The Myth of Desertification of China's Northwestern Frontier

The Case of Ningxia Province (1929-1958)

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In imperial China, government action to rangeland at the northwestern frontier was for centuries determined by defense and what can be called "turning waste into use." For the pacification of the region beyond the Great Wall, which frequently suffered from incursions by nomadic tribes, military colonies were established to reclaim land. The empire also set up Horse Pasturage Directorates (Mujian) under the auspices of the Imperial Stud (Taipusi) to ensure a steady provision of horses for military use. In contrast with the spatial perception of nomadic peoples, who valued the vast and open steppe, sedentary Han Chinese abhorred barren land that produced no grain. In their view, rangeland was no more than "wasteland" (*huangdi*) that needed to be reclaimed and cultivated.[1] The garrisons of the Great Wall contributed to this purpose. Exiles and landless farmers who had fled from war and famine were resettled in these areas with government support. Thus, the garrisons could be strengthened while catering for military self-sufficiency in grain.

In contrast to the late Qing era and the early Republican period, Chiang Kai-shek's government integrated socioeconomic and technical aspects in land development, although the basic format remained the same: agricultural reclamation (Christiansen, 1992: 79). Years of reclamation coupled with population pressure are believed to have led to rangeland degradation with desertification as the ultimate outcome.

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During the late 1930s and 1940s, the idea that rangeland is a depletable natural resource in need of conservation gained ground among government officials and academics. Instead of being open to reclamation, the steppe areas had to be protected. Gradually, the contours of modern rangeland management practices became visible. These included technical measures, such as the calculation and assignment of carrying capacities to plots of rangeland, rotational grazing, pasture seeding, and the sinking of wells. In addition, rangeland management reached into the socioeconomic sphere, touching on matters of regional planning and the sedentarization of nomadic people.

Since the late 1930s, rangeland management and protection have remained issues on the political agenda, occasionally vanishing during political turmoil but recurring when times were stable. Despite the fact that principles of modern rangeland management entered government thinking, real development and conservation action were lacking. Not until the Communist regime was firmly established were attempts undertaken to implement and formalize these measures by laws.

The prime question addressed here is the following: did government-induced reclamation of rangeland lead to desertification in Ningxia Province? There is a wealth of historical references in which certain locations (Mu'us, Tengger, Ulan Buh desert, etc.) are described as desert (but not necessarily "desertified"). From these sources, Chinese and Western scholars inferred that desert expansion results from opening up of land for agriculture and, moreover, that it expanded as reclamation increased. This concept of desertification relies on two assumptions: (1) the continuity of environmental pressure and (2) the irreversibility of rangeland degradation and desertification. I challenge this historical desertification thesis exactly on these two grounds.

Recent research in arid and semiarid areas has given rise to the speculation that degradation and desertification are not linear processes keeping pace with the intensity of human or animal (overgrazing) impact but are a natural phenomenon of expansion and contraction in response to rainfall (e.g., Binns, 1990: 106-13; Forse, 1989: 31-32). The extent to which human activity can lead to short-term (over several decades) desert expansion if ecological pressure is

maintained for a sustained period is still debated by rangeland scientists. Pending a conclusion to the debate, the second hypothesis on irreversibility remains in the air. It may be that even if reclamation induces degradation, the vegetation will exhibit sufficient resilience to recover as soon as the ecological pressure falls away and climatic conditions permit. A definite answer to this question from the time frame covered here (1929-1958) involves a detailed scrutiny of historical texts on the boundaries of deserts because more reliable material on the basis of satellite images is unavailable.[2] But such sources are fragmentary and unreliable, and this assumption remains an issue for future research.

What I do show to be false is the first hypothesis: the continuity of environmental pressure. I demonstrate that in a typical frontier region such as Ningxia Province, agricultural reclamation due to social conflict and natural disaster has been anything but continuous. Moreover, I argue that the initial emergence of rangeland management and protection in the late 1930s and 1940s was not a governmental response to an actual or "objective" desertification but propelled by the need to rebuild, develop, and modernize the pastoral sector after the ravages of the Second World War and the ensuing civil war. To address this argument, I review the changing role of the government of Ningxia Province in pastoral development since the province's founding in 1929 until the creation of the Ningxia Hui Autonomous Region in 1958. This textual analysis is done against the background of demographic and socioeconomic conditions of the time.

