State and Environment in the Ordos Loop (8th–early 9th Century CE)

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Abstract
This chapter explores the intersections of Tang imperial institutions and environmental adaptation to the Ordos Loop's ecological and climatic constraints. It investigates Tang state policies from the eighth to the early ninth centuries, including agricultural land reclamation, horse trade, military provisioning, transportation, and the resettlement of military and civilian populations, aimed at consolidating control on the northern frontier. In the chapter, I argue that instability in agricultural labor and low agricultural output of the military farms (*tuntian*) contributed to the decline of the military population in the mid-8th century. In response, the Tang state relocated agropastoral-military groups into the Ordos Loop. Despite persistent challenges, exacerbated by a prolonged drought and floods in the early ninth century, the state continued to invest in civil resettlement and local farming, even as low productivity discouraged agricultural engagement. Resource allocation persisted, particularly in the loop's eastern region.

By integrating historical and hydroclimatic data, I highlight the importance of examining how imperial institutions addressed environmental challenges and climate variability in the empire's semi-arid peripheries. A persistent tension existed between military priorities and agricultural sustainability. Soldiers, often inexperienced farmers, and displaced civilians, who were slow to resettle, struggled to sustain production. The mid-8th-century decline in the army was not only a consequence of troop redeployments from the frontiers to suppress the An Lushan Rebellion. Instead, it likely stemmed from structural weaknesses within the military-agronomic system itself, further exacerbated by a disregard for environmental and climatic constraints, thereby undermining long-term sustainability. The state prioritized securing the northern frontier, compensating for western territorial losses, and cutting transportation costs by exploiting local resources. This approach persisted even when hydroclimatic factors substantially limited what could be realistically achieved.

Keywords: Tang, Ordos Loop, Shuofang, Citadels for Subjugation (Shouxiang cheng), military farms (*tuntian*), Yellow River, floods, agropastoral groups, land use, agriculture, transportation, horses

1. Introduction

Flowing northward from the Qinghai Plateau, the Yellow River reaches the southern fringe of the desert before bending eastward around the Ordos Plateau, where it divides into two branches. The northern branch loops northward before turning eastward and flowing about 320 kilometers south of the Yinshan Range. Both branches then merge at the southwestern edge of Wula Mountain, and the river continues its eastward course. During the Tang dynasty (618–907 CE), the northern branch, now called the Wujia River, was the main course of the Yellow River (Li et al. 2003; Zhao 2011). The land within its course, now the Houtao Plain, and much of the floodplain within the Ordos Loop, also known as the Hetao Plain (an area significantly smaller in both length and width compared to the Po Plain in northern Italy), supported some agriculture, particularly where irrigation from the Yellow River enabled crop cultivation, and mainly pastoral activity. The flat alluvial plain was the first extensive area suitable for grazing that pastoral groups from the Yinshan region encountered after crossing the mountain passes. Herders and mounted warriors rested here, allowing their horses and other animals to graze as they awaited the winter freeze on the Yellow River, so they could cross to the southern bank (*Quan Tang wen* 630.6353). In the early eighth century, the Tang built a line of fortified citadels, known as the Citadels for Subjugation (Shouxiang cheng), at strategic mountain passes to cut off Yinshan-based Turkic groups' access to the Ordos and metropolitan regions, creating a complex of fortresses located near mountain and river passages and connected from afar by a line of almost two thousand beacon fires (see Fig. 5.2). The citadels became military centers and hubs for the economic interaction with the steppe polities to the north, and with the eastern Tianshan region, offering lodging and food to envoys, merchants, and travelers along the routes connecting the Tang metropolitan core region (*Yuanhe junxian tuzhi* 4.21; *Tongdian* 198.5438; Skaff 2012; Chen 2014; Wen 2023).

In this chapter, I explore the Tang state's expansion and contraction (agricultural, demographic, and military) in the strategic Ordos region. By comparing hydroclimatic and historical data, I analyze state responses to the region's ecological and climatic constraints. The state's primary objective was to ensure a stable supply of provisions for soldiers stationed on the northern frontier, thereby reducing transportation costs and alleviating the burden on the people of Guanzhong and the eastern plains, which produced most of the grain shipped north to sustain the army. As the region's economy developed around the citadels, the state

stimulated local agricultural production for military sustenance, while facing major constraints in maintaining a stable agricultural population in a region characterized by highly variable climatic conditions and prevalent grazing land. Declining conscription, poor agricultural output, and administrative breakdowns led to shrinking military and civil taxpaying populations, prompting the Tang state to resettle Inner Asian pastoral and military settlers from the western regions to provide military support. In response to the Tibetan military expansion east (Fig. 5.1) and the consequent loss of pastures and agricultural land in the Hexi Corridor and the Tarim Basin, the Tang launched initiatives to reclaim arable land and improve military infrastructure in the Ordos Loop. Furthermore, the increased demand for Inner Asian horses also played a significant role in the Tang state's strengthened presence in the north.

As shown in Chapters 1 and 2 of this book, the Ordos Loop region's past and present climate results from complex interactions between large-scale weather systems and local geography. Key atmospheric forces, including the mid-latitude westerlies, Western Pacific Subtropical High, East Asian Summer Monsoon, and Siberian High, combine with ocean patterns like ENSO to determine temperatures and rainfall. Due to this interplay, the region experiences significant seasonal climatic variability, manifesting as extremely cold, dry winters and variable summer rainfall. Moreover, the area's varied terrain, from the Ordos Plateau to surrounding deserts and the Yellow River, further shapes local conditions by altering winds, moisture flow, and heat exchange. In addition, river channel migration, anthropogenic activities, and hydraulic works undertaken by early empires played a significant role in transforming the environment and may have affected the local climate. Seasonal flooding, riverbank erosion, and changes to the riverbed likely impacted agriculture, transportation, and communication networks in the region; however, while the transmitted sources notably record frequent catastrophic hydroclimatic events in the Yellow River alluvial plain (Li et al. 2020; for a simulation of hydroclimatic vulnerability see Chapter 3), the Ordos Loop is seldom mentioned in records of floods and droughts, especially in the first millennium of imperial rule. The main reason for this absence is the lack of local administrative records documenting such events, as most information on hydroclimatic events comes from administrative centers south of the Ordos and in the Guanzhong metropolitan area. Furthermore, the Ordos Loop was much less densely populated and less cultivated than the Yellow River alluvial plain; while flooding events had the same catastrophic consequences for

agriculture and infrastructure, they affected fewer people. This chapter aims to analyse the available historical information regarding hydroclimatic events in the Ordos Loop and their relationship with regional state interventions.

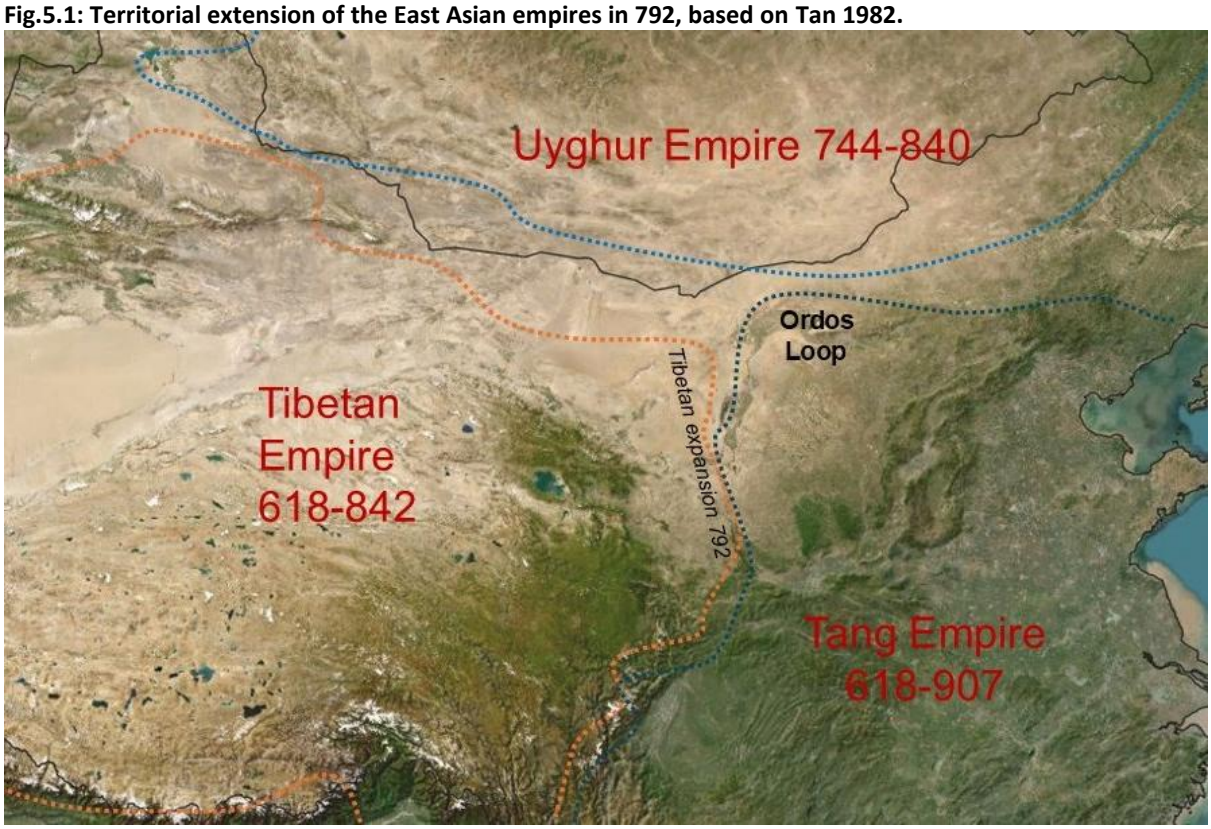
Historical sources document hydrological transformations that began in the early centuries of the Common Era, including the migration of river channels, which led to the formation and subsequent disappearance of lakes and wetlands. These hydrological shifts shaped an environment significantly different from contemporary conditions. After the 2nd century BCE, the northern alluvial fan river channels and the Tushenze Paleolake, known in the sources as Tushen Marsh or Yuhun Marsh, named after Han Yuhun County, began to form (Li 2003; *Hanshu* 28b.1619; Tan 1982). The first extensive mention of the marsh dates from the early 6th century, when Li Daoyuan (d. 527) described the branch as flowing northward before breaking its banks westward near the eastern side of the ancient fortress of Yuhun County, noting that the accumulated waters formed a marsh, which stretched thirty-seven miles from east to west (*Shuijing zhushu* 3.213–214). Recent analysis of lake sediment records in the Hetao region agrees with the historical records, showing how lake sediments from Tushenze Paleolake accumulated from the 6th Millennium to the 2nd century BCE, when flooding from the Yellow River expanded the paleolake, but it began shrinking in later periods due to river migration, monsoon decline, and human influence, leading to wind-blown sediment deposits. By the late 6th century, the lake began to dry, initiating desertification in the region. Concurrently, the upper river channel of the northern alluvial fan became the river's principal course. In the Tang period, the northern branch had a much higher water flow than it does today (Li 2003; Zhao 2011; Zhao et al. 2012; Wang et al. 2018). The Tang built a military town along the Yellow River's northern branch, utilizing its course for water resources and waterborne transportation (Li 2022, Fig. 5.2).

