Grassland Resources and Development of Grassland Agriculture in Temperate China

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Natural temperate grasslands occupy 2.4 million km² or one-quarter of the area of China. They form a broad belt from the plains of the northeast to the Tibetan Plateau of the southwest (Fig. 1).

The nature and distribution of the grassland is determined in large part by the influence of the monsoon. In the northeast where the monsoon is well developed, the grassland owes its existence to dry conditions in the spring. Westward and southwestward where the monsoon influence is weaker, the grasslands occupy higher elevations (to as high as 5,000 m) in response to the semiarid and arid regional climate. Similarly, temperate grasslands occur at high elevations in mountains of the desert region in northwestern China, far beyond the continuous grassland belt. Some 4,000 species of flowering plants comprise the vegetation of these temperate grasslands. About 200 are important forage species.

The livestock population in China is about 130 million cattle units. Most of the livestock are dependent on these natural temperate grasslands.

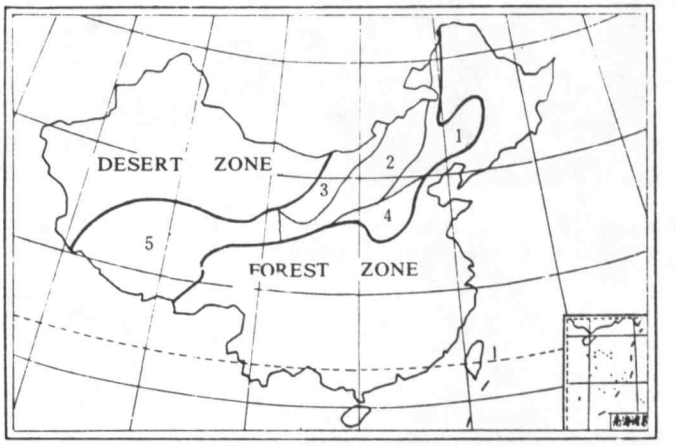
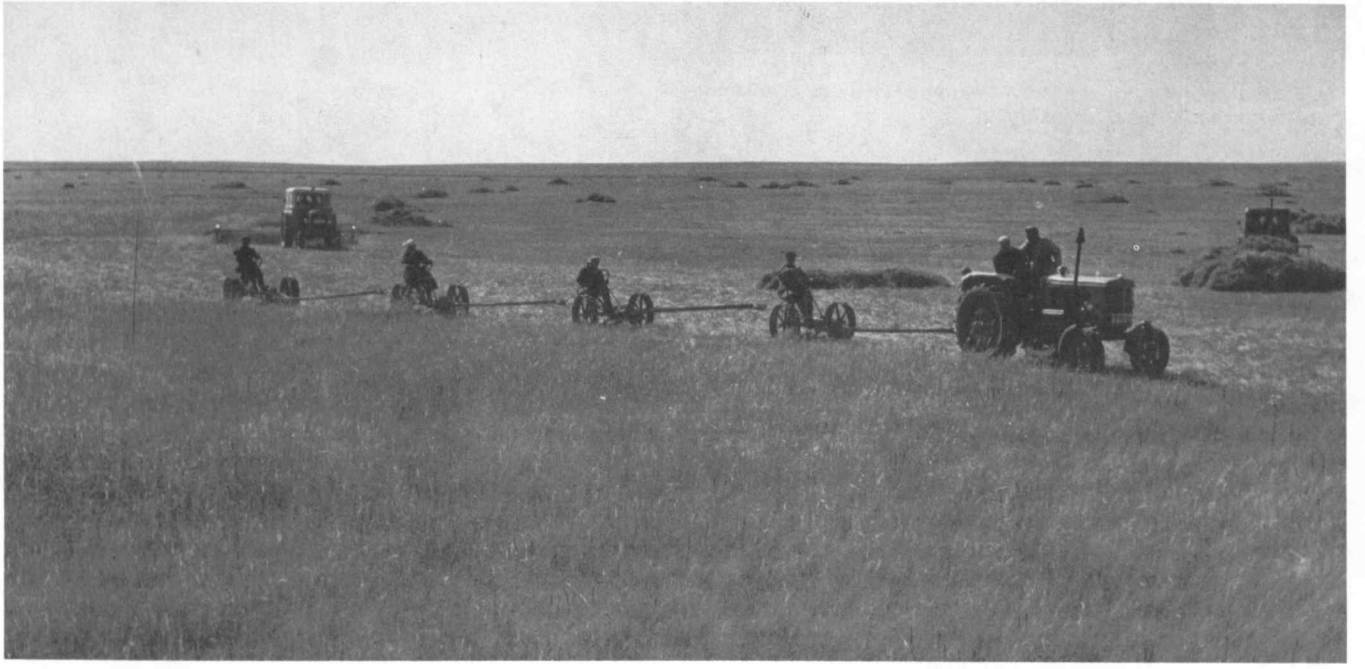


