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Natural Environments of Baiinxile, Xilinhot, Inner Mongolia

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Synopsis

The area belongs to south-eastern part of Haixi fold belt in Innermongolia with outcrop of callys of carboniferous and permian period limestone and sandstone. There were fluctuation movement and taphrogeny at Neozoic Era by which some subsided basins were formed. During the period of Himalayan movement, there were volcanism forming the basalt lava platforms. The altitude of the eastern part is 1300–1500m being higher than the western (less than 1000m). That caused a certian degree of vertical changes in soil and vegetation.

Climatically, it belongs to mid-temperate zone, semiarid region with continental temperate steppe climate but moistened by southeast Monsoon in summer. Yearly averaged temperature is −0.4°C. The growing period of steppe plants is 150–180 days.

The yearly precipitation is 320–400mm decreasing gradually from east to west. The zonal soil is the chestnut. There are some differentiation in regions and types according to vegetation and local water-het conditions connected with topography in eastern part with higher altitude more than 1250m on the low mountain, hill and basalt platform with vegetation of meadow steppe, dominanted by *Stipa baicalensis*, *Filifolium sibiricum*, *Carex pediformis and Aneurolepidium chinense*, the black earth is developed, in the middle part, above 1150m with typical steppe dominanted by *Aneurolepidium chinense and Stipa grandis*, there comes dark chestnut. While in western part with lower altitude less than 1000m, it comes to be chestnut dominanted by *Stipa krylovii* and *Artemisia frigida*.

Besides, there are some extrazonal soils concerning with local topography and water condition, e.g. meadow soil, awamp soil, solonchak and sand soil. On the sand soil some woodland and shrub are existed.

The Baiinxile region lies its position at N43°26′ and E116°04′–117°05′, coresponding to the middle stream of Xilin River, eastern side of Dashinganling Mt. middle part of Xillingole League with area of 3,730 km^2. (Fig.1)

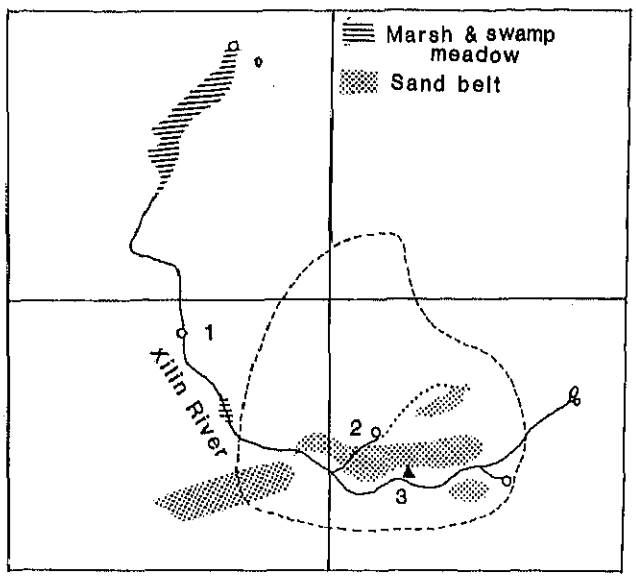

Fig. 1. A sketch map of the investigated area of the Baiinxile livestock farm. region. Dotte line is the boundary of Baiinxile livestock farm. Open circles and solid triangle are city, town (1: Xilinhot, 2: Baiinxile and 3: Grassland Ecosystem Research Station of Academia Sinica).

Geology and geomorphology

On the geological structure the investigated area belongs to south–eastern part of Haixi fold belt in Innermogolia with outcrop of callys of carboniferous and permian period limestone and sandstone.

In Mesozoic Era the distinguished basin range movement accompaning with a great quantity of gush and intrude of neutral and acid igneous magma by influence of Yianshan Mt. movement, makes the andesite, rhyolite, granite, granite porphyry distribute broadly, as the substancial basis of the uneven distribution of calcium–making elements for the modern soil development.