In the same period, hydrological shifts likely led to the formation of temporary and seasonal lakes to the east of the northern branch, north of Wuliangsu Lake (a much later-formed lake, Zhang 2024) and to the south of Mouna Mountain, the western edge mouth of Wula Mountain (*Xin Tang shu* 33b.1148; Zhao 2011; Fig. 5.2). One of these lakes, Maibo Pond (Barley Pond), is mentioned both in the transmitted sources and the Dunhuang manuscript Yu.032-1, preserving fragments of the itinerary of a ninth-century diplomatic mission traveling from Dunhuang to the Tang capitals through the Ordos Loop (Chen 2014, Wen 2023). While these bodies of water are only mentioned in ninth-century historical sources,

suggesting their temporary and seasonal nature, they were likely important sources of water for fishing and pastures, possibly also for agriculture, with the necessary irrigation infrastructure. As discussed in this chapter, the land surrounding Maibo Pond was reportedly very fertile and suitable for agriculture, and the Tang established a large garrison there (*Yuanhe junxian tuzhi* 4.19).

Although proximity to riverbanks and water bodies provided easy access to water resources, it also made the Tang military citadels vulnerable to flood risk. Historical sources record flood events in 722 and between 812 and 813 that could be linked to ongoing hydrological transformations. A prolonged period of drought (Hessl et al. 2018; see also Chapter 2 in this book) may also have contributed to the occurrence or severity of flooding. Based on an analysis of historical evidence, this chapter examines how state policies and resource management in the 8th and early 9th centuries were influenced by these events.

Fig.5.1: Territorial extension of the East Asian empires in 792, based on Tan 1982.



1.1. State presence and border settlements after the Han

For centuries before the establishment of the first bureaucratic empire, the Ordos region was inhabited by local agropastoral groups primarily located east of the Mu Us Desert. State colonization of the region began with the Qin (221 BCE – 206 BCE) and Han (206 BCE – 220

CE) empires (see Chapter 4). From this early period onward, state entities established administrative agencies in the region for salt extraction, agricultural production, pasture use, and the maintenance of communication routes (Chang 2009).

After the fall of the Han, the land within the Ordos Loop was sparsely utilized by the state for agriculture and predominantly used for pasture. The region once again was under the control of local agropastoralists of various extractions, whose dominant elites established regional military regimes that controlled the trade routes of the Ordos region and built cities to the south of the Mu Us Desert that became important hubs of communication with the Hexi Corridor (*Jinshu* 10.260; Rong 2022).

In the early 4th century, a confederation of agropastoral groups known as the Tagbach (Tuoba) moved south from the northeastern part of present-day Inner Mongolia and settled into the Yinshan and Ordos Loop regions. The Tagbach ruling elite established their capital, Shengle, to the east of the Ordos Loop. The Tagbach economy during this period was predominantly centered around hunting, fishing, and husbandry (Hou et al. 2023). By the early 5th century, the rulers of the Tagbach empire (Northern Wei dynasty, 386–534) transformed urban centers in Ordos and the Hexi Corridor into military garrisons, which were instrumental in controlling the newly acquired territories to secure a direct supply route from the Hexi Corridor, where the Tagbach controlled large pasturelands where horses, camels and sheep were grazed, to their growing new capital region, Pingcheng, located in the Sanggan River Valley (present-day Datong), east of the Yellow River (Rong 2022). Pingcheng rapidly grew into a large metropolitan center. State-directed policies resettled agropastoral groups from Inner Asia and agricultural households from the Central Plain and northeastern regions in Pingcheng. Within a very short period, the city became home to over a million inhabitants (Maeda 1994). As the Tagbach Empire extended well into the steppe region and the Hexi Corridor, the Ordos Loop became an integral part of the state. A system of six large northernmost military administrations was established, with two administering the western and eastern parts of the Ordos Loop (Wei 2019). To populate the garrisons, the Tagbach forced the relocation of pastoral groups from the Ordos steppe, dividing them into units named after their geographical locations. The new settlers were allocated pastureland and, possibly, agricultural land (*Weishu* 4A.75; Barenghi 2018), and nomadism was likely prohibited to them.

Archaeological and textual sources attest that the metropolitan region and northern garrisons were sustained by a diversified economy based mostly on animal husbandry and a mix of millet-based agriculture (*Qimin yaoshu jiaoshi* 2009). Archaeological excavations in Datong uncovered five large cylindrical granaries, with one containing charred millet remains; analysis of the grains suggests the use of fertilizers, likely animal manure, to enhance soil fertility and crop yields (Zhang et al. 2021; Liu et. al 2022).

Notably, in 492, the late Tagbach court introduced equal-field regulations for land distribution to farming households (for more details, see below in this chapter), a system that the early Tang court would implement in the seventh century. The only direct evidence of the equal-field system's operation prior to the Tang comes from mid-6th-century population registers compiled at Dunhuang, a frontier garrison (von Glahn 2022). From this, we can infer that the Tagbach state also regulated land distribution in other frontier regions, such as the Ordos Loop.

2. The Tang citadels

The early seventh century marked the start of a period of intermittent direct state control over the region. The Sui (589–618 CE) leveraged internal divisions within the Türk ruling family to entice Qimin Qaghan (r. 599–608 CE) and his followers south. The Sui court built two fortified towns for them to the northeast of the Ordos Loop, named Dali and Jinhe (in modern Togtoh and Horinger counties near Hohhot), encouraging their relocation to this area to bolster the region's defenses against annual raids by other Turkic groups based in the Yinshan mountains, whose economy was mainly based on raids and mercenary activity, but also husbandry and trade. The towns, garrisoned by Sui troops, represented a substantial investment, with the construction of Dali alone requiring the mobilization of 50,000 laborers. The Sui government's involvement likely increased Türk settlement in the area significantly, and possibly incentivized some agriculture in the region (Skaff 2004).

During the early Tang period, Yinshan-based Turkic groups reportedly raided Tang-controlled territories south of the Yellow River almost annually and fought for control of the Ordos Loop through the leadership of Zhang Changsun (d. 637 CE). When in 630 Illig Qaghan (r. 621–30 CE) and Zhang became clients of Tang Taizong (r. 626–49 CE), the court established a military command, the Chanyu Protectorate, and the region came under loose Tang administration as the northern part of Guannei Circuit (Fig. 5.2), governing a sparsely settled

tax-paying population. Members of the Zhang clan continued to exercise *de facto* authority over the territory, as they were entrusted with military positions until the mid-eighth century. The Tang lost control of the Ordos Loop during the rise of the Second Türk Khaganate (682–766 CE), following an increase in incursions of Yinshan-based Turkic groups, who reportedly raided Tang-administered territories every year almost without interruption from 682 to 715 CE, with only a few exceptions, and in many instances several times a year (*Yuanhe junxian tuzhi* 4.17-21; *Jiu Tang shu* 194a.5155; Skaff 2012; de la Vaissière 2024).

In 708, the Shuofang Supervisor-in-Chief, Zhang Renyuan (d. 714), seized the Ordos Loop militarily and secured court permission to build a line of fortified citadels, called Citadels for Subjugation, at strategic passes at the feet of the Langshan and Yinshan Ranges (Fig. 5.2). Zhang obtained court approval to employ soldiers for the construction work. Approximately 10,000 soldiers were involved, completing the task in only sixty days (*Quan Tang wen* 630.6353; *Tongdian* 198.5438; *Yuanhe junxian tuzhi* 4.21). The citadels were connected by a continuous defensive line stretching hundreds of miles east to west, covering the Ordos Loop. Scholars have debated the exact location of the West Citadel: Tan Qixiang locates it on the banks of the northern branch of the Yellow River. Others put the citadel forty miles to the southwest (present-day Linhe District, Inner Mongolia), where the remains of an old, fortified town are still visible today. This hypothesis is less plausible because it contradicts information provided by the Tang dynastic sources, which report that the West Citadel was located on the old site of the Han Gaoque Fortification: "To the north, it was three hundred *li* away from the entrance of the stone desert" (*Xin Tang shu* 217a.6114). This spot would correspond to the location reconstructed by Tan Qixiang (Tan 1982; Yu 2019; Meng 2019). In 722 CE, less than two decades after the West Citadel was built, the northern branch of the Yellow River flooded and partially destroyed the West Citadel. The then Shuofang Supervisor-in-Chief, Zhang Yue (663–730 CE), built a new citadel about fifteen miles east of the old site. Remains of the old Tang fortification are still visible on this site, which would become an important hub for trade, especially for horse exchange (*Yuanhe junxian tuzhi* 4.21).