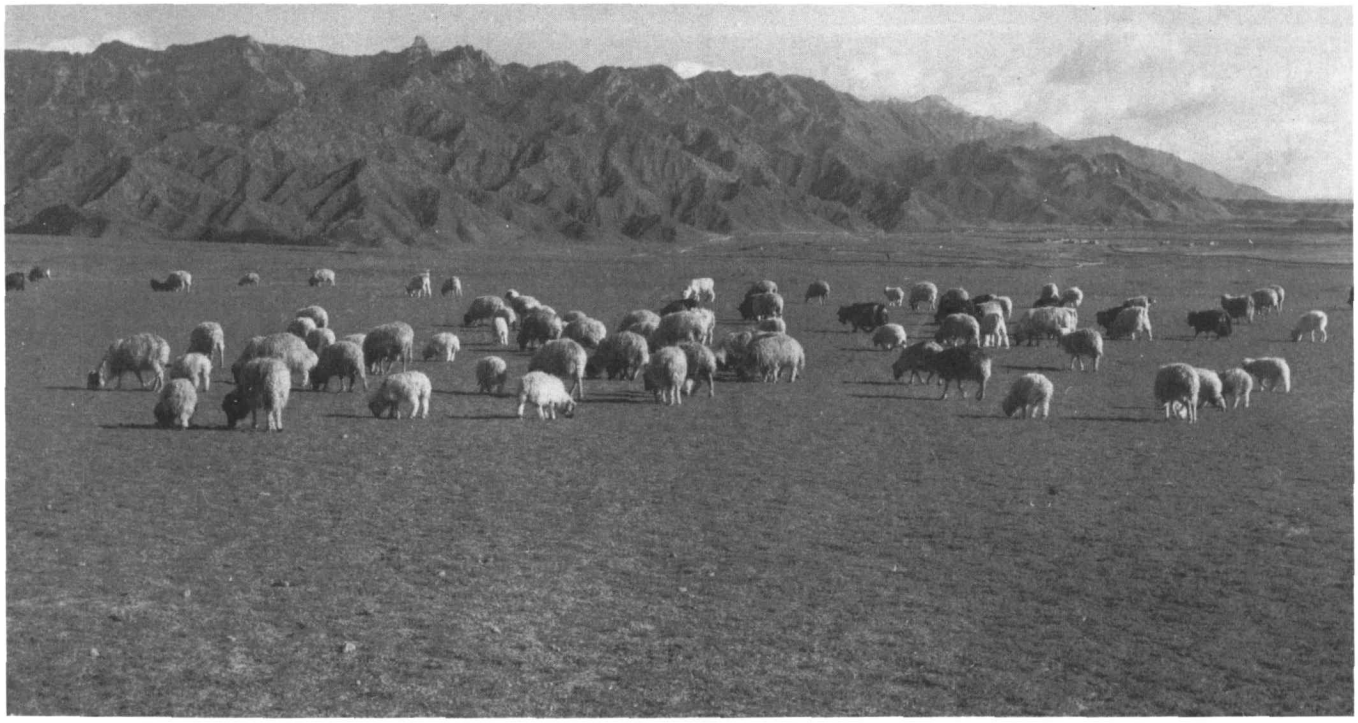
Fig. 1 Steppe zone of China
1. Meadow steppe, 2. Typical steppe, 3. Desert steppe, 4. Shrub steppe, 5. Alpine steppe.

