



major food production systems

- Background: Harvesting barley (crop dominated system)
- *Nyima Tashi*
- Top Inset: Combined harvester harvesting wheat crop in Tibet
- *Tej Partap*
- Bottom inset: Harvesting winter wheat (Duilong County)
- *Nyima Tashi*



Harvesting season in Central Tibet - Nyima Tashi

Major Food Production Systems

The law of regional differentiation is the theoretical base for delineating zones for food-production systems. Food-production systems are determined by land characteristics and human requirements for food. Land characteristics decide what types of food and how much of them can be produced. Human requirements determine what kinds of food and how much of them need to be produced.

Socioeconomic development in Tibet depends upon farming. Cropping, livestock raising, and forestry, which depend on biophysical conditions, are the predominant economic sectors and land uses. In some areas, raising livestock is the only means of producing food, and in others all three are integrated. Intensive and extensive adjustment of land-use patterns has not been carried out. This means that food-production systems are determined by natural, biophysical conditions according to human requirements. Therefore, socioeconomic data related to food production were used to delineate different zones of food-production systems. Contributions of crops, livestock, and forestry to the gross agricultural-production value were considered key indicators.

Delineating Food-production Systems

Maintaining the integrity of the administrative region or county was necessary to incorporate the delineated zone into the decision-making process for planning and development of agriculture. However, there also had

to be basic similarities in natural conditions and socioeconomic situations, and similarity in the status of food production or farming. Finally, there needed to be relative consistency of development perspective in food production or farming.

To understand the production system, a county administrative map was created using a geographic information system (GIS). Separate databases for production value of cropping, livestock, and forestry were built. By using the following formulae, the proportion of cropping, livestock, and forestry production value in total agricultural-production value — and an index of comparative advantage of cropping, livestock, and forestry for each county — were calculated and a database established. The results were linked with the county administrative map.

Proportion of X = (X production value / total agricultural production value) × 100%

K = (X production value of a county / total agricultural production value of a county) / (X production value of Tibet / total agricultural production value of Tibet)

Where X means crop, livestock, forestry, fishing and K means the index of comparative advantage of a farming activity component of a county.

As fishing is limited and the percentage of fishing production value in total agricultural-

production value is nearly zero, it was not compared with others or used in the delineation of food-production systems.

According to the percentage of cropping, livestock, and forestry production value in total agricultural-production value, and the index of comparative advantage of each sector (Table 4.1), it was possible to delineate four major food-production systems/farming systems of Tibet (Figure 4.1). These four zones are a pastoral production system zone, a crop-dominated production system zone, an agro-pastoral production system zone, and an agro-pastoral-forestry mixed production system zone. The crop-dominated production system zone is situated in the centre of Tibet among 18 counties. The pastoral production system zone is in northern Tibet among 17 counties. Between these is the agro-pastoral production system zone with 27 counties. The agro-pastoral-forestry mixed production system zone consisted of nine counties in south-eastern Tibet.

Although Tibet has been divided into four major food-production systems, there is still great diversification within each production system, particularly in the crop-dominated production system. Almost all households raise livestock and diversify activities to generate income and ensure food security. Further delineation of subsystems was not possible owing to lack of sufficient data.

Counties belonging to each food-production system are listed in Table 4.3, along with their prefectures. Most counties in Naqu and Ali prefectures belong to the pastoral food production system/farming system; counties in Linzhi Prefecture are in the agro-pastoral-forestry mixed production system. Counties in Lhasa Municipality mostly fall under the crop-dominated production system. Shigatse and Shannan prefectures are divided into the crop-dominated zone and the agro-pastoral zone.

Food resources, food supply, and the main features of food consumption in each food-

Table 4.1: Data derived from delineated map for each food-production system

Index	Crop-dominated production	Agro-pastoral production	Pastoral production	Agro-pastoral forestry mixed production
Proportion of crop production value in TAPV (%)	72.9	46.3	4.2	42.2
Proportion of livestock production value in TAPV (%)	25.9	47.9	95.8	36
Proportion of forestry production value in TAPV (%)	1	1.2	0	19.6
CAI of crop production	1.4	0.9	0.1	0.9
CAI of livestock production	0.6	1.1	2	0.6
CAI of forestry production	0.3	0.4	0	6.7

Notes: TAPV = total agricultural-production value; CAI = comparative advantage index.

In the process of delineation, adjustment of a particular county was done on the basis of land-use patterns and the requirement for regional continuity. Materials from the Tibetan Bureau of Land Planning (1992a; 1992b) were used as references.

Climatic data were collected for the main ecological zones in each food-production system. There are distinct differences in terms of temperature, precipitation, evaporation, and humidity (Table 4.2).

production system are described in Table 4.4.