The West Citadel became the administrative center of a standing army that had originally been part of the Chanyu Protectorate when Taizong's military control extended into the Mongolian Plateau. From 742 CE onwards, the army's administrative headquarters changed several times; in 754 CE, the army, then known as the Hengsai Garrison, was moved to a newly built fortified town on the Datong Plain, east of Wuliangsu Lake, about 120 kilometers

southeast of the West Citadel. In 758 CE, it was renamed Tiande Garrison, and, soon after, its headquarters were moved again within the premises of the West Citadel. When the Yellow River flooded repeatedly between 812 CE and 813 CE, it culminated in the destruction of the citadel's southern walls, and the garrison was relocated again to the Datong Plain (*Yuanhe junxian tuzhi* 4.18a; Fig. 5.2). The garrison is reported to have initially hosted only a small number of soldiers; as discussed below in this chapter, after 813 CE the number likely increased by several thousand.

The Central Citadel was built about 190 kilometers from the West Citadel (Fig. 5.2). Archaeological excavations have brought to light the remains of the old perimeter walls, destroyed partially by the river. The Central Citadel was built at the location of a religious site on a hillock to the south of present-day Baotou, surrounded by the flat terrain of the floodplain. It was likely an important place for worship: sources report that whenever Yinshan-based Turkic groups moved south, they would stop at the shrine and present tributes. Archaeological remains of the shrine have been found inside the perimeter of the walls (Liu 1994). Reportedly, the sacred hillock was used as an observatory: "It controls strategic points; the enemy lies in ambush below it to spy on the territory within. Performing rituals, inspecting the troops, and then launching raids. Before our armor could even be donned, they struck with sudden force, like a whale engulfing a boat with a single leap, or a tiger stalking its prey in just a few strides. The withering of the border grasses brings fear to the frontier people, and when the River ice hardens, urgent dispatches fly" (*Quan Tang wen* 630.6353). The urgent dispatches mentioned in the text were used to inform military units and the court of possible imminent raids, facilitated by the freezing of the Yellow River in winter.

The easternmost of the three citadels was built on the site of Jinhe, a former Turkic city, about 120 km from the Central Citadel, on the outer corner where the Yellow River bends south (Fig. 5.2). The East Citadel would host the headquarters of the Zhenwu Garrison (*Yuanhe junxian tuzhi* 4.21; Tan 1982). As shown below in this chapter, this area of the Ordos Loop was an important agricultural production area, and a storage and transfer hub of a land-water transportation system that connected the northern garrisons to Hedong and the metropolitan region via Taiyuan. The prefecture of Shengzhou, situated within the loop on the southern side of the Yellow River, hosted important military granaries for grain storage. Its defense was thus key to securing provisioning for troops in the Ordos Loop and the northwestern garrisons (Li 2022).

Starting from 742 CE, a Shuofang Command was established to coordinate the northwestern line of defense along the Yellow River, with headquarters in Lingzhou in western Guannei and extending to Shengzhou in the eastern part of the Loop. The command supervised 64,700 men and 24,300 horses and coordinated the military and supply activities of the fortified citadels built along the banks of the Yellow River, utilizing the river as both a resource for irrigation and a transportation route (*Tongdian* 172.4480; Table 5.1 and Fig. 5.2). In the early ninth century, with the loss of almost all the military forces of the western frontier line to the Tibetans, the Shuofang Command underwent restructuring, and the supervision of the Ordos Loop was split into two commands. The East Citadel would host the headquarters of the Zhenwu Command, whose control extended east to the Sanggan River Valley and down to the Yanmen Pass, in what is also known as Daibei in northern Hedong (in present-day Inner Mongolia and northern Shanxi). The Fengzhou Command, with headquarters in the Tiande Garrison, supervised the Western and Central Citadels (*Yuanhe junxian tuzhi* 4.1; Barenghi 2026; Fig. 5.2). Determining troop numbers accurately is challenging, mainly because defense primarily relied on Inner Asian military units that established themselves in the region at the turn of the century.

Fig. 5.2: Shuofang Command armies and Guannei Circuit administration, based on Tan's (1982) historical map. Only Guannei prefectures falling within the larger Ordos region are represented.

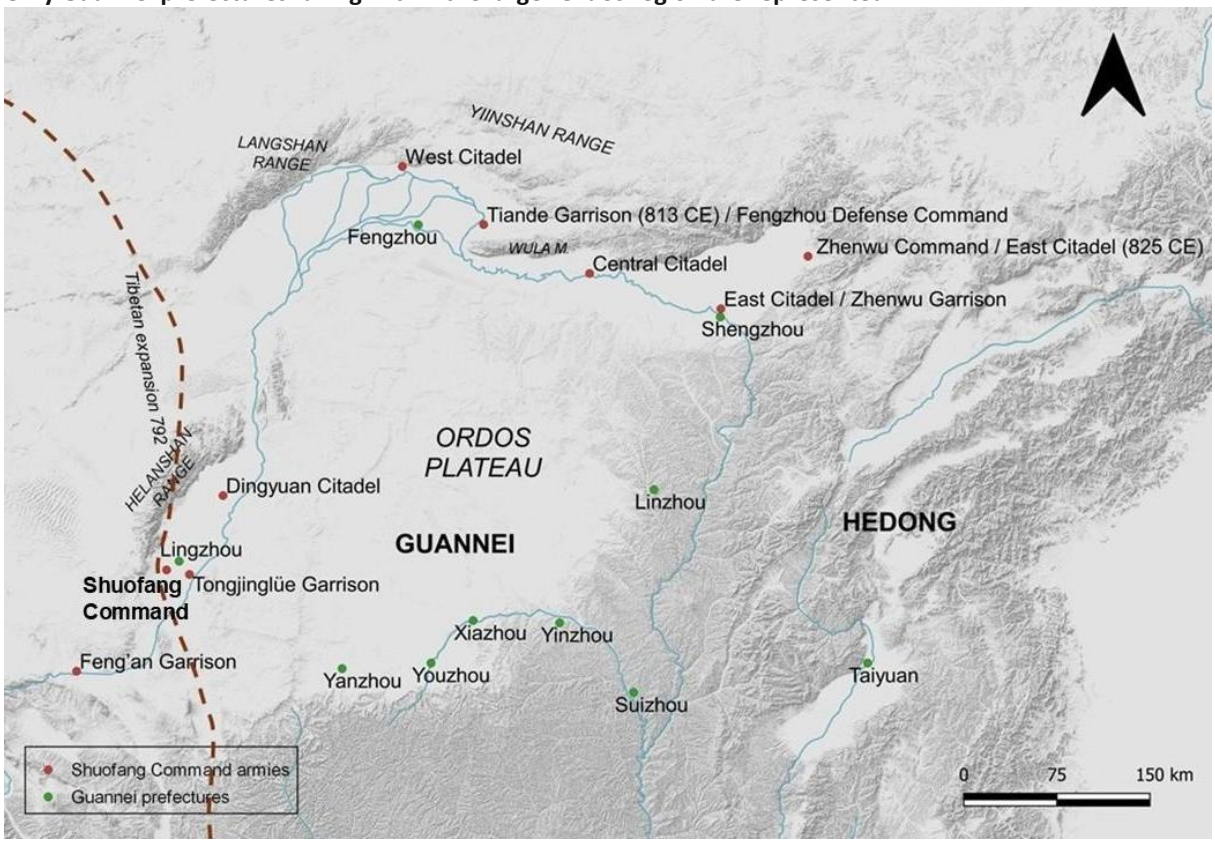


Table 5.1: Number of soldiers and horses of the Shuofang Command in 742. Source: Li Jifu, *Treatise on the administrative units of the Yuanhe Era* (806–820 CE) (*Yuanhe junxian tuzhi*); location (with approximation) is based on Tan (1982).

Shuofang military administration	Long.	Lat.	soldiers	horses
Shoufang Command (tot.)	106.13	38.34	**64,700**	**14,300**
West Citadel	108.07	41.27	7,000	1,700
Central Citadel	109.88	40.53	6,000	2,000
East Citadel	111.13	40.53	7,000	1,700
Zhenwu Garrison	111.97	40.65	9,000	1,600
Tongjinglüe Garrison	106.23	38.25	20,700	3,000
Feng'an Garrison	105.25	37.50	8,000	1,300
Dingyuan Citadel	106.50	38.83	7,000	3,000

2.1. Horse trade

The construction of fortifications at the site of the West Citadel likely served to manage and monitor the movement of herds into the fertile grasslands of the Ordos Loop. Small-scale horse trade and gift exchange between the northern garrison soldiers and the Yinshan-based Türks likely predated any formal state-sanctioned border market. In 727 CE, Emperor Xuanzong (r. 713–756 CE) officially established a horse-trading post at the new site of the West Citadel. The opening of a market sanctioned by the court likely favored the interests of the state and its Türk counterpart. It was approved following a visit by an emissary sent by Bilge Qaghan (r. 717–734 CE) to the Tang court. The emissary offered thirty prized horses as tribute to the emperor. At the same time, taking advantage of the Tang's fear of a potential Tibetan and Türk coordinated assault, the Qaghan's emissary allegedly used the Tibetan correspondence with the Qaghan as leverage to extract significant concessions from the court. Xuanzong then affirmed permission for trade at the West Citadel under the jurisdiction of the army and ordered the annual delivery of hundreds of thousands of bolts of silk to the border as "gifts", one of several ways to secure a sufficient supply of horses for the military (*Yuanhe junxian tuzhi* 4.20; *Jiu Tang shu* 194a.5177; Skaff 2017; Meng 2019). Purchased horses were pastured on-site or sent to ranches and pastures in Hedong and Longyou (*Xin Tang shu* 50.1338). The increase in the number of horses bred led to the establishment of eight state-managed pastures within the Ordos (*Tang huiyao* 72.1302).