At the Neozoic Era there were distinct fluctuation movement and taphrogeny. As its results, some subsided basins were formed, such as Hailute, Hundashank, Choakula etc. to provide a basis for the forming of beach deposite. It turns to be the aubstancial basis of Quatenary wind deposites.

During the period of Himalayan Movement, the great scale of volcanism with basic

igneous magma had overflowed often along the taphro–line to surface of the earth intermittently. And as the results basalt lava platform was formed.

The relief of the eastern part is 1300–1500m being higher than the western (less than 1000m) because of the influence of the fold and arise of Dashinganling Mt. in the east. Thus the distinct relative difference caused a certian degree of vertical changes in water–heat condition, soil and vegetation. Although such differentiation is often concealed by the smooth and slowly changing topography, even misunderstand as horizontal distribution.

Topography

Topographically, the area belongs to the region of Xilingole high plateau and hill, middle part of Innermongolia high plateau. It neighbours with Dashinganling middle mountain and low hill in the east, connecting with basalt plateau in the south; with distinct vertical differentiation.

While from a view of regional distribution, a distinct regional differentiation also is recognized. In the southern part there are mainly basalt platforms, partly with hill and wide valley and scattered lower volcanic cone. The northern part is a part of the Innermongolia abrasion upland plain with characteristic of alternatively distributed hills and Talas.

Between the two regions, there is Xilin River streaming from southeast to nothwest, and a band of sand belt from east to west alonging the north bank of the river.

The main topographic types are divided to be 6: hill and humpy, river valley, Tala, platform, windy sand land and fan etc.

The hill with relative height of 200m or so, mainly with direction of east to west distributes at the eastern part of the area, for example: Hailiute Mt. etc. The ridge is rather smooth and thre is distinct development of fan which forms gently pluvial plain.

The relative height of the hill is about 50–200m with difference of high, middle and low hill. Most of them is the middle with height of 50–150m. Besides, the transitional humpy type between gently slope and hill with height of several ten meter mostly distributes at the circumference of Tala. Socalled Tala is a mongolian, i.e. broad plain, e.g. Hailiute plain, Taolintala etc. They are pluvial plain formed by some connected large pluvial fans. It distributes broadly in the north and west parts of the area and is the main agricultural land and rangeland for hay.

The basalt lava platform distributes by the banks of the Xilin River mostly at the southern side. It is divided in 3 levels: above Xilin River 30–50, 100–150 and 200–250m respectively. The platforms are made of basalt lava with outcropping of base rock on the surface of ground. The depth of soil layer is about 1m, the underground water being very deeply more than 100–200m, frequenltly to be used as non–water or water lacking pasture only in the snowing winter.

The sand belt between both north and south regions extents from west to east by

the northern side of Xilin River with the length of several decades meter and the width of 10km. The relative height of the sand belt is mainly 10–20m, the highest being 50–80m, e.g. in Ulasutai where there is forest of *Picea meyeri, Betula platyphylla* shrub dominated by *Ostryopsis davidiana, Rosa davurica, Salix characta etc. and Festuca dahurica* steppe and *Aneurolepidium chinense* forb meadow-steppe. Most of sand belt are in stabilized or semistabilized state, while partly there are some sand dune covered with scattered psamophytes e.g. *Artemisia desertorum, Agriophyllum pungens, Corispermun chinganicum.* etc. Vegetation on the sand belt increases the diversity to the steppe landscape and suggests the mutations of the environment and the variants of steppe vegetation.

Earth's surface water and underground water

The main river in this area is Xilin River with tributary of Haolaitu river and Sanggenbaolege river etc. The yearly run off of Xilin River is only 0.1854m^3 and in the curved river course there are broad washland, marshland and developping terrace. In the Xilin River valley because of its moist water condition, the wet–mesophytic plant communities are formed and makes a striking contrast with surrounding xerophytic steppe vegetation. It is the pasture with most intensive grazing and largest carrying capacity. Its productivity would be doubled and redoubled by the establishment of cultivated grassland.