Crop-dominated production system zone

The crop-dominated zone includes the majority of Lhasa Municipality and some counties of Shigatse and Shannan prefectures. It is located in the river valleys of the middle reaches of Yalongzangpo (Brahmaputra) River and its two tributaries, Lhasa Stream and Nyachu Stream (known locally as 'One River, Two Streams').

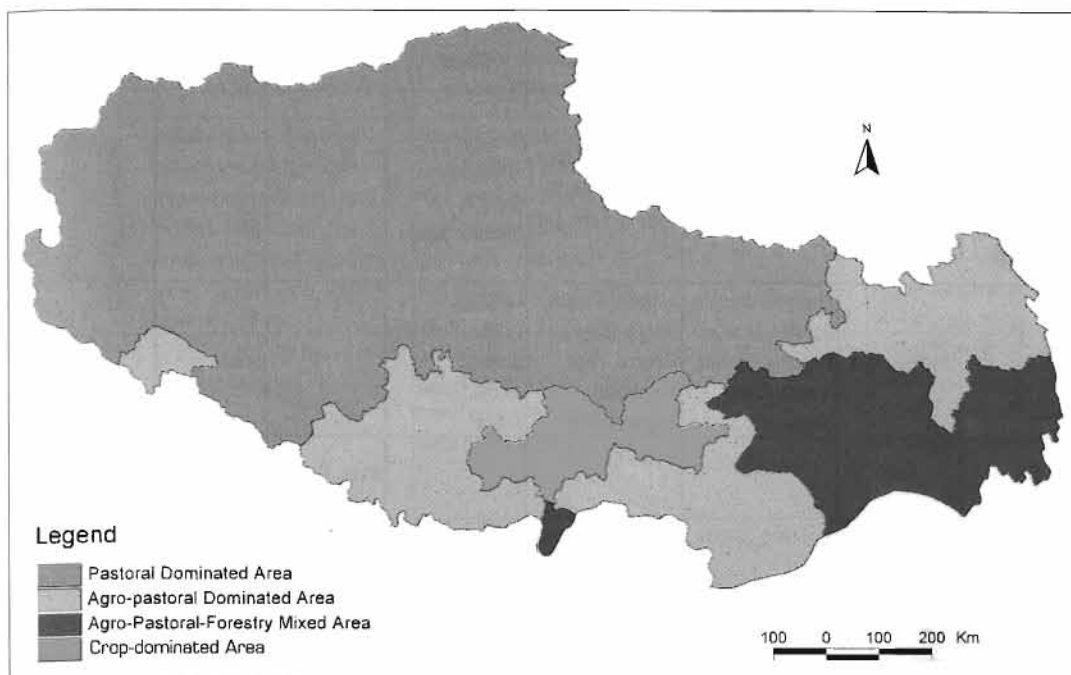


Figure 4.1: Food-production systems in Tibet

Table 4.2: Climatic data for each food-production system

Systems	Annual mean temp. (°C)	Annual mean evaporation (mm)	Annual mean rate of sunshine (%)	Annual mean precipitation (mm)	Annual mean relative humidity (%)	Average temp. range day to night (°C)	Annual mean minimum temp. (°C)	Annual mean maximum temperature (°C)
Crop-dominated production system	7.0	2,425.5	70	390.7	43	15.3	(-0.3)	15.1
Agro-pastoral production system	3.0	1,878.5	63	422.5	54	14.0	(-2.9)	10.9
Pastoral production system	-0.5	1,924.3	65	382.0	46	14.8	(-7.5)	7.3
Agro-forestry-pastoral mixed production system	8.3	1,641.1	44	679.5	62	13.3	2.8	16.1
Tibet on average	4.5	1,967.3	60.5	468.7	51.6	14.3	(-2.0)	12.3

Table 4.3: Counties in each food-production system

Production system	Lhasa	Changdu	Shigatse	Shannan	Naqu	Ali	Linzhi
Crop-dominated production system	Linzhou, Dazi, Lhasa City, Qushui, Duilongdeqing, Nimu		Nanmulin, Renbu, Jiangzi, Shigatse, Bailang, Sajia, Lazi	Gongga, Zhannang, Qiongjie, Naidong, Sangri			
Agro-pastoral production system	Mozhugongka	Changdu, Jiangda, Gongjue, Leiwuqi, Dingqing, Luolong, Bianba, Chaya, Basuo	Kangma, Gangba, Dingjie, Dingri, Nielamu, Saga, Xietongmen, Angren, Jilong	Langkazi, Luozha, Cuomei, Qusong, Jiacha, Longzi, Cuona		Pulan	
Pastoral production system	Dangxiong		Zhongba		Naqu, Biru, Jiali, Suoxian, Anduo, Shengzha, Bange, Baqing, Nima	Zhada, Ritu, Geji, Gaer, Gaize, Cuoqing	
Agro-pastoral forestry mixed production system		Mangkang, Zuogong	Yangdong				Linzhi, Milin, Gongbujiangda, Langxian, Bomi, Chayu, Muotuo

