserts of south Ukraine, Daghestan
- Phlomis tuberosa* Steppes and Semi-deserts of Russia, highlands of Kazakhstan in grassy places
- Peganum harmala* Rue-like, narrow grey lvs, yellow fls. Kerch, Daghestan to River Terek on sandy soil. (Zygophyllaceae)
- Palimbia (Poucedanum) rediviva* (Umbelliferae) Much cut lvs greenish-yellow umbels. Volga, Turgay to Altai foothills
- Potentilla bifurca* In grassy hollows, Volga, Turgay, west Kazakhstan
- Rheum tataricum* A Rhubarb of grassy hollows, Ural and Emba River basins. West Kazakhstan
- Scilla autumnalis* 6-9", grassy lvs, spikes of small purple-blue to pink star fls. Kerch, Daghestan to Terek River in grassy hollows
- Serratula zeranthoides* Centaurea-like Composite. Volga, Turgay to Altai foothills in grassy hollows in semi-desert
- Seseli glabratum* (Umbelliferae) On east Kazakhstan highlands, Tengiz to Tarbagatai
- Seseli eriocarpum* In Siberian steppes and highland semi-deserts of east Kazakhstan in grassy hollows
- Scabiosa isetensis* On highlands of east Kazakhstan
- Tulipa schrenkii* Kerch, Daghestan, highlands of Kazakhstan, grassy plains
- Tulipa biebersteiniana* Volga, Turgay to Altai foothills, grassy places

Tulipa biflora More than one fl per stem, white with yellow throat, green and crimson outside. Volga, Turgay, Irtysh to Altai foothills and on Kasakh highlands. In open semi-desert and on Solonets soils

Thymus marschallianus Steppes and semi-desert highlands of east Kazakhstan

Ziziphora bungeana (*Labiatae*) Thyme-like. Semi-desert highlands of east Kazakhstan, grassy places

Zygophyllum macropterum Lvs of 2 leaflets, solitary pale yellow fls in leaf axils. Semi-desert highlands of east Kazakhstan

Plants of the Salt Soils

The salt areas in the semi-deserts may stretch for miles, and vary according to the nature of the soil, but are very similar over the whole wide territory. Salts do not accumulate on the surface of the Solonets type of soil in this dry country, but collect below a close-textured layer lying several inches down on better soils, or only under a crust on poorer ones. When wet after the occasional spring or autumn shower, this layer becomes impermeable forming temporary swamps, but soon dries out and shrinks into columns. Sodium sulphate (Na_2SO_4), with Sodium chloride (NaCl) in the south are the main alkalis, replacing the Sodium carbonate (Na_2CO_3) of the salt hollows in the Blackearth region.

In low-lying flat country around salt lakes and along river plains, where the water table is close to the surface, especially in the south of the semi-deserts, the Solonets stretches merge into salt deserts on the wet soil where evaporation is constantly fed from below, and salts often encrusts the surface in gleaming white sheets (Solonchak soils)

Plants of the Sononets-type soils

Most belong to the Goosefoot family (*Chenopodiaceae*) *Camphorosma monspeliaca* Sub-shrubby, hairy 8-12", small stiff lvs in bundles, little cup shaped green fls (*Chenopodiaceae*)

Kochia prostrata Also a grey sub-shrub

Artemisia pauciflora A low Wormwood

The dominant plants scattered on less, salty dry ground

Nanophytum erinaceum Forming a transition to more salty soils

Anabasis salsa

Atriplex canum

An orache forming low mounds

Dominant, often nearly alone on very salty and damper soils. Mostly succulent *Chenopods*

Plants of the Solonchak-type soils*Atriplex verrucifera*

Petrosimonia crassifolia

Halocnemum strobilaceum

Salicornea herbacea (europaea) The main dominants. Low mounded succulent plants often turning red or purplish, scattered thinly over the wet, often salt-encrusted soil

Atriplex (Obione) pedunculata Annual Orache resembling Sea Purslane (*A. portulacoides*)
More scattered or local

Atropis (Glyceria) convolute Annual grass. More scattered or local

Bassia (Echinopsilon) sedoides Succulent summer annual also on Solonets soils
(Chenopodiaceae). More scattered or local

Frankenia pulverulenta Prostrate annual Sea Heath. Scattered or local

Limonium caspium (bellidifolium caspium) Matted Sea-Lavender. Small perennial. Scattered or local

Ofaiston monandrum Scattered or local

Suaeda maritima Annual, Seablite. Reddish or greyish succulent lvs, bushy growth

Lasiagrostis splendens Man-high, plume-headed grass forming wide stands where it can reach fresh ground-water, even in surface Solonchak areas