Stockbreeding was crucial in the northwestern borderlands, where agricultural land was limited. A successful breeding system in the western pastures made the early Tang court less dependent on Inner Asian horses than later in the dynasty. The Tang state established government ranches, primarily in the western Guannei and Longyou Circuits. By the early 8th century, about 65 ranches were located on the western border. The number of horses registered on imperial ranches varied over time, with around 706,000 registered horses in 650 CE, dropping to 240,000 in 713 CE, 430,000 in 726 CE, and about 320,000 registered horses in 754 (Skaff 2012 and 2017). The court also sourced horses from Turkic and Sogdian markets in northern Guannei (*Tang huiyao* 72.1302; Skaff 2017). Turco-Sogdian elites, such as the powerful military commissioner An Lushan (703–757 CE), later took control of the horse trade and breeding (*Xin Tang shu* 50.1339).

During the An Lushan rebellion, the Tibetan military exploited the Tang military's weakened defenses and seized most of the imperial pastures and horses in the western borderlands, marking the decline of the imperial stud system. Attempts were made to establish new studs in regions such as the Ordos and the Hexi Corridor, with the court considering purchases of horses from local breeders. By the 9th century, medium-sized studs remained east of the Yellow River, and the court began procuring more horses from the Uyghurs. The Tang growing demand for Inner Asian horses reinforced the need for increased state presence in the north (*Tang huiyao* 66.1145-47; *Jiu Tang shu* 141.3861, *Xin Tang shu* 50.1339; Beckwith 1987a; Beckwith 1987b; Maeda 1994).

2.2. Population shift

Historical sources provide census information on the population in the Ordos Loop by 742 CE. The registered population in the first half of the eighth century consisted of taxpaying farming households and soldiers. While less reliable population figures are also available for the early ninth-century civilian population, for the same period, we have no information on the number of soldiers(see Table 5.1 and Table 5.2). The latter were initially recruits or conscripts serving rotationally two-to-three-year deployments in the empire’s frontier army and were often engaged in agricultural activities to support themselves, and later professional soldiers who could voluntarily register themselves and their dependents in the garrisons, mainly relying on state supplies, salaries, and rewards (von Glahn 2015; Graff 2017). Tax-paying households were also probably employed in salt extraction. The region also hosted more or less

independent agro-pastoral communities, possibly descendants of early Tagbach and Turkic settlers, involved in state and private horse trade and breeding activities that could contribute to the military defense or enter into competition with the state's interests. Moreover, we know little about the workers who sustained the military supply network. This group included craftsmen and merchants, as well as seasonal or temporary laborers employed in transport and logistics operations, particularly in Shengzhou, a key hub in the transportation network. It also included skilled navigators familiar with local waterways, essential for moving supplies efficiently (Ren 2008; Li 2022). Eighth-century fragmentary Dunhuang manuscripts provide some information on the recruitment of transport sailors, their duties, and the changes in the recruitment system over the course of the 8th century (Li 2024).

As shown in Table 2, Li Jifu (758–814), writing in the early ninth century, records that in 742 CE the two prefectures of Fengzhou and Shengzhou had 1,900 and 4,000 tax-paying households, respectively. No tax-paying population data is available for the early ninth century. We can then assume that the state received little or no tax revenue from the region, at least in the first half of the century. Li Jifu documents a general decline in the population across the Guannei Circuit, with some prefectures reportedly losing up to 90% of their population compared to the 742 census (Table 5.2). This decline has been attributed to a combination of factors, particularly the disruption of the local administrative system and the subsequent inability of local and prefectural authorities to maintain an up-to-date population census and to collect taxes in kind from smallholder farms, due to the disturbances that followed the An Lushan Rebellion and subsequent unrest in the border regions (von Glahn 2022). Moreover, the Tibetan progressive expansion into the Hexi Corridor and Ordos region led to the loss of entire administrative units between 758 and 792 (Fig. 5.1). Climatic conditions, particularly a prolonged drought in the first decades of the 9th century (Di Cosmo 2018; Hessl 2018; Gong and Hameed 1991; see also see Chapter 2 in this book), likely impacted agricultural production and prompted farmers to engage in alternative activities, or even to move to other regions. In the latter case, we lack corroborating data because the population disappeared from the state's fiscal system. In the specific case of the Ordos Loop, it is plausible that the population might have shifted to more profitable economic activities linked to the network of supply, transportation, and trade, or to salt extraction and animal husbandry.

Table 5.2: Guannnei population censuses. Source: Li Jifu, *Treatise on the administrative units of the Yuanhe Era* (806–20) (*Yuanhe junxian tuzhi*); the location of the prefectural seats is based on Tan (1982)

Prefecture	**Pop. in households (742 CE)**	**Pop. in households (early 9th century)**
Lingzhou	9660	-
Yanzhou	3025	-
Huizhou	3540	-
Xiazhou	6132	3100
Suizhou	8715	840
Yinzhou	6120	-
Headquarters of the Zhenwu Command (East Citadel, Linzhou, Shengzhou)	-	-
Linzhou	-	-
Shengzhou	4095	-
Fengzhou (Tiande Garrison, West Citadel, Central Citadel)	1900	-
Yánzhou	16.345	938
Binzhou	19.461	2670
Qingzhou	17981	-
Ningzhou	30226	1170
Jingzhou (Yuanzhou)	15952	1990
Yuanzhou	-	-
Fuzhou	30185	850
Fangzhou	15715	1842
Danzhou	12422	816
Yanzhou	16345	938

In the mid-700s CE, the Ordos Loop citadels each held 6,000-7,000 troops, with the Zhenwu Garrison having approximately 9,000 soldiers (Table 5.3). These numbers likely decreased after the An Lushan Rebellion, following the disruption of the conscription system. However, at the beginning of the 9th century, the trend in the military population appeared to reverse as the Ordos Loop, particularly the Tiande Garrison, attracted new settlers. As will be discussed below, Li Jifu notes that between 812 and 813, more than 30,000 households settled within the newly rebuilt citadel that hosted the Tiande Garrison, and "as people came flocking from near and far, the border troops grew stronger" (*Yuanhe junxian tuzhi* 4.18-19).

No additional historical data can corroborate these figures, which may be an exaggeration. However, we can hypothesize that the military component of these new settlers was significant. This increase in army personnel in the region is possibly also connected to the state-led resettlement of Inner Asian agropastoral groups of different extractions (Türk, Tangut, Tuygun, and Sogdians) from the western border "loose-rein prefectures" (*jimi zhou*)

to prevent them from aligning with the Tibetans and retain human and animal resources (*Jiu Tang shu* 46b.5243, 196b.5249). The loose-rein prefectures were semi-autonomous administrative districts of varying sizes, administered by agropastoral elites that enjoyed considerable independence and held hereditary civil and military positions bestowed by the Tang court. They were not required to pay standard taxes but could be subject to smaller dues (Yang 2023). With their expertise in horse breeding, elite members of these communities managed the northwestern imperial ranches (Skaff 2017). They were often trained in warfare, making them potential mercenaries for the Tang army or allies of neighboring powers like the Uyghurs and Tibetans. They were called upon to provide soldiers for frontier battles and enlisted in mobile field armies for long-distance campaigns. Beginning in the 750s, following the Tibetan expansion east, the Tang state initiated policies to induce, or force, the movement of these groups northeast, into the Ordos Loop and northern Hedong region (Barenghi 2020, Yang 2023).

The Tanguts of the "Six Tangut Prefectures" were forcibly relocated to the Ordos region (*Xin Tang shu* 220a.6216). In subsequent periods, Tangut groups competed with Tang state agencies for control of salt extraction and horse-trading routes in the Ordos. Around the same time, Tuygun military households of Anlezhou loose-rein Prefecture were also relocated to the Ordos Loop. These were descendants of Tangut and Tuygun groups that migrated into Tang territory in the late 7th century to escape Tibetan conquest (Yang 2023; Barenghi 2026). The Tang court may have induced them to move northeast by dangling the prospect of entering military service in the northern garrisons. Sources say that the regional military authority settled the Tuygun units in Fengzhou where they conceivably contributed to the military defense of the West Citadel and Tiande Garrison (*Xin Tang shu* 146a.6228).

In subsequent years, the relocation might have served as a pull factor for other Tuygun military groups to settle in the Ordos Loop. In 837 CE, 3,000 Tuygun tent encampments (*zhang*, with one *zhang* corresponding to a household's unit and its herds, so overall approximately between 15,000 and 20,000 people) settled in the Houtao Plain. These figures are estimates only, but still indicate a considerable increase in population. A source specifies that the Tuygun were settled on "good land", which can possibly refer to a land with an abundance of grass and water for pasture. From this snippet of information, we can also infer that the new settlers were, in most cases, assigned land for pasture and possibly also animals (presumably ovicaprids and horses). It is thus possible that some agricultural areas were returned to

pasture for livestock production, or used to produce winter fodder for livestock. Moreover, while they must have retained a certain degree of autonomy (as in the former loose-rein prefectures), they were under the administration of a military command and served in the regional armies. For instance, between 837 and 841 CE, a unit of Tuygun warriors served in the military campaigns against Tangut groups along the western frontier(*Jiu Tang shu* 17b.564; *Zizhi tongjian* 282.9219; Barenghi 2020).