Grassland Types

Based on the concept of zonal vegetation, the natural temperate grasslands of China can be divided into two major types: steppe and meadow. Steppe vegetation is zonal, responding to climate and distributed in the form of a belt. Meadows are not zonal; they are controlled by local environments. About 80 percent of the area of grassland is occupied by zone steppe types and about 20 percent by meadow types.



*Needlegrass (*Stipa breviflora*) typical steppe covers the Inner Mongolian plateau. August is the best season for cutting.*



*Gobi needlegrass (*Stipa gobica*) desert steppe covers the western Chinese steppe zone. Here the grasses are short, so this kind of steppe is adapted only to grazing uncontrolled sheep.*

An important characteristic of grasslands is the grass species composition, particularly the dominants. The latter and their water ecological characteristics have been used to subdivide the types.

1. **Steppe**

Five types of steppe are recognized in China: Meadow Steppe, Typical Steppe, Desert Steppe, Shrub Steppe, and Alpine Steppe.

(1) **Meadow Steppe** occurs in the eastern part of the grassland belt, extending westward to the eastern edge of the Inner Mongolian Plateau. The principal dominants are *Stipa baicalensis* and *Leymus chinensis*.

(2) **Typical Steppe** lies west of Meadow Steppe in the Inner Mongolian Plateau. Here the dominants are *Stipa grandis, Stipa krylovii,* and *Stipa breviflora*.

(3) **Desert Steppe** occupies the western part of Inner Mongolia and extends southward into parts of the near provinces. The principal dominants are *Stipa glareosa, Stipa klemenzii* and *Stipa gobica*.

(4) **Shrub Steppe** has a discontinuous distribution due to irregular topography. It occupies the midwestern parts of the Yellow Soil Plateau. The dominants are *Stipa bungeana* , *Themeda Triandra,* and *Bothriochloa ischaemum*. The most common shrubs are *Vitex negundo* and *Zizyphus spinosa*.

(5) **Alpine Steppe** occurs over much of the Tibetan Plateau at elevations of 4,000 to 5,000 m. The most important dominants are *Stipa purpurea* and several cushion plants: *Androsace tapete* and *Arenaria musciformis*. This type of steppe is suited to grazing by yak and Tibetan sheep.

Moisture and Temperature Relationships in Steppe

The relationship of the five steppe types to moisture and temperature gradients are shown in Figure 2. Typical Steppe is located midway on both gradients. Increasing moisture favours development of Meadow Steppe, while decreasing moisture results in Desert Steppe. Likewise, increasing temperature favours Shrub Steppe and decreasing Temperature results in Alpine Steppe.

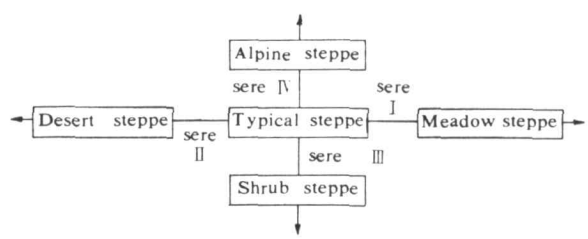


Fig. 2 Ecological series of steppe types

Increasing humidity in sere Ⅰ
Decreasing humidity in sere Ⅰ'
Rising temperature in sere Ⅲ
Droping temperature in sere Ⅳ

2. **Meadows**

According to their habitats, the meadows are classed in three types; Typical Meadow, Marsh Meadow, and Salt Meadow.

(1) **Typical Meadow** occurs as a type under somewhat moister conditions than Meadow Steppe, and is located in the forest zone proper as well as in and near the zone of transition to forest. The dominant plants are mesophytic forbs. Members of the *Liliaceae* are common, particularly *Lilium dauricum* and *Hemerocallis minor* both of which are widely distributed in Typical Meadows of far eastern Asia.

(2) **Marsh Meadow** occupies imperfectly drained low-lying habitats throughout the grassland region and also in

The typical cushion plants in the Alpine Steppe—rockjasmine—scatter on the Tibetan Plateau where the altitude is 4,500 meters.