The total area of this production system is 55,900 sq.km, and the area of arable land is about 180,100 ha, accounting for about 50.5% of the total arable land in Tibet. It contains only 6.5% of the total area of rangelands in Tibet. Cropping, livestock, and forestry account for 73%, 26%, and 1% of the total agricultural production value, respectively (Figure 4.2), and the indices of comparative advantages of cropping, livestock, and forestry are 1.44, 0.62, and 0.33, respectively (Table 4.1). Cropping is generally combined with livestock raising. The main production is food grain and rape seed. This area is the source of commodity food grain.

The average altitude is 3,800m. The area has high solar radiation and long hours of sunshine. The average annual radiation is 191 kcal cm⁻². The percentage of sunny days is over 70% and the amount of annual

sunshine is 3,000 hr. The weather is cool, with seasons that are not clearly demarcated. There is great difference between day and night temperature but little fluctuation from year to year. The average annual temperature is about 7°C, and the daily temperature variation is 15.3°C. The average temperature is 15.1°C in the warmest month and -0.3°C in the coldest month. Precipitation is mainly concentrated in late summer and early autumn. Dry and rainy seasons are clearly demarcated, and most rain falls during the night. The average annual precipitation is 250-450 mm except for the north-eastern part with higher elevation where average annual rainfall reaches 550 mm. Precipitation in this zone is not distributed evenly either spatially or seasonally, with 90% occurring during June to September and 80% falling during the night. Spring and winter are dry, with annual average relative humidity of

Table 4.4: Food resources and supply in each food-production system

		Crop-dominated production system	Agro-pastoral production system	Pastoral production system	Agro-pastoral forestry mixed production system
Crop-based food production	Main food sources	Barley (spring & winter), wheat (spring & winter), rape seed, potatoes, buck wheat, faber bean, maize, peas, vegetables (glasshouse & non-glasshouse), apples, peaches, pears	Naked barley (spring), wheat (spring & winter), rape seed, potatoes, buckwheat, peas, vegetable (glasshouse & non-glasshouse), peaches	Early matured naked barley, rape seed, peas, buckwheat, vegetables (short season)	Naked barley (spring & winter), wheat (spring & winter), rape seed, potatoes, buckwheat, faber bean, maize, peas, vegetables and all kinds of fruit, tea, etc.
	Situation of food supply	Supplier of crop-based food, surplus exported	Self-sufficient in crop-based food, but importing some crop based food from other areas of Tibet	Importer of crop-based food	Self-sufficient in crop-based food, but need to import some crop based food from other areas of Tibet.
Livestock-based food production	Main food sources	Yak, cattle, sheep, goats, pigs, chickens, ducks, fish, etc.	Yak, cattle, sheep, goats, pigs, chickens, fish, etc.	Yak, sheep, goats, fish, etc.	Yak, cattle, sheep, goats, pigs, chickens, ducks, fish, etc.
	Situation of food supply	Importer of livestock-based food	Self-sufficient in livestock-based food, and export some to other areas of Tibet	Supplier of livestock-based food to other areas of Tibet	Self-sufficient in livestock-based food, but importing some livestock products from other areas of Tibet
Food consumption structure		Consume mostly grain; lack of meat, milk, eggs, vegetables and fruit in diet	Mostly grain and meat, lack of vegetables and fruit in diet	Mainly meat, milk and grain, lack of vegetables, fruit, and grain in some cases	Balanced food consumption structure (grain, meat/milk, and vegetables)

43%. Strong sunshine and wind, especially during the spring, lead to high annual evaporation of 2,425.5 mm, almost 10 times more than precipitation. Crops in this zone are prone to drought during the spring and flooding during the autumn. In higher areas, crops are damaged by both spring and autumn frost, and by hail in late summer and early autumn.

A little over 50% of the arable land and 51% of the urban area of Tibet are in the crop-dominated zone. Rangeland, forest, orchards, and water cover relatively small areas, accounting for 6.5, 0.9, 0.9, and 2.8% of the total area of each land type in Tibet, respectively. Arable land accounts for only 3.06% of the total area of the zone, whereas rangeland covers about 73.8%. Forests and orchards

occupy 2.03 and 0.06%, respectively, and barren land covers 18.2%. The remainder of the land area is covered by water bodies and roads. Tibet has only a small area of arable land compared to rangeland and barren land, and it is mostly distributed in this zone. Most of the urban area is also concentrated here. It is predominantly a crop-based food production system, but there is also considerable livestock raising — mainly cattle, sheep, and goats. Crops and livestock co-exist in this crop-dominated zone of Tibet.