2.3. Land use and transportation

Military supplies (including food, military equipment, and clothing) were provided through a combination of long-distance transportation and local production, each posing distinct administrative challenges for the state. Local communities were compelled to provide porters and other laborers to support military logistics during campaigns (Graff 2017). Estimates from Tang sources indicate that each soldier in the Shuofang Command required an annual supply of 7.2 *dan* of rice, converted into 12 *dan* of millet equivalent to 1,200 liters (Li 2022; on the conversion of grain produce into millet equivalents see below in the text). Beyond these staple provisions, additional grain stores were necessary to support the siege equipment, necessitating the storage of both dry and or used to produce winter fodder raw grains. Moreover, the Shuofang Command maintained a cavalry force of 14,300 horses, grazing them on pasture in spring and summer and providing a mix of hay and grain in autumn and winter (Skaff 2017). While seasonal variations and local conditions influenced feeding behaviors, on average, each horse consumed the equivalent of six liters of millet daily, totaling 18 *dan* (1,800 liters) per year, in addition to their daily intake of salt and hay (Li 2022). Furthermore, transport animals were utilized for logistical support, each requiring approximately 540 liters annually. The total annual grain requirement for the military garrisons stationed along the Yellow River in the mid-eighth century was approximately 125 million liters of millet (Li 2022). About half of this quantity was allocated to sustain the garrisons along the Ordos Loop.

Salt was primarily extracted locally from salt lakes in the western and northern parts of the Ordos region, where semi-arid conditions contributed to their formation. Extraction and transportation of salt were under the supervision of a state provisioning commissioner until 850, when salt lakes fell under the control of Tangut local groups, and salt supplies had to be procured further east from Hedong. In the latter part of the ninth century, salt resources were under the direct control of the Hedong Military Commissioner (*Tang huiyao* 88.1611).

There were generally two sources of grain procurement: local procurement near the stationed troops and grain purchase from distant regions. The government purchased grain during the autumn harvest at market price and stored it in the military granaries. This policy was called "harmonious purchase," *hedi* (von Glahn 2015; Graff 2017; Li 2022). Government grain purchases were transported from Hedong, relying on a network of granaries and combined land-water transport. River transport was costly, both in terms of human labor and resources, hazardous, and subject to navigability conditions that often depended on the seasons. Local agricultural production and grain tax allocations did not entail long-distance transportation costs but did require the consistent presence of labor and taxpaying individuals.

In the early seventh century, the Sui harnessed the Yellow River to create a navigable waterway, the Pinghe Canal; its primary function was to connect the military granaries in Shengzhou to the Yelow River (*Yuanhe junxian tuzhi* 4.16; Li 2022 and 2024). At the beginning of the 8th century, a waterway supply line was established along the Yellow River, connecting the northern capital Taiyuan in Hedong to the Ordos Loop. It transported military supplies from Hedong to the northwestern garrisons, integrating the waterway with Hedong's land routes, and creating a combined land-water transport system centered in Taiyuan. Travel between the citadels was also possible via overland routes that connected key locations. For example, one could travel north from Lingzhou along the left bank of the Yellow River to reach Fengzhou and the West Citadel. However, given the navigability of the Yellow River, water transport was generally preferred. As Li (2022) notes, several factors led to the prioritization of water over land transport. For one, the section of the Yellow River upper course running from Lingzhou to Shengzhou featured a sandy riverbed, relatively deep waters, and a steady but slow current, conditions favorable for navigation. Moreover, water transport was more efficient and less labor-intensive than organizing land convoys, which required significantly more manpower and were limited by terrain and vehicle capacity. And last, while overland transport struggled to move large volumes of bulky supplies, waterborne supply were more logical and practical as the military garrisons in the Shuofang region were situated directly on or close to the riverbank. That said, river transport, especially upstream, was dangerous, costly, and constrained by seasonal and climatic conditions. A Commissioner of Water Transport and Military Farms oversaw the route, coordinating local production and long-distance transportation. The prefecture of Shengzhou, situated within the eastern loop of the

Yellow River, hosted a transfer hub where grain collected in Hedong by land transport was stored in granaries built at specific elevations to facilitate grain drying (Li 2022; for grain preservation, see also Bray 1984 and Wong 1991).

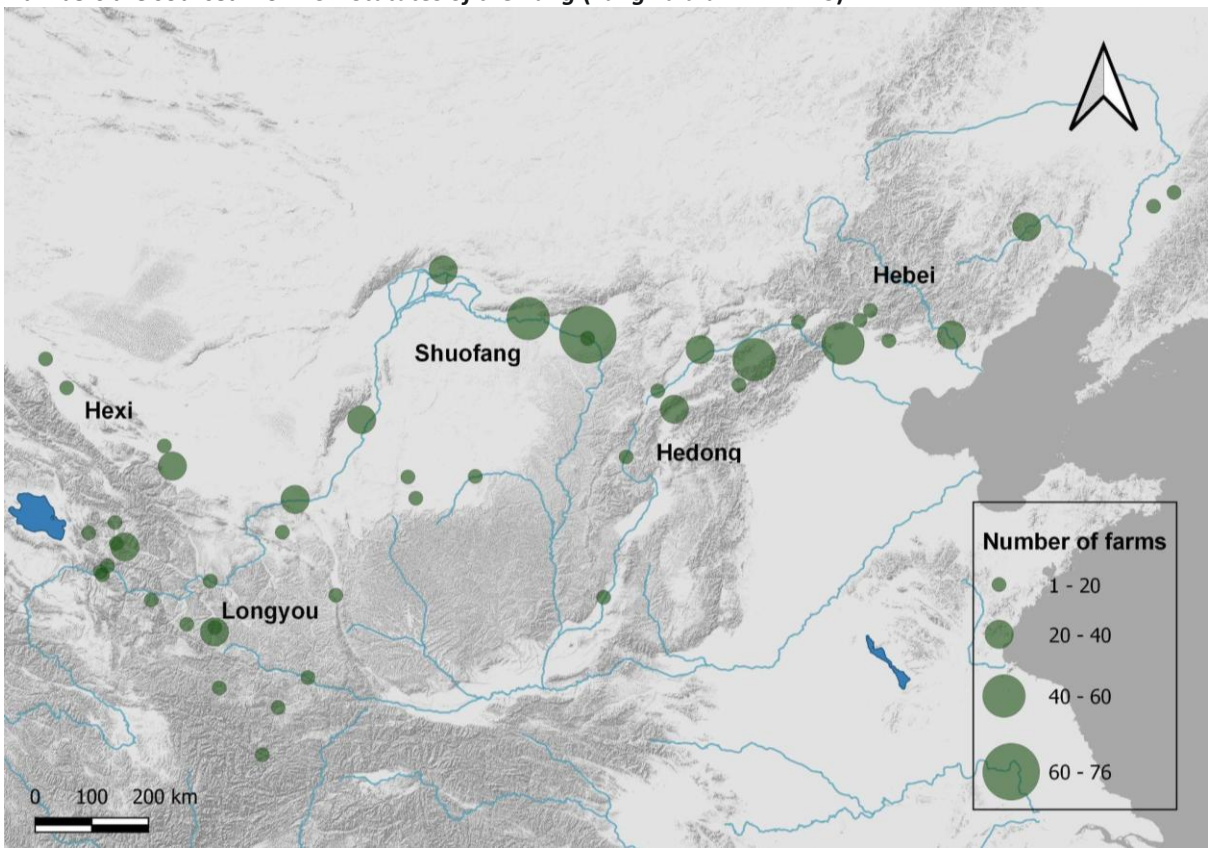
This integrated system of storage and transport was fully operational until the second half of the eighth century, when it was partially disrupted by the An Lushan Rebellion and later restored under Emperor Dezong (r. 779–805 CE). In 792 CE, when the Tibetans besieged Lingzhou on the western border, causing severe food shortages, the court reportedly shipped over 500,000 *hu* of rice from the granaries in Hedong to relieve the besieged city (*Cefu yuangui* 498.5970; Li 2022). In the early ninth century, the granaries in Shengzhou were still in use after floods damaged the East Citadel (*Quan Tang wen* 705.7234-7235).

Granaries served as key storehouses for tax revenues, particularly during the first millennium of imperial rule, when taxes collected in kind greatly exceeded those collected in monetary form. There was a tripartite system of "official granaries" (*zheng cang*), "charity granaries" (*yi cang*), and "ever-normal granaries" (*changping cang*) (*Tongdian* 12.292-294; Li 2022). The latter were granaries that provisioned both frontier zones and interior regions, and were supervised by officials who bought and sold grain to stabilize supply and prevent shortages. Charity granaries were established during the Sui and Tang dynasties to provide relief during famines. However, the military often redirected these resources for its own needs. Although these granaries stored a significant amount of grain, it is unclear to what extent they benefited civilians. The Tang dynasty notably expanded the granary system on an unprecedented scale (Wong 1991). In addition to ensuring food security by storing grain for disasters, ever-normal and charity granaries also supported prefectural tax revenues, helping stabilize regional finances (Shin'ichirō 2018).

Due to the high costs and risks of long-distance transportation, the subsistence of the frontier garrisons also relied on a system of military farms (*tuntian* or *yingtian*), farming fields administered by the state and cultivated by farmer-soldiers stationed in the garrisons, or by commoners conscribed into special corvée service. While soldiers farmed collectively, civilian households worked individually assigned plots of land (Twitchett 1959; Graff 2002, 2017). Introduced by the Han in the first century BCE to provision troops in conquered western territories (Trombert 2020), the system of military farms cultivated by farmer-soldiers was also adopted by the states of the post-Han period and by the Tang in the 8th century, when

military farms were established for the sustenance of the northwestern and northeastern frontier commands (Fig. 5.3).