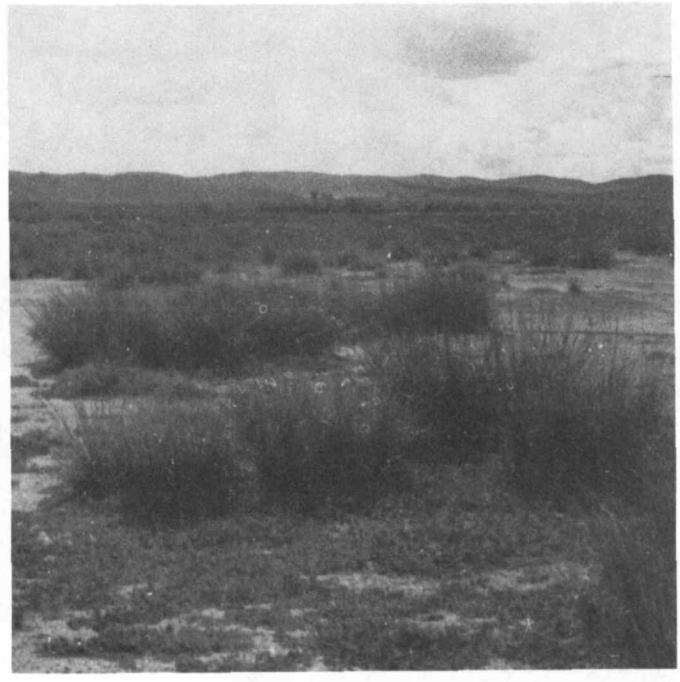
the forest region. The vegetation is composed of hygrophilous herbs, mostly of the *Cyperaceae* and particularly species of *Carex* and *Kobresia.*

Sedge Marsh Meadow covers the beaches of lakes and basins between mountains of Tibet-plateau, and the sedge makes up many hillocks.

(3) **Salt Meadow** characterizes saline and alkaline low-lying areas in various parts of the grassland and desert zones. The vegetation consists of salt-tolerant herbs such as the widespread dominant *Achnatherum splendens* that reaches heights of 120 to 200 cm.

Characteristics of the Grasslands

Various characteristics distinguish these grasslands from others in the North Temperate Zone. Ephemeral plants are



Achnatherum splendens *salt meadow covers the alkali-saline soil in the semiarid region of China. There is much salt efflorescence on the soil surface and grasses are sparse.*

absent because of the long winter coupled with a short but dry and windy spring. Because 60 percent of the annual precipitation coincides with the warm season, a midsummer dormant season does not occur. Therefore, plant growth is concentrated in the period June to August when a single peak in the production curve occurs.

Climatic conditions greatly affect certain characteristics of the vegetation that are important to livestock production (Table 1).

Table 1. Nutrient contents of herbs in various steppes (%).

Type	Coefficient of humidity	Crude protein	Crude fat	Crude fiber	Nitrogen-free extract	Ash
Meadow steppe	0.6 -1.0	6.63	3.29	23.27	49.25	4.96
Typical steppe	0.3 -0.06	13.16	2.93	28.66	30.16	5.80
Desert steppe	0.13-0.3	14.78	2.92	28.13	29.51	6.05

With increasing dryness, protein content of the herbage increases while N-free extract decreases. Herbage with high C to N ratios in Meadow Steppes is well suited to production of cattle, while Typical Steppes and Desert Steppes are better for grazing sheep to produce wool. Camels can make good use of the herbage of Dessert Steppes which has high ash content.

Development of Grassland Agriculture

Grassland agriculture has developed rapidly in China

since the mid-century, based on a combination of natural and seeded forages. The value of outputs from grassland agriculture in 1983 was 10 times that in 1949, and it presently amounts to more than 15 percent of the gross value of all agricultural products (Table 2). The proportion is expected to continue to increase to 20 percent by 1990 and to 40 percent by the year 2000.

Table 2. Output of grassland agriculture compared to the total agricultural output in China, for selected years 1949 to 1983.