This zone accounts for over 56% of Tibet's grain production and 70% of rape seed production. The main crops are barley, wheat, rape seed, peas, and potatoes, which occupy 46, 16, 5, 7, and 5%, respectively, of the total cropping area. In the upper, drier

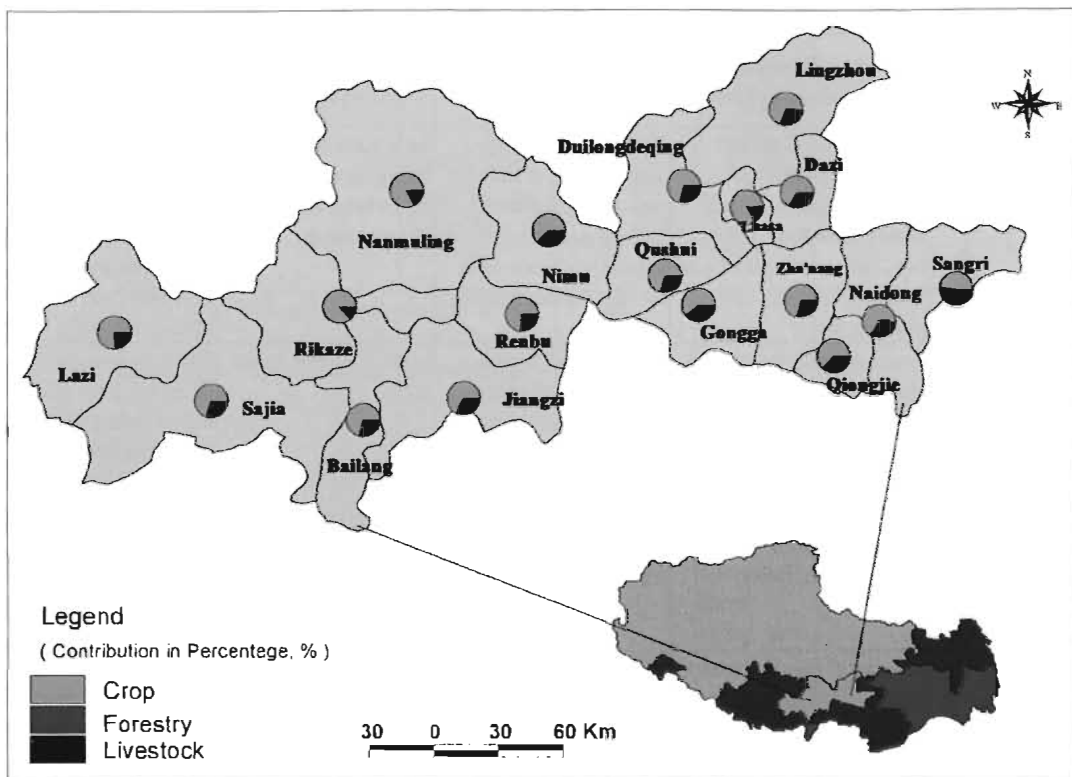


Figure 4.2: The proportions of cropping, livestock, and forestry in total agricultural production value in the crop-dominated production system of Tibet

shrinking. Vegetable farming is increasing rapidly with the development and promotion of greenhouse-vegetable cultivation. Many local farmers rent their cropland to Chinese farmers from central China to grow greenhouse vegetables. After a few seasons of working with the Chinese farmers, local farmers have now started growing greenhouse vegetables by themselves. At present, more than 45% of Tibet's total vegetable supply is produced from this zone. Many kinds of fruit trees, such as peach, apple, and plum, and so on, can be grown. Some orchards were established during the 1960s and 1970s, but now most have been abandoned or turned into cropland because of low productivity and competitiveness with imported fruit in the free market. Selection of new, high-quality fruit tree species and varieties for this area is becoming increasingly important and could be an alternative for local farmers for generating income.

Although cropping dominates the economy of this zone, raising livestock is also an important activity. The number of animals, meat, and milk produced here comprise 16, 16, and 22%, respectively, of the totals for Tibet. Yak, cattle, sheep, goats, pigs, and chickens are the main animals. Pastureland has relatively poor productivity as it lacks irrigation and precipitation. Raising livestock depends mainly on the use of crop residues and by-products as feed, especially during the spring and winter. Yak and zo are the main draught animals. In the lower river valleys, milk is mostly from cows but on higher lands yak milk is the main dairy product. Driven by demand for pork and poultry products in urban areas, the raising of pigs and chickens has increased rapidly in recent years. However, large amounts of poultry and pork products are imported from other parts of China. Compared to other areas of Tibet, the crop-

dominated zone is important for production of cereals. Over 70% of the total food grain production is from this area, and there is considerable surplus of cereals, oilseed, and vegetables that supplies other areas. Although a large number of animals produce large quantities of meat and milk, as the zone has over 56% of Tibet's population, there is a severe deficit of livestock products, particularly meat and milk. More than 76% of all meat and milk consumed has to be imported.