Fig. 5.3: Military farms of the Longyou, southern Hexi, Shuofang, Hedong and Hebei frontier commands in 741 CE. It represents the number of farms and approximate location (Twitchett 1959, Tan 1982, Skaff 2017). Numbers are sourced from: *Six Statutes of the Tang* (*Tang liu dian* 7.222-23)



According to Tang sources, state farms varied in size, with larger ones encompassing 50 *qing* of land (approximately 280 hectares) and smaller ones 20 *qing* (approximately 112 hectares). Frontier military farms were ideally among the largest, but in practice they were often small. Recent estimates of agricultural land in the Longyou region, in the valleys between the Yellow River and the Huang River in the western Loess Plateau, calculate an average of approximately 261 hectares per military farm (Wu et al. 2017; Barenghi 2026). In the first half of the eighth century, the Shuofang Command comprised 245 military farms, with 156 located in the Ordos Loop alone. These numbers exceed those of the military farms in each of the other four border commands (Fig. 5.3). This disparity is not necessarily due to a larger presence of soldiers in Shuofang, but may instead reflect its lower agricultural population density, and thus lower entries in local grain tax revenues. With fewer local grain tax revenues, there was likely a greater need for land production effort by soldiers for their own sustenance (*Tang liu dian* 7.222-23; Twitchett 1959; Li 2022; Table 5.3 and Fig. 5.4).

Fig. 5.4: Shuofang Command military farms in 741 CE, based on a drawing by Twitchett (1959), representing the number of farms and approximate location (Tan 1982). Numbers are sourced from: *Six Statutes of the Tang* (*Tang liu dian* 7.222-23)

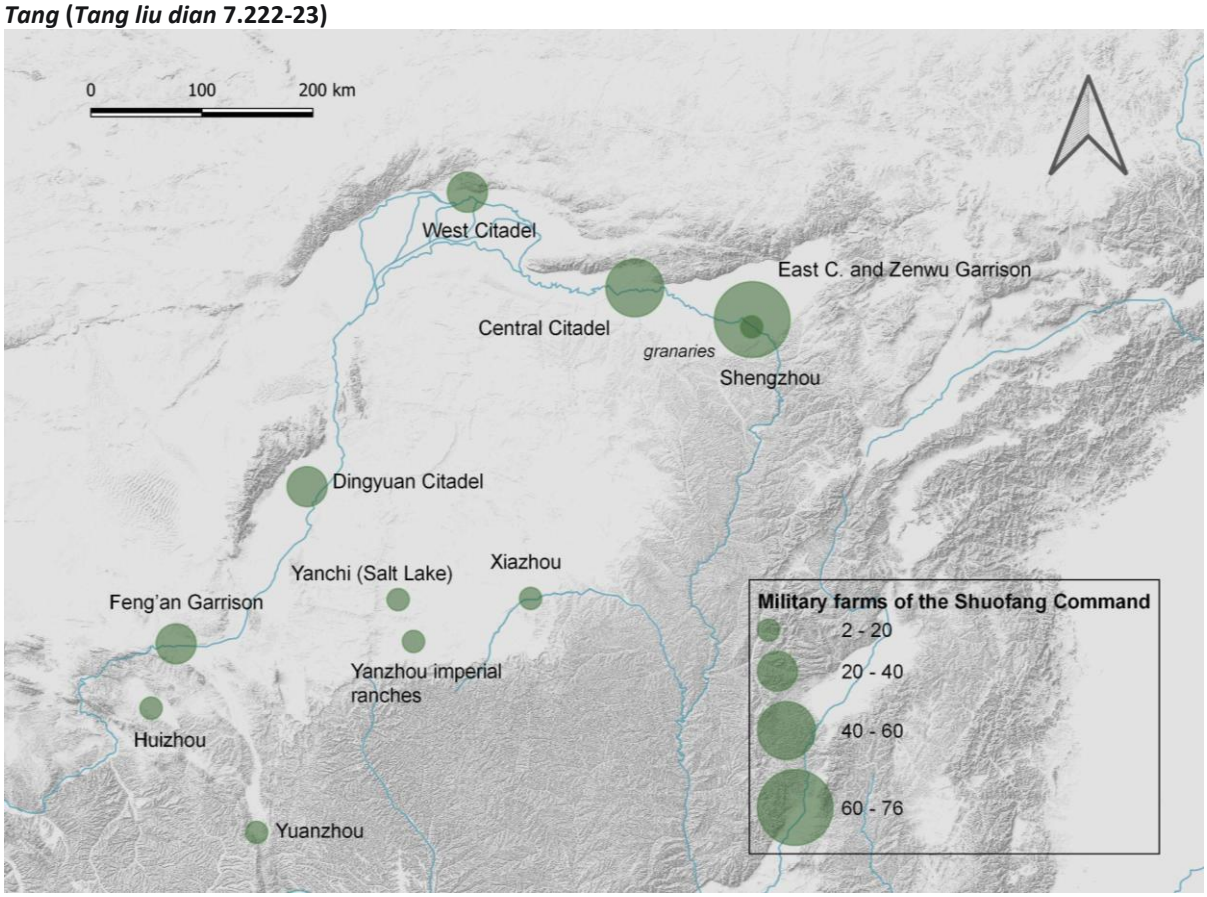


Table 5.3: Military farms of the Shuofang Command in the first half of the 8th century. Source: *Six Statutes of the Tang* (*Tang liu dian* 7.222-23); 1 *qing* approx. 5.6 hectares (Twitchett 1979). The coordinates are approximate, based on Twitchett 1959, Tan 1982, and Skaff 2017.

Administration	Farms	Long.	Lat.	Hectares	Soldiers	Horses
East Citadel	45	111.13	40.28	12,600	9,000	1,700
Zhenwu Garrison	31	111.13	40.28	8,680	7000	1,600
Western Citadel	25	108.07	41.27	7,000	7,000	1,700
Central Citadel	41	40.53	109.88	11,480	6,000	2,000
Shengzhou	14	40.22	111.13	3,920	-	-
Yanzhou imperial ranches	4	107.59	37.59	1,120	-	8 ranches (24-40,000)
Huizhou	5	104.68	36.56	1,400	-	not specified
Yanchi	7	107.49	37.95	1,960	-	not specified
Yuanzhou	4	106.27	36.01	1,120	-	not specified
Xiazhou	2	108.79	37.59	560	-	not specified
Feng'an	27	37.50	105.25	7,560	8,000	1,300
Dingyuan	40	38.83	106.50	11,200	7,000	3,000

Tang administrative sources provide the general guidelines for the management of military farms, according to which a three-tiered grading system had to be implemented to assess agricultural land based on land quality and harvest success, and labor was calculated,

per person per day, based on the quantity of land cultivated (*Tang liu dian* 7.222-23; Twitchett 1959). For crops, such as barley and buckwheat, yields were to be converted into millet equivalents and then calculated in *hu* (bushels, 1 hu=50 liters) to determine performance ratings (*Tong dian* 2.44). However, it remains unclear to what extent this regulation was systematically applied to frontier farms and how it accounted for the ecological constraints of more arid territories. As no specific information is provided regarding the classification of the land within the Ordos Loop, it is difficult to assess whether acreage productivity was adequate for the subsistence of one individual, and possibly his household. Moreover, the sources do not provide details about the exact locations of the agricultural lands (for a simulation of land-suitability in the Greater Ordos region, see Chapter 3 in this book). Since these lands were cultivated by soldiers who resided in the fortresses, we can reasonably assume that fields were located within a working day walk from the citadels. As agricultural intensity is closely related to population density, early eighth-century military population sizes and the number of farms can be used as indicators for agricultural productivity. Under optimal conditions, if one military farm had an area of approximately 280 hectares, each farmer-soldier would have cultivated between 1 and 1.5 hectares of land, with each farm cultivated collectively by 200 to 280 soldiers. For instance, the West Citadel and Zhenwu Garrison had a ratio of 1 ha/soldier, while the East Citadel had 1.3 ha/soldier, and the Central Citadel 1.8 ha/soldier (Table 5.3). If, on the other hand, the size of a military farm was smaller, then the land-to-soldier ratio was probably less than one hectare per individual. In both cases, the agricultural land was likely insufficient to meet the annual crop demand. These estimates can be compared with the results of recent studies on the relationship between cropland area and the number of households at a regional scale in the northwestern Loess Plateau (Wu et al. 2025; for a discussion on the uncertainties in comparing administrative data, see also Li et al. 2018). Furthermore, the land distribution quotas most likely did not adequately account for the environmental constraints and climatic variability of frontier regions (see Chapter 7 of this book for a similar argument regarding early Ming military colonies).

While yield figures for the Ordos during the Tang period are not available, the region's agricultural productivity was certainly significantly lower than that of the more well-watered central and southern areas (Kishimoto 2022). Due to limited rainfall, agriculture in the Ordos Loop mainly relied on irrigation. Over various periods, early states invested resources in the construction of hydraulic systems for irrigation in the region (for a reconstruction of the

spatial patterns of the irrigation canals in Miran, Xinjiang, see Luo et al. 2017); however, evidence of state intervention in the construction of irrigation canals for the Tang military farms appears relatively late, with documentation only dating to the late 8th century. We can thus assume minimal state involvement in hydraulic infrastructure during the first half of the century and prior to that.