To talk about Ningxia is to talk about a province with mind-boggling boundary alterations over the ages. It is important to note that Ningxia during Republican times or the Second World War (when divided into Ningxia Province and the Shaan-Gan-Ning Soviet Border Region) is quite different from the post-1958 autonomous region. The changes in administrative boundaries also entailed socioeconomic, ethnic, and ecological changes, which influenced the content of rangeland development policies over the decades. Figure 1 shows that Ningxia during the Republic included the steppes of Inner Mongolia: Ejin Banner, Alxa (Alashan) Left and Right Banner, and Dengkou County.[3] This area consists of the Alxa Plateau rising to nearly 1,000 meters above sea level, as well as several deserts, including the Tengger, the Badain Jaran, and the Ulan Buh. The rangeland in this region has been

classified by Chinese scientists as "dry grassland" (*ganhan caoyuan*: vegetation dominated by short grass species) found in Dengkou and "desert grassland" (*huangmo caoyuan*: grass and shrubs interspersed with bare soil) located further west (Committee on Scholarly Communication with the People's Republic of China [CSCPRC], 1992: 12-18). Annual precipitation in the area confined by Ningxia Province hovers around 150 mm (or even lower in the northwest) to 300 mm in the south (Yanchi County).

The livestock sector in Ningxia from 1929 to 1958[4] compares to pastoral regions such as Xinjiang and Qinghai. The greater part of Ningxia Province was inhabited by Mongol herdsmen, who led a traditional nomadic life and engaged in the raising of sheep, goats, horses, and camels. Irrigated agriculture (including rice cultivation) was concentrated in the fluvial plains of the Yellow River, but dryland agriculture predominated.

NINGXIA BEFORE THE REPUBLIC: IMPERIAL HORSE PASTURAGES, MILITARY COLONIES, AND AGRICULTURAL RECLAMATION

Ningxia's defining characteristic has been its frontier status. Located at the fringes of the empire, Ningxia was also a location at the perceived boundary between Chinese civilization and the Xiongnu—the barbarian tribes.[5] Ningxia was positioned at the crossing of a sedentary, agrarian culture and the nomadic, pastoral way of life.[6] Since earliest times, Ningxia suffered from incursions by nomadic tribes and roving bands of farmers and was often the seat of war. It is this strategic position that for centuries justified military colonization and government-supported horse breeding. The middle and south of modern Ningxia are lined with ruins of withered forts and watchtowers that once formed a mighty system of defense along the Great Wall. As early as the Qin dynasty (221-206 B.C.E.), the empire established military colonies for defense, agricultural reclamation, and resettlement of landless peasants.[7]

To safeguard the supply of horses for its armies, the Western Han (206 B.C.E. to 24 C.E.) founded imperial horse pasturages under the Imperial Stud (Hucker, 1985: 149 (848), 336 (4046), 337 (4062,

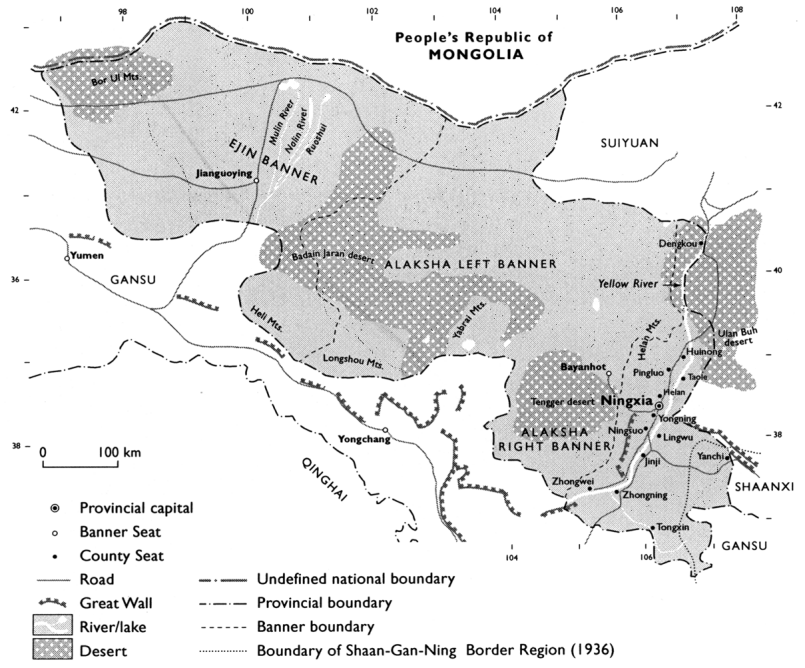

Figure 1: Ningxia Province (1929-1949)