Climate

On the climatic regionalization of China, the Xilin River basin belongs to mid-temperate zone, semi–arid region with continental temperate steppe climate. The seasonal change is distinguished. There are many cyclones in the spring and winter over the area controlled mainly by the Mongolian high pressure current with arid and cold windy. As the results, it is very unsuitable for growth of plants. It is rainy and warm in the Summer and Autumn by the influences of the southeast Monsoon and being suitable for plants growing. However, the yearly varied rate and amplitude is very large much more with cold spring and winter, so the period of plant growing is less than 150 days so on. Therefore, it is rather a severe climatic condition for plants.

Based on the data of Baiinxile Livestock Farm and the Grassland Ecosystem Research Station, the averaged year temperature is −0.4°C with increasing towards west as the altitude being decreased, e.g. at Xilinhote (989m) is −1.7°C, Baiinaobao (1200–1300m) east of Baiinxile being −1.4°C. The mean 5 monthes temperature is less than 0°C, among them in the coldest month decreased to be from −22.3 to −23°C with an absolute minimum temperature of −40°C. In the hottest month (July), it is 17.9–18.8°C, and the summed temperature of over 5°C being 2082°C. Its stable date from May 4th to Sept. 23rd all of 142 days. While in lower Xilinhot it is more higher as 2581°C, corresponding duration from April 24th to Oct. 4th 164 days being longer (Fig.2).

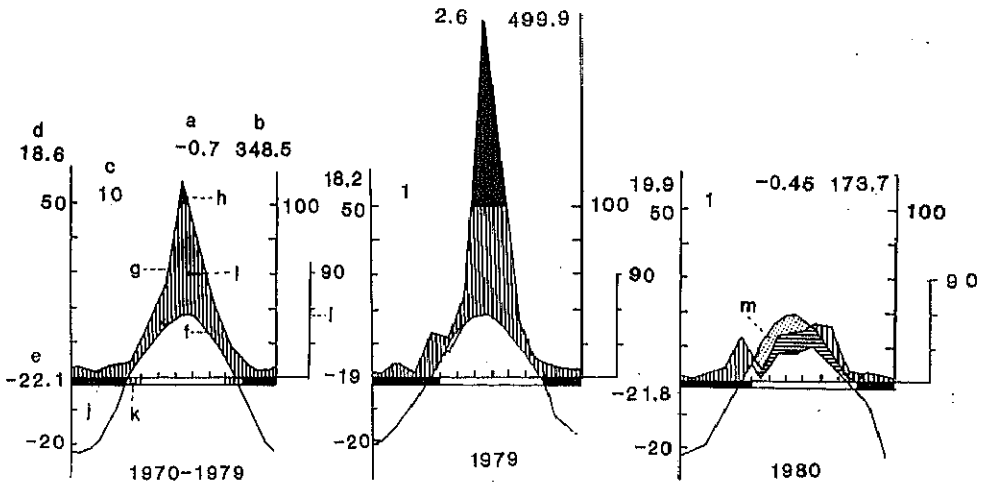

Fig. 2. The climate diagram (Walter 1968) of Baiinxile region a: yearly averaged temperature (°C), b:yearly averaged precipitation (mm), c:observation year on temperature and precipitaion, d: absolute maximum temperature(°C), e: absolute mimimum temperature(°C), f: curve of averaged month temperature(°C), g: curve of averaged month precipitation (mm), h: averaged month precipitaion more than 100mm marked as blackend area, i: degree of precipitation curve changed as 10C=30mm, j: month of minimum day's averaged temperature less than °C, k: months of absolute observation minimum temperature less than 0°C marked as slant, l: humid period (areas of vertical line) and m: dry period (areas of dots).

During the beginning and middle of April, the day averaged temperature stabilized as 0°C, the grass begin to returning green, and then it grows rapidly when the stable temperature is higher than 5°C. As the last ten days of September, the plants of steppe stop growing because of the decrease of temperature less than 5°C, and subsequently it enters to be withered in October. The growing period of steppe plants is 150–180 days. The long and cold winter is one of the important characterstic for the steppe and it is unfavourable for grassland utilization and animal husbandry management. If we identify the winter by day's averaged temperature of 0°C, the winter in east and middle parts will be 170 days from the last ten days of October to the first ten days of April, while in west part is rather short only 150 days or so.