Additionally, there is a lack of specific information on whether annual production was sustained through practices such as manuring or fallowing (for a bibliography on these practices in the imperial period, see Hüsemann 2022). Assuming that in the Ordos Loop, a farmer-soldier cultivated 0.5 hectares annually (Hara 2022), leaving the remainder fallow, it is plausible that the annual yield would have been insufficient to sustain an individual, excluding the produce allocated for winter fodder and storage for military emergencies, even under optimal climatic and borderland conditions. Though direct comparison may be challenging, this aligns with 18th-century agricultural yields from military farms in Xinjiang, which reported that 1,200 liters equate to an average of 1.5 hectares, and that allocations ranged between one and two hectares per soldier (Liu et al. 2016). These numbers are estimates under optimal conditions. In areas with limited water availability, it might have been necessary to allow the land to lie fallow every other year to maintain soil fertility. The practice of leaving the land fallow was adopted already in ancient times. In some cases, fallow years may have been extended to two out of three years, increasing the area needed to sustain agricultural output (Qin and Fuller 2019). However, as later agricultural treatises do not mention it, it has been suggested that it may have become rare already after the Han period (Bray 1984). According to the equal-field regulations (*juntian*), established in 492 by the Tagbach Northern Wei and adopted in the early Tang period, under optimal conditions each adult male was allotted 80 *mu* of arable land, equally divided into 40 *mu* for cereal cultivation and 40 *mu* designated as fallow land, to be cultivated in a two-year rotation; however, many households received only half or less of the land they were entitled to (von Glahn 2022a). Early Tang land tenure statutes and land contracts excavated from the Astana cemetery (Turfan) testify to the adoption of the practice of leaving less productive land fallow. Ideally, in Turfan the land was classified as unchanging land, *chang tian*, suitable for continuous cultivation, including double-cropping, and as fallow land, *bu tian*, a much-debated term which might have included remote and high land where irrigation was more difficult; in case of unproductive land that required fallow periods as long as three years or

more, the state would have granted additional land (Xiong 1999). In later periods, due to limited land availability and the need to sustain continuous agricultural production while restoring soil fertility without leaving the land fallow, a complex system of crop rotation was often adopted, combined with manuring (Bello 2022).

Furthermore, military farms to the west, such as Dingyuan and Feng'an, also had a low acreage-man ratio, making it impossible to produce a surplus that could eventually be transported to the Ordos Loop in case of need. Under optimal conditions, estimates suggest that each soldier at Feng'an farms had less than 1 hectare of land. Considering that the garrison had a high number of horses for which winter fodder had to be stored, we can assume that local agricultural production was insufficient to meet the needs of both men and animals. As for Dingyuan, the ratio, under optimal conditions, was 1 hectare per soldier, but with double the number of horses (Fig. 5.4; Table 5.3).

Moreover, other prefectures south of the Ordos Plateau, which did not host military units and relied on local labour, also had few farms, and the agricultural produce was most likely consumed locally or aimed explicitly at procuring winter fodder for the local imperial ranches. The prefectures of Yanzhou, Xiazhou, Huizhou, and Yuanzhou all hosted ranches, each with 3,000 and 5,000 horses. For instance, the four military farms in Yanzhou supplied grain to eight imperial ranches (which supported approximately 24,000 to 40,000 horses). Additionally, the livestock raised in the imperial ranches also included large numbers of sheep, goats, and cattle, as well as camels, donkeys, and mules. Sources attest that, given that the annual output from military farms was insufficient, a miscellaneous hay tax was levied on farmers residing within a 250-kilometer radius of the capital to supply the ranches (Skaff 2017; Fig. 5.4; Table 5.3). Moreover, by 792, with the Tibetan occupation, agricultural production from the military farms of Feng'an, Huizhou, and Yuanzhou was no longer under Tang control (Tan 1982).

It can thus be inferred that the overall agricultural output of the military farms was inadequate, failing to meet even local consumption needs. As a result, the farm produce was likely not distributed and, instead, consumed locally. Insufficient productivity likely contributed to the decline in military labor within the Ordos Loop region. The rotating and unstable conditions of agricultural labor, as well as the resulting management issues, are significant factors to consider. As shown by Trombert (2020) in the case of the Han military farms in the Hexi Corridor, the harvests produced by farmer-soldiers in the colonies came at

the cost of exhausting labor performed as part of their military service, resulting in minimal agricultural productivity.

By the middle of the eighth century, military farm produce reportedly accounted for only 20% of the total supplies, and government grain purchases became the primary means of procuring provisions, with purchased grain making up 80% of the Shuofang armies' total grain and fodder requirement (Li 2022). The breakdown of the conscripted regiments and the emergence of professional soldiers who formed the core of the frontier armies and relied entirely on supplies from the central government led to a decline in the military farms cultivated by farmer-soldiers (von Glahn 2015).

In response to increased demand for agricultural products, in 780 CE the court allocated resources to open new farms, employing labour from the metropolitan region. Reportedly, households from Chang'an were mobilized to construct irrigation and drainage canals to increase the agricultural land and facilitate transportation. The Lingyang Canal was dug in 782 CE, but was soon abandoned. Between 785 CE and 805 CE, the Xianying and Yongqing canals were opened, irrigating several hundred *qing* of land (*Xin Tang shu* 37.976). Court officials contended that the primary cause of land abandonment was the lack of labor rather than insufficient water. They proposed revitalizing existing farms and warehouses instead of constructing new canals. Utilizing the existing water storage in these farms and encouraging soldiers to engage in agriculture would have circumvented the high costs associated with digging new canals and relocating workers (*Tang huiyao* 89.1619-20). Despite a labour shortage, this case and those discussed in the next section suggest a persistent state policy aimed at investing in local production, which could alleviate the high costs of long-distance transportation.

3. Climate, floods, and state policies

Tang historical records indicate that between 811 and 814 CE, local officials in the eastern Ordos Loop reported episodes of famine due to crop failures, followed by floods that destroyed military infrastructure. The situation was exacerbated by speculation in the grain market by local frontier officials who had been stockpiling large quantities of grain to sell at higher prices (*Quan Tang wen* 556.5623).

This historical information suggests a period of below-average precipitation that would have affected crop production. It is comparable to the results of a year-by-year hydroclimatic

reconstruction based on tree ring data, which identifies the year 804 CE as the beginning of a 19-year period of severe drought in the Mongolian Plateau, located further north than the larger Ordos region (Hessl et al. 2018; Di Cosmo et al. 2018; for discussion, see also Chapter 2 of this book). Given the scale and severity of the drought, it is plausible that it affected southern regions and severely reduced already low land productivity in the Ordos Loop. The sources report comparable cases of crop failure in prefectures south of the Ordos Plateau, where in September 808 CE and April 814 CE, local officials reported that spring frost had killed agricultural crops and mulberry trees (*Xin Tang shu* 36.943); in this case, in addition to frosts and low temperatures, drought may have also played a role. Drought episodes are also reported in the capital city of Chang'an. In 813, due to the drought, summer taxes were levied in the capital region (*Xin Tang shu* 7.213). The following year, in November, the capital again was hit by floods, drought, and frost, damaging 212,800 hectares of agricultural land (*Jiu Tang shu* 15.448). In 821 CE, the court issued an imperial edict that granted land and tax exemptions to households displaced by floods, droughts, or warfare (*Tang huiyao* 85.1566). Similarly, in November 830, eight counties in the capital region reported crop failure (*Xin Tang shu* 36.943); that year's land tax was levied for those counties (*Xin Tang shu* 8.232).

In the winter of 812 CE, the court sent the Commissioner for State Farms, Grain Procurement, and Water Transportation on an inspection tour to the north. This was Han Chonghua (d. 835 CE), a nephew of the scholar and court official Han Yu (768–824 CE), whose commendatory piece praising his nephew's job has been transmitted to us. Upon arrival, Han uncovered the crimes of several hundred local officials. He converted their penalties into labor, providing them with plows, shares, and oxen, instructing them to cultivate nearby suitable land, personally surveying the plains and marshes for suitability, and offering guidance on farming methods. This allowed those sentenced to death to have their convictions overturned. Reportedly, for two consecutive years, there were bumper harvests, and the officials were able to fully repay their debts and even produce a surplus. Sources indicate that more than 900 convicts cultivated 300 qing of land, corresponding to approximately 1,680 hectares (*Quan Tang wen* 556.5623; *Xin Tang shu* 53.1373).

While the positive outcomes of Han Chonghua's policies, as praised by his uncle, should be taken with caution, the source offers valuable insight into the state's efforts in implementing agriculture in the eastern part of the Ordos Loop. Instead of moving production elsewhere or increasing long-distance procurement of crops, the state's first response to crop failure was

to open new farmland. Han proposed creating a line of 15 fortified farming villages along a stretch of the border more than 600 li (about 150 kilometers) long, from Zhenwu to the Central Citadel. Each farm would be run by 130 people, cultivating farms collectively for 100 *qing* (560 hectares) of land each, which is approximately the size of two large military farms. The settlers were also expected to build fortifications and provide for the defense of the farms. Accordingly, the allocated land corresponded to 4.3 hectares per person, a ratio significantly higher than the land-to-person ratios in former military farms, potentially enabling the production of surplus grain. Given the dry period, it is likely that some of the land had to remain fallow for longer, thus requiring more land to achieve adequate output. The court approved Han's request. His uncle reports that these measures were so successful that the autumn harvest was doubled and transportation costs were significantly reduced (*Quan Tang wen* 556.5623-24).

In the winter of 814, Han returned to the capital. He reported to the court that a further 4,000 *qing* of land (22,400 hectares) could be reclaimed to produce enough grain to supply the citadels, employing about 7,000 men for agricultural labour, resulting in a ratio of 3.2 hectares of land per person. The appraisal concludes that if Han's policies were to be fully implemented, "the lost territories in the northwest could be recovered within a foreseeable timeframe" (*Quan Tang wen* 556.5623-24).

Although it may have seemed more prudent to relocate production to a region with more favorable climate conditions, the state chose to address the drought by expanding farmland and bringing in (and relocating) new settlers. This policy highlights the significant challenges the state faced regarding transportation costs, as well as the loss of land and resources in the west, which led to prioritizing local production despite ongoing hydroclimatic limitations.

Assuming that all of Han's policies were effectively implemented, the state would have established the equivalent of approximately 55 new large farms in the eastern Ordos Loop, each of them being double the size of a former military farm. These would correspond approximately to the same number of farms opened in the early eighth century in central and eastern Ordos Loop. By court design, the farms were to provide for their own subsistence, defense, and produce grain to supply the citadels. The number of farmers would have been, in total, almost 10,000 individuals. If we include their households, figures rise to approximately 50,000 people (Table 5.4).