4067)). These lasted almost two thousand years until their demise in the early Qing. Horse breeding was concentrated on the Loess Plateau in the south. Apart from two imperial horse pasturages in Lingzhou (present-day Lingwu County), many other horse ranges were set up under the Han. At the time, more than 300,000 animals were raised in Ningxia. The imperial horse ranges were abolished in the fourth year of the Kangxi reign (1665) as the production of military mounts shifted to Qinghai and Mongolia. Some 60 years later, they were revived for a short period, probably to support Yongzheng's western campaigns starting in 1726.

Over time, however, horse breeding was replaced by the raising of sheep and goats. This shift might be a sign of climatic change to a more arid environment as goats and sheep have lower water requirements. On the basis of the water level of the Yangzi and migration patterns of nomads, Fang and Liu argued that the period from 1600 to

1800 was characterized by a warming up of the climate in China (Fang and Liu, 1992: 151-69; Zhang, 1993: 289-99). In Republican times, sheep and goats far outnumbered horses. According to 1941 statistics, approximately 21,800 sheep and goats were raised in Guyuan, as opposed to 930 horses. The annual production of wool at the time reached a total of 45,000 kg. Wool and hides were exported to places as distant as Xi'an, Baotou, and Pingliang (Chen Yuning, 1993a: I/44-45, 313; Guyuan xianzhi bangongshi, 1992: 265-67; Chen Tongming and Song Guogui, 1993: 407).

So agricultural reclamation in this region started more than two thousand years ago. Since then, it is said, the reclamation process went on relentlessly. During the Republican era, the Ningxia government created great plans for agricultural reclamation. Sometimes land was opened up in combination with the development of irrigation. But generally, agriculture in the new regions was dependent on rainfall.

Modern Ningxia is enclosed by two deserts: the Mu'us in the northeast and the Tengger on the west bank of the Yellow River. It is believed that these deserts encroached on rangeland as a result of reclamation and continuous cultivation. A Western scholar writing about the "sandland" of today's Inner Mongolia remarked,

> Records from the Liao dynasty (C.E. 907-1125) show that this was once an area of substantial forests and grasslands that supported a modest population of nomadic herders. Only in the nineteenth century did significant numbers of Han agriculturalists begin moving into the region, putting marginal lands under cultivation. . . . This trend continued during the twentieth century, reaching a frenzied pace in the 1950s and 1960s. [CSCPRC, 1992: 18]

The current academic view on the history of desertification is that its origins can be traced back to the Ming dynasty (1368-1644). At the time, human influence was rather limited. Desertification increased over the Qing dynasty (1644-1911) as the scale of reclamation expanded. Human activity became a factor in the late Qing and early Republican periods when reclamation was heavily stimulated by foreign missionaries who gained large tracts of land from the Mongol nobility as collateral for the Boxer Uprising indemnities (Chen Yuning, 1986: 69-82; Chen Yuning, 1993b: 175-77; Zhao Yongxia, 1981: 24-47; Ma Zhenglin, 1984: 38-47).

According to the 1540 provincial gazetteer, the environment of Tiezhuquan, a town in the middle of Yanchi County (formerly called Huamachi), had abundant and fertile grassland suitable for reclamation. Near the end of the Ming dynasty, Liu Tianhe, an official who had inspected the area, confirmed the accuracy of this description. Toward the end of the Ming dynasty and the beginning of the Qing, chronicles already describe Yanchi—and not Tiezhuquan in particular—as a region of "flying sands" (*feisha*). Based on this, Chen Yuning concluded that military colonization caused great parts of Yanchi County to be reclaimed for agriculture and livestock farming, which put increasing pressure on the grasslands and led to the expansion of the desert (Chen Yuning, 1993b: 175-77).

This conclusion is flawed. Linking a description of a single town (Tiezhuquan) with those of the entire county does not provide sufficient evidence to conclude that desert in the entire county expanded. Only more detailed descriptions on the historical boundaries of desert can justify such a conclusion. In addition, the causal relation between reclamation and desert expansion is grounded on the assumption of a gradual buildup of pressure on rangeland from the Ming through the Qing dynasties. Reclamation was not sufficiently continuous to cause land degradation. Even taking the shorter period of the late Qing and early Republican era as the time frame in which reclamation had a perceivable impact on rangeland ecology, the matter is unequivocal. As I demonstrate below, it is exactly the perspective of time that makes reclamation and its environmental impact complicated issues to analyze.