In this zone, people consume mostly grains, little meat, and milk as butter tea. In the rural zone, there is a severe shortage of eggs, vegetables, and fruit in the diet. In terms of energy intake, barley makes up over 77% for farmers. In urban areas, wheat and rice consumption is increasingly common, and those grains account for 35% of the total energy intake.

Agro-pastoral production system zone

This production system or zone includes northern Changdu, north-western Shigatse, and southern Shannan prefectures, including 27 counties. It is located in the upstream valleys of the Yalongzangpo, Cuona, Longzi, Nujiang, Lancangjiang, and Jinshajiang rivers. The production value of crops and livestock is 46 and 48%, respectively, of the total production value of agriculture, and forestry output value is 1.22%. The indices of comparative advantage of cropping and animal husbandry are 0.95 and 1.09, respectively, and forestry is 0.40. In this zone, there are lakes with high reserves of fish, such as Yangzhuo Cuo and Cuona Cuo. However, local cultural belief prohibits fisheries. Therefore fishing has not been developed to bring any economic benefit to local people. It is a typical mixed crop and livestock, agro-pastoral production system zone.

The agro-pastoral system is spread over most of the cold semi-arid highlands. The average elevation ranges between 4,000-4,500m. The climate is similar to that of the crop-dominated zone, but spring temperatures rise more slowly, autumn temperatures decrease

earlier, and the frost-free period is shorter. The annual average temperature is 3°C, average temperature in the hottest month is about 10.9°C, and in the coldest month - 2.9°C. The temperature difference from day to night is 14°C, much higher than that of season to season. Precipitation is concentrated in summer and the beginning of autumn, and the percentage of night rainfall is high. The average annual precipitation of 422.5 mm is slightly higher than that of the crop-dominated zone. Most of this area is dry in spring and winter. Dry and rainy seasons are clearly demarcated. There is abundant sunshine. The percentage of annual sunshine is 63%. The average relative humidity of air is 54%, and annual evaporation is 1878 mm. This zone suffers from natural disasters such as gales, frost, hail, snow, and so on. This severely restrains the development of agriculture and food security for local people.

This zone covers 291,300 sq.km, 24.3% of Tibet. The percentages of each land use are 0.06% arable land, 54.4% rangeland, 1.3% forestry land, 0.01% orchard, and 17.5% barren land. The percentages of arable land, rangeland, forest, and barren land for Tibet as a whole are 36.9, 24.4, 42.0, and 18.1%, respectively. Affected by the cold and high altitude, most land resources are rangeland and barren land. Widespread crop production is limited by the high altitude and cold climate, and livestock production is undertaken instead. Large amounts of farm land have been cultivated in lower valleys of the zone. In river valleys, small-scale forestation has been carried out using willow and seabuckthorn. In a few counties in the lower area, apple and peach trees are grown on a small scale. However, the general picture of this area is of a food-production system in which livestock (cattle, sheep) have equal importance with crop farming.

Barley is the predominant grain crop, accounting for over 65% of the total area of cropland. In lower parts, spring wheat is grown where possible. Peas are the only pulse grown, and are important as the main

pulse grown, and are important as the main source of plant protein for both humans and animals. The total sown area of peas and the total production of the pea crop make up over 55 and 47%, respectively, of that in Tibet. Both sown area and production of grain comprise 30% of the total in Tibet. Many varieties of peas are well adapted to the local environment. Pea grain is mostly used for human food, usually mixed with barley. It is also used as feed for animals, particularly horses. Pea straw is considered locally as the best feed for animals. Mixing barley straw with pea straw is commonly practised. Most farmers grow peas with barley or rape seed. Potatoes and small areas of vegetables, both in greenhouses and outside, are also grown.

Cattle, yak, sheep, goats, and chickens are the main livestock animals. The number of animals, production of meat, and production of milk are 47, 45, and 40%, respectively, of the totals for Tibet. Vegetable, fruit, and poultry production are limited by local environmental conditions. With the exception of these, this zone is generally self-sufficient in food. Small quantities of barley grain are imported from other parts of Tibet and exchanged for meat and other animal products. Barley and mutton meat are the main sources of energy for local farmers. There is a severe lack of vegetables and fruit in the local diet.