Such temperature condition is able to satisfy the need for the growth of temperate grasslad plants and some crops such as spring wheat, oat, and potato etc. While the fox tail millet only can be cultured at western part of the area. Besides, the higher hours of sun shine (2600–2800hr/yr) and larger day temperature difference are suitable for photosynthetic production and dry matter accumulation.

The precipitation decreases gradually from east to west i.e. from more than 400mm to 150–320mm with large amplitude and yearly variation e.g. at the middle part of

Baiinxile, it had been 645.6mm/yr in 1979, while the minimun only 182mm in 1980. And seasonally it is also unbalanced, mostly concentrated in monthes of July, August and September. It is often dry with few precipitation from April to June which is unsuitable for plant growth, particularly, the drought in June and July may be a tremendows influence on productivity of grassland. During this time, the dominants grasses had to stop the earing and growth even, will be withered temporally. In such states the productivity would not be recovered again even it comes rainy in August.

It is snow in the winter. A moderate snow would provide drink water for grazing livestock in the field and profitable to add water content of soil in the comming spring for plants green return. But if the snow is too few or excessive, some disasters may be caused, i.e. so called "black disaster and white disaster". In the past 50 years, it had had 5 times of "white disaster" particularly in 1977, as the thickness of snow had been 70–80cm, the livestock had died more than 50% of the total head number.

The wind is one of the important factor in this area. It is frequently and with main direction of northwest. The days of gale is 71, among them, 50% in April to June. During this time, the progressive effection of drought and wind makes the soil water content lossing rapidly, and very unsuitable for the growth of the plants just after turn green. As for the cultivated crop land without any cover of natural vegetation, but a little quantity of wheet seedling, frequently is sandified by wind flowing and subsequently becomming to be sand dune. Therefore, the strong wind in spring is a very active and destroied environment factor. It requires to pay much attention and effective treatments as grazing and crop cultivation.

Soil and Vegetation

The zonal soil of the area is chestnut. There are some differentiation in regions and types according to the influences of vegetation and local water–heat conditions connected with topographical factors. In the eastern part, the altitude is more than 1250m, the yearly precipitation more than 400mm on the low mountain, hill and basalt platform with vegetation of meadow-steppe, the black earth is developed. It is surely that a certain degree of vertical distribution is existed. In the middle part above 1150m under the typical steppe dominated by *Aneurolepidium chinese* and *Stipa grandis*, there comes dark chestnut. While in western part with lower altitude less than 1000m, it becomes to be chestnut. They are zonal soil at all, but except the black earth must be distinguished as vertical zonalities.

The profile characteristics of the black earth can be summarized as the following base rock loess, basalt and andesite; rich in organism about 4–6.5%; thick humus layer 30–50cm; without CO_2 reaction in the upper layers, but in the lower layers is usually with pseudo–hypha like or lump, kernel–lump like calcareous illuvium; texture rough and light, mainly mesosand (1–0.25mm), thin sand (0.25–0.05mm) and powder sand (0.05–0.01mm), clay grain less than 20%.

The black earth with characters of fertile, loose and rich in water, is profitable for plants growing. The grass is higher than 50cm and can be used as the range for hay. Besides, it is able to cultivate cereal crops but only at the limited place where there is good sun shine, no strong wind and plain topography, so as not to cause the wind and water erosion.

The chestnut is one of the main zonal soil type in this area, which can be divided into two subtypes: dark chestnut and chestnut forming respecitively at the semiarid climate and *Aneurolepidium chinense, Stipa grandis,* and *S. krylovii* typical steppe conditions. There were distinct accumulation of humus and calcium in the process of soil forming. At the upper layers of the profile the chestnut coloured humus layer is formed, while at middle and lower parts it comes to be grey–white calcareous illuvium and weathered base substance layer respecitively. The thickness of the humus layer is about 30–45cm and the organic content being 2.0–4.0% with grain or lump like structure. Under this layer there comes calcium illuvium layer, and between the 2 layers a transitional layer with thickness of 30–50cm is existed. At the different place the content of $CaCO_3$ is differently according to the base substances: basalt is the highest of 30%, and the acid rocks rather fewer only 1%, the pH about 7.5–9.0. This is the difference with the chestnut in western part of Eurasian continent, and it may be concerned with the rainy and high temperature summer.