VARYING RECLAMATION EFFORTS

First, due to war and natural disasters, reclamation occurred in a wavelike pattern, waxing and waning. For example, under the Qin, the boundaries of Beidi Commandery (to which Ningxia belonged) kept changing. The Hetao region was annexed and colonized after successive campaigns under Meng Tian (215-221 B.C.E.). But the cultivated land and fortifications were lost again to the Xiongnu during the early Han dynasty (Chen Yuning, 1993a: I/35, 39). During the Ming, Ningxia (then called Ningxiazhen) was one of the empire's nine important military border regions. In 1376, early in the reign of the Ming founder, five military garrisons and seven command posts (*wu*

wei qi suo) were established. The approximately 40,000 soldiers[8] (supposedly self-sufficient in grain and fuel) must have had at least some impact on the environment. In the early Qing, however, much of the land brought under cultivation earlier was abandoned. Apart from wars of the Ming-Qing transition, the vicissitudes of nature also contributed to this. Over the last 40 years of the Ming, Ningxia (including Guyuan) frequently suffered from natural disasters. For example, ten severe droughts occurred between 1609 and 1644. And there were other calamities, such as hail, storms, and earthquakes. Over the same period, the years 1615, 1628, 1629, 1630, 1634, 1638, 1640, and 1643 entered the annals as years of extreme famine during which "people ate the bark from the trees, while fathers and sons, husbands and wives ate each other and eight or nine died out of ten" (Yuan, 1994: 427-38, 1625-38).

The Qing government decided that abandoned farmland on the east bank of the Yellow River should again be opened up for cultivation. In 1655, Governor Huang Tu'an reported a variety of problems to the throne. From his memorial, an image arises of a region depopulated by wars and natural disasters. According to Huang, the several thousand soldiers who had remained in Ningxia (then called Ningxiafu) after its conquest were ill equipped and poorly fed, and the greater part of the region consisted of desert with virtually no population. About trade, he wrote, "If markets are opened, only a few dozen people show up to exchange sheep skins or wool" (Huang, quoted in Yang Huanyu, 1992: 647-51).

Until the Qianlong era (1736-1796), Ningxia experienced relatively stable development. A devastating earthquake killed 50,000 people in 1738 and displaced many more, yielding a sudden population drop. In 1812, Ningxia had 1.3 million people. In the late nineteenth century, Ningxia again suffered a serious decline in population, due to Muslim rebellions during the Tongzhi reign (the official death toll was 120,000). By the last decade of the Qing dynasty, the population of Ningxia was a mere fraction of what it had been a century before, with approximately 350,000 people in 1908 and 250,000 in 1909. Assuming the bulk of the population was rural, land under cultivation likely followed the same trend of decline and growth as the population. By 1875, much land was reportedly left idle because of a decade of war. General Zuo Zongtang subsequently ordered a new

land survey and to "widely recruit refugees and support them to revert to agriculture" (Chen Yuning, 1993a: II/40-43; Hu Pingsheng, 1988: 336-37).

THE ECOLOGICAL ENVIRONMENT OF RECLAMATION

It is essential to understand the ecological environment in which reclamation occurs. Reclamation likely happens on fertile soils first, as these are better suited for agricultural purposes. Sandy and ecologically fragile areas (such as Yanchi County) are reclaimed in a later stage and often abandoned after a certain length of time. Some recent statistics can clarify this. For example, in Qitai County in Xinjiang, more than one million mu[9] of rangeland were reclaimed early in the socialist era. At present, not even one-fifth of this land is under cultivation. The same applies for Qinghai Province, where 5.7 million mu were reclaimed in the 1950s, while in 1963, only 3.2 million mu were still under cultivation (Shi Wenzheng, 1996: 94).

Modern insights into the dynamics of rangeland ecology caution us not to believe too easily in the myth of the marching desert. The theory on nonequilibrium ecology postulates that rangelands in semiarid and arid regions—characterized by highly erratic rainfall—show a natural pattern of alternating vegetation decline and growth in response to changes in precipitation, rather than due to human or animal influence. In this pattern, desertification is a natural phenomenon, which casts a completely different light on soil degradation and its irreversibility (Behnke, Scoones, and Kerven, 1993; Scoones, 1995). This implies that the same plot of land that has been reclaimed, cultivated, and abandoned when soil fertility declined can be very well re-reclaimed when it has had sufficient time to recover.