Pastoral production system zone

The Changtang, the vast open land of the northern Tibetan Plateau includes the entire territory of Naqu Prefecture, most of Ali Prefecture, and Dangxiong County of Lhasa Municipality, and makes up the pastoral area. Altogether it includes 18 counties. It is surrounded by the Kunlun Mountains in the north-west, the Gandisi Mountains in the south-west, the Nianqingtanggula Mountains in the south-east and the Tanggula Mountains in the east. It occupies almost 60% of Tibet, with a total area of 711,000 sq.km.

Livestock production is the predominant industry in this zone, accounting for over

95% of the total value of agricultural output. Cropland, basically given to barley and rape seed, has been cultivated since the 1960s in the lower river valleys of the southern region, but even today its percentage of total agricultural production value does not reach 5%. There is hardly any forestry in the north, although small areas of forest are scattered in the far south and lower river valleys. Pasture and livestock production are the basis for food and livelihood security for herders in this zone.

Biophysically, this area is characterised as a semi-humid temperate or a semi-humid cold zone. With an average elevation of 4,600m, it is cold and dry all year round. The annual average temperature is lower than 0°C, with an average of 7.3°C in the hottest month and -7.5°C in the coldest month. The daily temperature difference from night to day is greater than that of season to season, and reaches 14.8°C. Precipitation is greater in the east than the west, with an annual average of 382 mm. The majority of the north-western part is cold, dry, semi-desert land and unpopulated. Owing to high, strong solar radiation, long sunshine period (65% of the year), and strong winds or gales, the evaporation is high with an annual total of 1924 mm and relative air humidity of 46%. These harsh natural conditions, unfavourable climate, and a lack of oxygen seriously restrict production of food. Cropping is impossible in most of areas of this zone, and even animal husbandry is restrained by the harsh natural conditions. Moreover, disasters such as windstorms, hail, and frost are frequent, and nomads in particular often suffer from snow calamities. Heavy snow in late 1997 and early 1998 almost resulted in the collapse of the food production system. Nearly 50% of the livestock died. Food security for these nomads was threatened and many plunged into poverty despite having been rich before.

As a result of the harsh biophysical conditions, there is hardly any place suitable for cropping or forestry. Over 67% is rangeland

and 20% is barren land. This accounts for 63.8% of the rangeland and 71.7% of the barren land in Tibet. Most of the lakes in Tibet are distributed in this zone. Almost 60% of Tibet's total water surface area is here. Salt lakes provide an opportunity for herders to exchange salt for food and other necessities. It used to be a major trade for nomads but now is dying out. Fishing could generate income. It used to be practised in some places but now there is hardly any, possibly due to religion and marketing. However it can become a viable source of livelihood in this zone. Collection of herbs is increasing where possible, and is becoming a main source of additional income for households. Overexploitation, driven by market demand, is beginning to appear. Some nomads hunted traditionally as part of the livelihood system. Unique and rare wild animals fetched good value in the market. Since the Changtang Conservation Area has been established, hunting has been declared an illegal activity although it has not been fully controlled yet.

Alternative food resources are limited in this zone. There are hardly any crops, except early-maturing barley, rape seed, and peas. These are low yielding and restrained by climatic conditions. Livestock depends totally on grazing, as there is little production of forage and hay. In the eastern part, rangeland is dominated by highland meadows and swampy meadows. These are relatively productive and can support large grazing animals. The yak is predominant. Over 40% of the total number of livestock (or 80% of livestock in sheep-equivalent units) is yak. Yak provide almost 80% of meat and milk, and 70% of the income for nomads. In the west, rangeland is mainly alpine steppe and alpine desert steppe. Constrained by water scarcity, low precipitation, and low temperatures, the productivity is low. It cannot support large ruminants, but local sheep and goats are well adapted to the conditions. Figure 4.3 further illustrates the difference between the eastern and western parts of this zone. It is clear that there is a larger proportion of yak meat production in

the eastern than in the western part of the zone.

For the last few decades, particularly during the 1960s and 1970s, reclamation and cultivation of cropland have been undertaken where possible. The idea was to grow food grain locally to solve the problem of shortages and to avoid the heavy cost of transportation. Unfortunately, many attempts failed as there are no suitable varieties of barley, rape seed, or turnip, and herders do not have the knowledge to manage farm land. A few farmers succeeded in growing cereals and oilseed where there were favourable microclimatic and environmental conditions such as in lower river valleys and on the banks of lakes. Those who gained knowledge and experience in growing crops later went to other counties to reclaim land for cropping. Cropland in both eastern and western parts increased rapidly during the 1970s but decreased considerably after the 1980s. One important lesson learned was that this frigid and fragile land often cannot maintain its productivity when cultivated because decomposition of organic matter is difficult. Large amounts of farm land were abandoned and became useless for both cropping and grazing. Recently, with the introduction of new varieties of barley that can adapt to local conditions and improvements in crop management, new attempts to achieve food grain self-sufficiency have been made in areas such as Ge'er, Suoxian, Biru, and Geji counties. However, food grain and oilseed production in this zone have never reached even 1% of that in the whole of Tibet. Raising livestock is still the essential means for sustaining livelihood. This zone currently supplies over 36% of the meat, 47% of the milk, 56% of the sheep wool, and 40% of the sheep leather for the whole of Tibet.