Some differences exist between dark chestnut and chestnut soil, the altitude of the former is 100m higher than the later, so its distribution is mainly at the middle and eastern part, The organism content is rather high, calcareous illuvium more deeply, pH 7.7–8.69 slightly less than the later (7.7–8.8). The climate is rather humid with humid degree of 0.4–0.6, the temperature relatively lower than the later. The vegetations on both soils are the community of *Aneurolepidium chinense* with some lower grasses and the community of *Stipa grandis* with *Artemisia commutata* respectively.

Excepting the zonal soils described above, there are some extrazonal soils concerning with local topography and water condition, e.g. meadow soil, swamp soil, solonchak and sand soil. The meadow soil distributes at washland, low terrace, low–lying place of the Tala and sand dunes. Where is rich in water with luxuriant meadow vegetation and distinct accumulation of organism which decomposites rapidly without peat, but with gley horizone, and usually developing to be meadow–solonchak at the edge of the low–lying places. The meadow soil with good condition and higher fertility is suitable for crop cultivation, particularly, for artificial range forming. Its usage and development is an important problem for the animal husbandry and agriculture of the area.

At the end, the soil of sand belt would be described. Such soil can be called as woodland sand soil with forests of *Betula platyphylla, Populus davidiana, Picea meyeri, Ulmus pumila,* and shrub of *Ostryopsis davidiana, Salix flavida, Rosa davurica* etc. It usually distributes on northern slope and forming a complex with the sand texture dark chestnut at

the low–lying places and the chestnut like sand soil at southern slopes. The organic matter in sand soils is rather few between 0.21–1.64%, non–structure and non–CO_2 reaction (Fig.3).

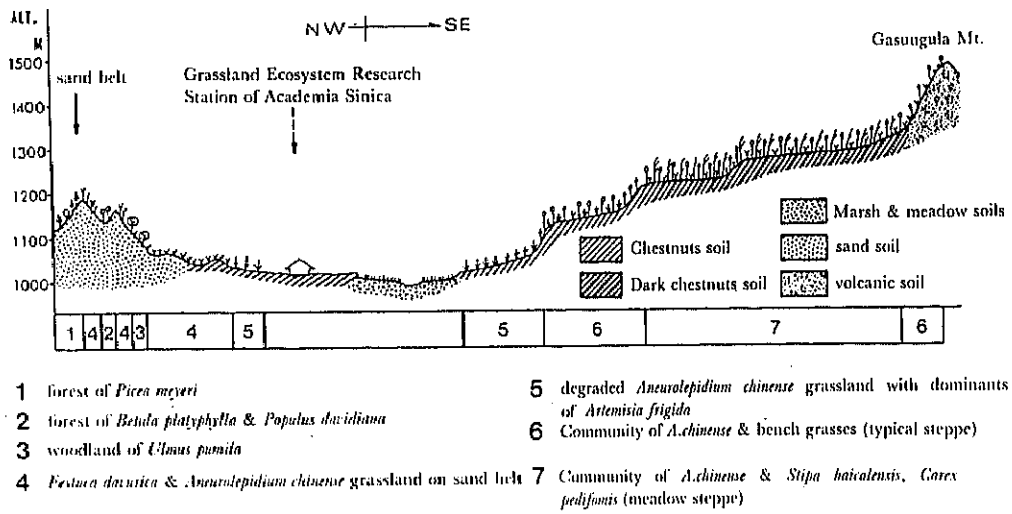

Fig. 3. A sketch map for the distribution patterns of vegetation types and its corresponding natural environments at the Baijinxile region

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