Ephemerals, Annuals and Bulbs Common on Solonets-type Soils*Achillea leptophylla (pubescens)* On the edge of Solonets areas in the Semi-deserts

Anabasis species (A. truncata, A. aphylla) In very dry country

Agropyron prostratum

Alyssum desertorum Also common in non-salty soils. Spring ephemeral

Ceratocephalus orthoceras (Ranunculaceae) Spring ephemeral

Colpodium humile Spring ephemeral

Gageae bulbifera

Lepidium ruderale Narrow-leaved Cress, Spring ephemeral

Lepidium perfoliatum Spring ephemeral

Mysosurus minimum Mousetail (Ranunculaceae) Spring ephemeral

Polygonum bellardi Summer annual

Scorsonera pusilla

Scorsonera tuberosa

Salsola brachiata

Salsola tamariscina Summer annual

Tulipa biflora

Ephemerals, Annuals and Bulbs of the Non-Salty Semi-Deserts *Arenaria serpyllifolia*

Androsace turozaninovi

Amaranthus albus

Amaranthus retroflexus

Agilops squarrosa (Graminae)

Bromes decorum Drooping Brome grass

Bromus squarrosus

Crypsis alopecuroides (Graminae)

Cerastium ucrainicum

Cerastium anomalum

Consolida (*Delphinium*) *paniculata*

Capsella bursa pastoris Shepherds Purse

Ceratocarpus arenarius

Chenopodium album. Fat Hen

Chenopodium urbicum Upright Goosefoot

Europhila (*Draba*) *verna*

Eragrostis minor (Graminae)

Hordeum leporinum

Holosteum umbellatum (Caryophyllaceae)

Hymenolobus procumbens

Medico romanica

Medico minima

Matricaria chamomilla Wild Chamomile

Polygonum patulum

Polygonum pseudoarenarium

Polygonum arvensis (Chenopodiaceae)

Pholiurus pannonicus (Graminae)

Plantago tenuiflora

Pulicaria vulgaris (*Inula pulicaria*) Small Fleabane

Trifolium arvense Hares-foot Clover

Trifolium parviflorum (*pratense parviflorum*)

Thesium multicaule

The Deserts of Russia and Central Asia

The most extensive Salt-desert country in Russia is in the plains of the Caspian depression. Outlying stretches occur in undrained hollows in the flood-plains of rivers far into the region of the Semi-desert and even that of the Grass-steppes.

The typical flat and wet clay brine-deserts are dotted with small dull-coloured bushlets, grey or blue-green, or some with purplish-brown or even red shades, especially as they age. Between are stretches of greyish soil, or salt patches blindingly white in the sun. The most abundant and characteristic plants, as in most salty places, are members of the Goosefoot family (*Chenopodiaceae*), such as the low *Halochemum strobilaceum*; many species of Saltwort (*salsola*); Oraches (*Atriplex*); and Seablite (*Suaeda*). Taller members of the same family, which also colonize wet salty sand near the Caspian Sea, are the dark brownish-green *Halostachys caspica* and *Kalidium capsicum*, both bushes of four feet high or so. All have small leaves, hard or sometimes fleshy, as the presence of strong brine makes absorption of water difficult, and they must conserve moisture. These Chenopods grow and come into flower in the late summer, but their flowers are very small and not highly coloured. At this season the Sea-Lavenders (Limonium) also bloom, and their patches of lilac and pale pink are conspicuous among the dull greens and greys and reds. The commonest is *L. suffruticosum*, but perhaps the finest is *L. Gmelini* with blue-green leaves and sprays of purple. *L. Caspium* is also attractive, a small neat plant with twiggy heads of lilac. They do not need salt in cultivation, but do well on good retentive soil on the ground, mats of two Sea-Heaths show their little mauve-pink flowers among tiny leaves. They are *Frankenia pulverulenta*

and *F. hirsuta*. There are hardly any grasses on the salt-flats, except for the running patches of *Aeluropus littoralis* which is common on sea-coasts.

Where elevations rise from the salt-flats, feathery light-green bushes of Tamarisk grow, of more than one species, the naming of which is obscure. A handsome Tamarisk of these lands, often grown in gardens, is *Tamarisk pentandra (pallasii)*, also known as *T. hispida aestivalis*. It is a bush with a cloud of tiny light blue-green foliage on numerous slender twigs from which rise large plumes of minute pink flowers in late summer. Another beautiful Tamarisk, wild near the Caucasus, is *Tamarisk tetrandra*, brighter green, and producing its pink sprays all over the bush in spring.