The sources provide no information on the logistical aspects of the resettlement, nor on the status and identity of the resettled people. The latter could be peasant families who received state wages as seasonal workers, or, more likely, people on the margins of society, such as landless peasants. During the 8th century, the court began adopting military recruitment policies targeting "vagrant households," impoverished households that had abandoned their landholdings, offering tax exemptions and bonuses to men who served four- to six-year terms in frontier military service (von Glahn 2022a). Moreover, the court could dispose of large numbers of convicts to be employed as labour. As in Han's case, more than nine hundred corrupt local officials were engaged in agricultural work. In another instance, Tang sources report that, due to the drought, in 810 CE the court decreed that the death penalty for individuals convicted of crimes other than murder be suspended (*Xin Tang shu* 7.210); a similar policy was adopted in 827 (*Xin Tang shu* 8.230). Conceivably, the court used the pardoned convicts as agricultural labour. These people constituted a pool of labour that the state could easily dispose of but was difficult to control, as they were often uprooted from their social support networks and hard to keep tied to the land.

Tang sources indicate that by the end of the 820s, military farms were typically cultivated by either hired tenants or conscripted laborers. Poor-quality land was often exchanged for better land. By court decree, farmers were ordered to return all the land that was supposed to revert to the state. This caused great hardship for household farmers. It was also decreed that soldiers and officers themselves should undertake the cultivation, and that those who worked state land were to receive one-third of the produce for life (*Xin Tang shu* 53.1373). Epigraphic evidence from the tombstone epitaph of a military commissioner who was killed at the end of the 9th century amidst a military upheaval (Barenghi 2020) reports that he "persuaded the military officers and soldiers to deepen and restore ancient canals, opening up fertile plains and irrigating several million *mu* of farmland" (Li 2022; Nishimura 2009), once again demonstrating the Tang state's determination to boost local agricultural production.

Table 5.4: Han Chonghua's new farms presented in numbers, as detailed by Han Yu. Source: *Tang Complete Documents* (*Quan Tang wen* 556.5623-24).

year	number of farms	ha/ farm	people/farm	ha/person	tot. people	tot. hectares
812	-	-	-	1.8	900	1,680
812	15	560	130	4.3	1,950	8,400

814	40	560	175	3.2	7,000	22,400

In the early Spring of 812 CE, floods affected different places in the region, causing considerable damage to the East Citadel and, according to the epitaph of the then Commissioner for Salt, Iron, and Transportation, Lu Tan (748–817 CE), destroying the walls of the West Citadel. Reportedly, in early Spring 813 CE, the West Citadel again suffered significant damage caused by another flooding event (*Tang huiyao* 73.1310-11; *Jiu Tang shu* 37.1360 and 44.784; *Quan Tang wen* 497.5069; *Xin Tang shu* 159.4960). In 825 CE, the East Citadel was relocated further away from the Yellow River's banks on account of the risk of possible flooding (see Fig. 5.2; *Jiu Tang shu* 17a.517, *Quan Tang wen* 73.1311).

The floods caused significant damage to military infrastructure and may have impacted the water transportation system. In 812 CE, the court debate began with a request from the then Fengzhou Defense Commissioner to repair the West Citadel. By contrast, the central government wanted to move the Tiande Garrison further east, reportedly 120 kilometers southeast of the West Citadel, in a location along the route leading to the northern steppe, with its southern end connected to the Mouna Range, which reportedly yielded excellent timber that could be used for the reconstruction of the fortress. To the south of the mountains lay Maibo Pond, surrounded by fertile land unparalleled in its vicinity (*Yuanhe junxian tuzhi* 4.18-19, *Quan Tang wen* 6.11235-36). As a result of the dispute, the military commissioners were removed from their positions, one of them reportedly dying of sorrow, and the newly appointed Fengzhou General Protector eventually moved the garrison, causing resentment among the soldiers who killed him and his family (*Tang huiyao* 73.1311; *Quan Tang wen* 64.6465; *Jiu Tang shu* 15.452).

Despite the military unrest, the relocation is depicted as a successful policy, encouraging a large number of people to settle within the newly restored and fortified citadel, reportedly more than 30,000 households, which would correspond to approximately 150,000 people, assuming an average of five members per household. This number is likely an exaggeration and should be taken with caution. However, as noted above, the information provided suggests that this new population was primarily composed of soldiers, as the garrison army grew, attracting warriors from afar to relocate on-site (*Yuanhe junxian tuzhi* 4.18-19).

The court likely aimed to position soldiers closer to agricultural production centers in the central and eastern regions of the Ordos Loop. This strategy suggests that the state aimed to restrict long-distance transportation to military emergencies and promote reliance on local production. Even if we approach the provided figures with caution, they still suggest a significant increase in the military population dependent on the state for agricultural supplies. While the influx of new settlers is viewed positively by policymakers, it is clear that this growth could create tensions within the border garrisons. In 813 CE, Uyghur units approached the edges of the West Citadel. Fearing that garrison soldiers and mercenaries might defect to the Uyghurs, the court appointed a Grain Procurement Commissioner, responsible for coordinating grain purchases during the autumn harvest and for storing supplies in the military granaries in Shengzhou. This was intended to ensure that the Tiande Garrison would still have access to resources if communication with Zhenwu were cut off. Perceiving a potential risk of supply shortages, soldiers at the Zhenwu Garrison rebelled against the military governor, leading to the killing of his family and assistants (*Jiu Tang shu* 15.448). In the ensuing decades and until the end of the ninth century, the Ordos Loop region was largely under the control of the Hedong Military Governor (Drompp 2005; Barenghi 2020, 2021), effectively beyond the direct control of the central government.

Concluding remarks

From the early 8th century, the Ordos Loop underwent significant state intervention, marked by the establishment of military citadels housing permanent garrisons. Subsequently, resource exploitation, land and water management, transportation infrastructure, and the local economy were predominantly shaped by state-led policies aimed at provisioning military activities. The local horse trade, previously operated independently by regional markets, was regulated by a state-sanctioned border market overseen by the military. The West Citadel became a key hub for horse commerce, supported by nearby abundant pasturelands for grazing. A structured grain supply system was developed to sustain the military presence, relying on local taxation, regional production, and long-distance procurement. This supply network provided provisions for the troops and was centered around the citadels.

To reduce transportation costs, the Tang military relied on state-run farms, where farmer-soldiers cultivated land for their own sustenance while simultaneously fulfilling military duties. In this chapter, I argue that the consistently low productivity of the agricultural land assigned

to the northern frontier military farms can be attributed to a land allocation and management policy that did not consider the specific environmental and hydroclimatic constraints of the northern frontier territories, nor did it take into account the difficulties faced by farmer-soldiers, who had to balance agricultural labor with military responsibilities. Evidence of local mismanagement and widespread corruption is also apparent in historical accounts. Overall, the extent of agriculture for sustaining soldiers in much of the Ordos Loop remained relatively low in both time and space, and pastureland may have prevailed over agricultural land. A comparative analysis of the agricultural practices of military farms on the western frontier could offer further insights into land use for military subsistence (Barenghi 2026). When military farms failed to yield adequate harvests, this contributed to a decline in the military population and the eventual collapse of the farmer-soldier system in the region. The withdrawal of farmer-soldiers and the creation of civil agricultural settlements can be compared to a similar process in the Hexi Corridor during the late Han period, following the dismantling of the Han military farms. In the Han case, Trombert (2020) argues that the profitability attributed to the military farms was a narrative encouraged by government officials who supported a long-term policy of territorial expansion. He suggests that the actual value of these military farms lay in their role as a foothold that facilitated the large-scale settlement of civilian farmers.

The decline in the military population resulted in demographic and economic shifts. Starting in the 750s, as the Tibetan expansion moved eastward, the state implemented policies to compel the relocation of various pastoral-military groups into the Ordos Loop and the northern Hedong region. These resettlements were not spontaneous movements of individuals; instead, they were the outcome of state-driven policies. The regional economy (horse trade and breeding, goods transportation, and salt extraction) that had developed around the northern citadels, combined with the opportunity to serve in the military ranks, constituted a significant factor of attraction for frontier military groups. The new settlers were primarily pastoralist-mercenaries engaged in animal husbandry and military service who settled mainly in the central and western parts of the Ordos Loop, relying on the state for agricultural produce.

In this paper, I highlight the historical significance of state and institutional responses to environmental constraints and extreme climate events. Despite persistent challenges, including low agricultural productivity and a prolonged drought in the first half of the ninth

century, the Tang state continued to allocate resources to local agricultural production in the eastern Ordos Loop. This shows how military farms were unsustainable without constant state investment. As institutionalized systems, they appeared to expand during favorable climatic phases, masking structural ecological fragility. Moreover, the tension between military priorities and agricultural sustainability persisted: soldiers were poor farmers, and displaced civilians were slow to return. The state's decisions were influenced by political factors that prioritized control over regional resources, with the aim of stabilizing the population on the northern frontier, recovering from losses in the western territories, and reducing transportation costs. The Tang state management problems appear to stem from a failure to take ecological conditions seriously, with a prioritization of political and military considerations. This approach persisted even when hydroclimatic circumstances significantly constrained what could realistically be achieved in political or military terms.

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Tang units for volume and area (based on Twitchett 1979)

hu 斛 (bushel) unit for volume, used for grain and liquids, one *hu* corresponds to 50 liters

dan 石 unit for volume, used for grain and liquids, one *dan* corresponds to 100 liters

mu 畝 unit of area, one *mu* corresponds approximately to 0.056 hectares

qing 頃 unit of area, equivalent to 100 *mu*, one *qing* corresponds approximately to 5.6 hectares

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