Year	Grassland agriculture (billion yuan)	Percent of total value of agricultural Production
1949	3.37	12.4
1957	6.90	12.9
1962	4.45	10.3
1965	8.27	14.0
1975	17.94	14.0
1978	19.30	13.2
1979	22.12	14.0
1980	23.67	14.4
1981	35.96	15.2
1983	30.70	15.5

Cropland agriculture has been so successful in my country that it provides an adequate diet of plant foods to nearly one-fourth of the world's human population from only 7 percent of the earth's total arable land. This success has recently increased the demand for more meat, milk, and eggs (Fig. 3).

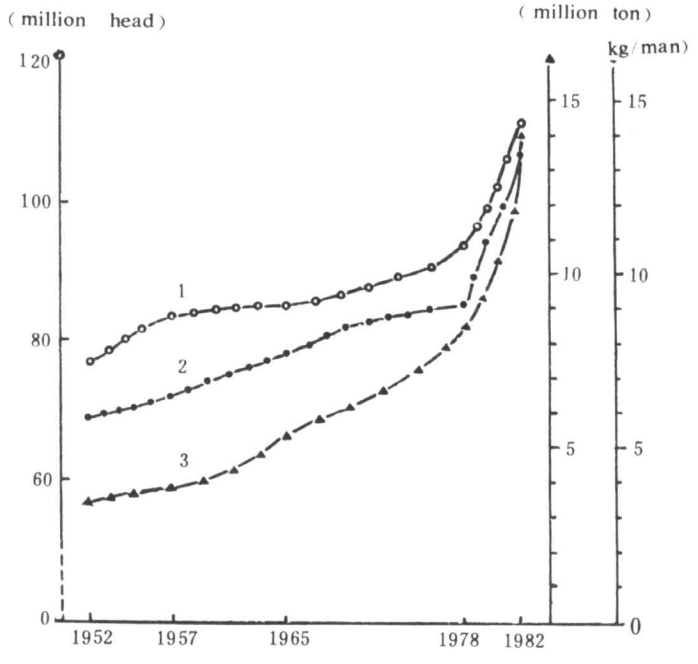


Fig. 3 Number of large stock(1), meal production (2) anb mean meal consumption of per man (3) in China.

The products of grassland agriculture are also important for export, contributing about one-seventh of the gross value of Chinese export trade. This figure is expected to increase further as a result of China's open trade policy. Thus grassland agriculture is expected to play an increasingly important economic role, particularly in the development of western China.

Because of population distribution, economic development is likely to be focussed on sparsely settled grassland areas for the rest of this century. In the northwest nearly one million km^2 of grassland with high potential are not at present fully utilized. Even in those grasslands that are presently in use, replacement of the current unrestrained grazing practices with a system of rest-rotation grazing in fenced areas is expected to increase herbage production by 20 percent.

Emphasis is being given to selection, breeding, and experimental seeding of forage crops. More than 30 seed-production centres have been established that now supply in excess of 17,000 tonnes of forage seeds per year.

Some 7,000 km of shelterbelts have been planted in northern China to control soil erosion.

A recently developed feed-processing industry supplies more than three million tonnes of mixed feed and formula per year.

On rangeland, attention is being given to additional means of increasing stocking rates. Expansion of the area of seeded grassland, which at present is only one percent of the area of the natural grassland, would assist greatly in the further development of grassland agriculture.

Progress has been made in research and teaching in the area of grassland ecology and grassland science. Units for grassland research, grazing resource surveys, and extension services to herdsmen have been established at national, provincial, and county levels. Departments of grassland science have been established at four major educational institutions, and this discipline is included in the curricula of about 20 other universities and agricultural colleges. To support research and education, the Grassland Society of China was established in 1980.

Despite the advances mentioned above, a large difference exists between the importance of of China's extensive grasslands and the minimal scientific resources so far assigned to their study. The nation has about 1,000 grassland scientists; only one for every 300,000 ha of grassland.

If the goal of expansion of grassland agriculture is to be reached, major support will be needed to train more and better qualified grassland scientists, and to support more specialized research on grassland ecosystems. ●