Salt lakes and pools occupy many of the deeper hollows in the salt-flats. In the summer, as they evaporate, they become surrounded by very briny mud. This mud is bare in the spring, but is colonized in the late summer by succulent annuals, the most abundant and characteristic of which is the Marsh Samphire *Salicornia europaea (herbacea)*, so common on British tidal marshes. Where the mud is drier further from the water, other succulent Chenopods join it, species of Camel Plant (*Alhagi*), grey and purple-stained Seablites (*Suaeda*), and species of (*Halocnemum*) passing into the true salt-flat vegetation.

The Sand-deserts are formed by crescent-shaped moving sandhills or Barchans. They arise near the Caspian Sea and far across Turkestan, and are quite plantless in their early stages. They are blown westward by the prevailing winds out of Asia in winter, but the southern west winds of summer drive them back again. Their movement diminishes and eventually ceases as the land rises at the edge of the Caspian depression. As they travel and become more stable and lower, pioneer plants colonize them. These are mostly plants with long underground runners which root in the sand as they spread; first of all the tall Lyme-grass with blue-grey leaves, *Elymus sabulosus (giganteus)* also low suckering bushes, including *Calligonum aphyllum*, which is a Broom-like shrub, but belongs to the Polygonum family (*Polygonaceae*).

The increasing number of plants gradually dries out the internal moisture of the Barchans, their surface becomes matted with roots, and the pioneers die out. A poor, thin Sand-steppe, scattered with low bushes then develops on the older fixed Barchans. Grey bushes of *Artemisia*, of several sand-loving species, grow fairly commonly. In some areas the Wheat-grass *Agropyrum sibiricum desertorum* is equally abundant. The green Rush-like shrubs of *Ephedra distachya* are scattered, and here and there are the stiff, erect stem-clusters of the Spurge *Euphorbia seguirana (gerardiana)* which is typical of sands all over the Steppe and Desert regions. It has narrow, pale blue-green leaves and stalks, topped by yellow-green panicles, and stands up conspicuously in the meagre vegetation of the sands. Other plants that can be found are the Yarrow *achillea gerbera*; the white-woolly leaved subshrubs of the Yellow Everlasting *Helichrysum arenarium* with its

yellow, orange-centred, papery flower clusters; species of Milk-Vetch (*Astragalus*), and a good many more, but the vegetation is sparse and the grey-yellow sand shows everywhere. Several annuals, especially grasses, spring up in the sand between the bushes and form a green flowering but patchy and scattered carpet for a short season. Among them are Brome grasses (*Bromus*), the Dogstooth grass *Cynodon dactylon*, *Poa bulbosa*, and the Crucifers *Alyssum desertorum*, the yellow Flixweed *Sisymbrium (Descurainia) Sophia*, and the white Cress *Lepidium perfoliatum*. Various Chenopods such as *Alhagi*, *Agriophyllum* and *Salsola* also inhabit the sands.

The Barchans travel across the low, often wet lands of the Caspian depression, so the hollows between them are usually very damp. They drive over the wormwood hunger-steppes and salt-flats alike, even burying the salt lakes. Most of the hollows are therefore at first salty, with *Halocnemum*, Seablites and Oraches (*Suaeda* and *Atriplex*), Saltworts (*Salsola*), and even the March Samphire *Salicornia*. As the Barchans become stabilized, small lakes of brackish water, or even fresh water near rivers, collect in their deeper valleys, with beds of Reeds (*Phragmites communis*), Reedmaces (*Typha*) and other water plants. Later these ponds become silted up or filled with sand, and damp meadows develop, in which the Bushgrass *Calamagrostis epigeios* is abundant with different sorts of Sedge (*Carex*). Soon the Twitch or Couchgrass *Agropyrum repens* invades, or sometimes the running clumps of the Liquorice plant *Glycyrrhiza glabra* follows the Reed and nearly fills the valleys. It is a Leguminous plant, three or four feet high, with large pinnate leaves and spikes of bluish flowers and is often accompanied by its relative. Shallow valleys are often overgrown by the large bushes of the Oleaster *Eleagnus angustifolia* with its narrow metallic-silvery leaves shining in the sun or the much lower creeping grey Willow *Salix repens*. Old thoroughly stabilized sand-hills become partly bushed over also by Tamarisks, both *Tamarix pentandra (pallasii or ramosissima)* and *T. tetrandra*, or near rivers by the widely suckering White Polar *Populus alba*, the backs of whose leaves are pure white. Along the rivers tall trees of the Black Poplar *Populus nigra* grow also.

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