Exchanging animal products for cereals and oilseed or edible oil is a common practice. Before 1992, it was done by the herders themselves with subsidies from the government. Recently, private businessmen have begun exchanging animal products for

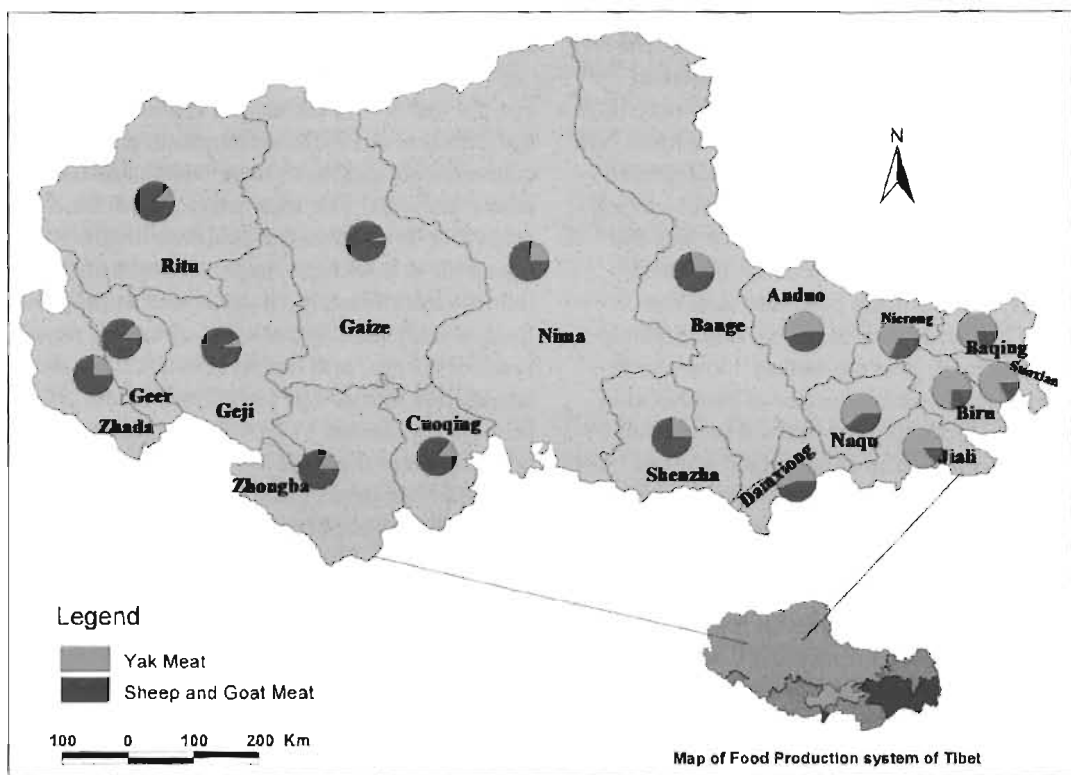


Figure 4.3: Production of yak meat and sheep and goat meat in the pastoral food production system

considerable amounts of barley and wheat, which make up 83% of their total energy intake. Most nomads generally feel comfortable only when they have at least 12 yak or 50 sheep, or 60 sheep-equivalent units, per person in the family, and enough tsampa. Meat and milk are sufficient in most nomads' diets. They can live without barley in their diet. Severe lack of vegetables, fruit, and poultry products is common in the nomadic area.

Agro-pastoral-forestry mixed production system zone

This production system is prevalent in the middle valleys of the Niyang, Nujiang, and Lancangjiang rivers. It includes the entire Linzhi Prefecture, and Mangkang County and Zuogong County of Changdu Prefecture. It has 10 counties altogether. The total land area is 142,100 sq.km, and it occupies 11.9% of Tibet. The percentages of cropping, livestock, and forestry production value to

total agricultural output value are 42, 36, and 19%, respectively (Figure 4.4). The comparative advantage indices of cropping, livestock raising, and forestry are 0.94, 0.68, and 6.72, respectively. Compared to other production system zones of Tibet, forestry has a greater advantage in this zone, which is the major forestry area of Tibet. There is also scope for crop and livestock production in the more favourable environmental areas. Cropping, livestock raising, and forestry co-exist and are fundamental to ensuring food and livelihood security.

Affected by topography and atmospheric circulation (the monsoon from the Indian Ocean), the climate varies both horizontally and vertically. Vertical differentiation of climate and vegetation are much more overwhelming than horizontal differentiation, and greater than in the other three food-production systems. Climatic variation ranges from hot and humid in the south, to warm

and humid in the middle range, to temperate semi-humid in the north, and even to frigid arid at higher altitudes. In general, the annual average temperature is about 8.3°C. Average temperatures of the warmest and coldest months are about 16.1°C and 2.8°C, respectively. Precipitation reaches 679.5 mm on average, with a high of up to 800-1,000 mm. The daily temperature difference is wide, on average reaching 13.3°C. Relative humidity reaches 60%. The number of sunshine hours is much lower than in the rest of Tibet, with 44% sunshine. Evaporation in this zone is much lower than elsewhere at about 1,641.1 mm.

Over 38% of the land is suitable for forestry, 27% can be developed into rangeland, and 0.03% is arable. Almost 20% of the land is barren or land that is frigid and snow-capped. This zone accounts for 62.7% of the total land that can be used for fruit farming in Tibet and 55.3% of forest land. Arable land and rangeland account for 10.7 and 5.4%,

respectively, of their total areas in the whole of Tibet. Orchards and forestry have the potential to promote food security and improve the economic situation. Forestry has become one of the pillars of economic development in Linzhi Prefecture since the late 1980s (Dan Zhixu 1990).

With its many rivers and great vertical changes in vegetation, this zone is abundant in ecosystems and biodiversity. Richly endowed by the natural environment, there is wide scope for diversifying agricultural activities for generating income. There are many kinds of crops and animals. The food-production system has developed over a long time, typically incorporating different resources through cropping, livestock-raising, and forestry. Farmers here are much better off than in the rest of Tibet. Most are self-sufficient in both livestock and crop-based food production. There is a more balanced intake of food in this zone than in others.

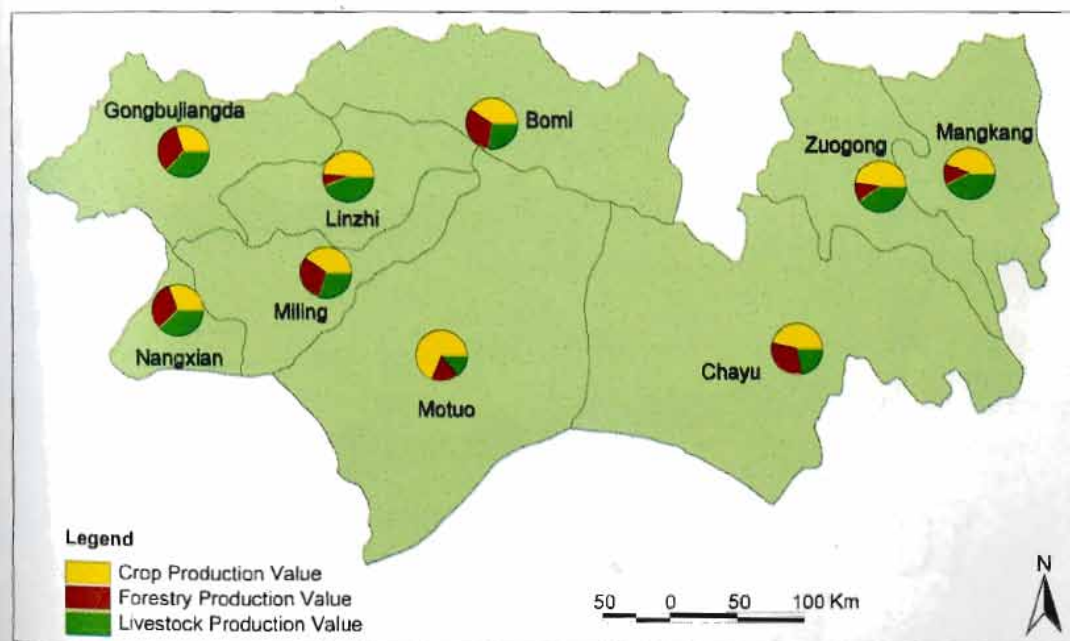


Figure 4.4: Production value of crops, livestock, forestry, and fishing in the agro-pastoral-forestry mixed production system



Cattles grazing near farmland (Agro-pastoral system) - Nyima Tashi



A block of yak in Naqu - Nyima Tashi