CHANGING REFERENCE POINTS

A last reason why historical figures on reclamation can be highly misleading are the changes in administrative boundaries. Ningxia underwent countless boundary shifts. Therefore, the aggregate reclamation data of Ningxia Prefecture during the Qing in the Ningxia Province before, during, and after the Shaan-Gan-Ning Soviet Border Region are virtually impossible to compare. Moreover, as a means to

cope with insecurity, traditional farmers in modern Ningxia (like farmers in arid areas elsewhere)[10] are known to reclaim more land if they expect better weather, which is just as easily left fallow if rainfall is disappointing. More research into whether this technique was also known during the Ming and Qing eras.

Assessing the environmental impact of agelong reclamation is not just a matter of accumulating the data to arrive at a total of cultivated land, after which it can be concluded that reclamation expanded and, thus, the desert. From the above, it can be questioned whether—in traditional societies—the pressure on rangeland through agricultural reclamation could have been enough to cause long-lasting or even irreversible degradation.

*"DEVELOP THE WEST, BUILD UP NINGXIA": LAND DEVELOPMENT POLICY IN THE 1930*S *AND 1940*S

When Ningxia was officially proclaimed a province on 1 January 1929, Men Zhizhong, commander of the Feng Yuxiang's Seventh Army, was appointed its first governor. From the start, he had to deal with two rebellions: one in 1928 under Yang Zifu, immediately followed by another under the Muslim leader Ma Zhongying. Defeated by Ma Zhongying's forces, Men Zhizhong was discharged. He was replaced by Ma Hongbin, a nephew of Ma Fuxiang (who ruled Ningxia long before it was a province). In 1931, another descendent of the powerful Ma clan, Ma Hongkui, became Ningxia's paramount leader (Hu Pingsheng, 1988: 134-47; Chen Yuning, 1993a: II/102-9). It was Ma Hongkui who stayed in power long enough to come up with and carry out long-term plans for Ningxia's development and modernization. Under his direction, the most comprehensive work on the development of this border province was written: "An Outline of Policies in Ningxia Province during the Past Ten Years" (Ma Hongkui, 1940).

As in the past, land development policies during the Republican period were strongly influenced by the socioeconomic instability of wars, rebellions, and natural disasters. At its very inception, Ningxia Province was disrupted by Ma Zhongying's revolt, which swept over Gansu, Ningxia, and parts of Qinghai. Although Ma Zhongying's

soldiers had a reputation of being disciplined and supposedly "harmed no chicken or dog," some places, such as Yongchang (Gansu), where more than 2,000 were killed, were left as "widows' towns" (Hu Pingsheng, 1988: 134-40). Also under Ma Hongkui, Ningxia had few peaceful days. Due to a strategic move by Chiang Kai-shek, who hoped to reduce the power of the Ma clan, Sun Dianying was appointed to the post of "Military Reclamation Commissioner of the Western Region of Qinghai" (Qinghai Xiqu Tunken Duban) in July 1933. Not long after his appointment, war erupted between Sun and Ma. The conflict lasted several months and took heavy casualties on both sides. It ended when Chiang Kai-shek personally intervened. In 1939, three successive Hui rebellions erupted again, in Haiyuan and Guyuan Counties, just over the border of Ningxia Province (Chen Yuning, 1993a: II/118-19, 225).

The incessant wars yielded another pressure on the population: the conscription of young and able-bodied men. In the twelve years from 1937 to 1948, Ma Hongkui drafted soldiers into his army seventeen times. At full strength, the army counted more than 100,000 men. Initially, the age limits for soldiers were set at 18 to 25 years, but they were gradually expanded when it became harder to find sufficient manpower. Toward the end of Ma Hongkui's regime, all men between ages 15 and 55 could be drafted. In addition, he set up reserve troops for which each county had to provide 10,000 men (Chen Yuning, 1993a: II/129-30).[11]

Nature also did not spare Ningxia. In the 1920s, two major calamities befell the peasants on the Loess Plateau. In 1920, an earthquake killed more than 200,000 people in more than 50 counties in northwestern China. During an inspection tour organized by the China International Famine Relief Commission a year later, its field director Andrew Findlay related,

> During the year 1921 it was a fairly common sight to see the harvested grain standing upon the threshing floors of farmsteads where the inmates had all been killed. Or to excavate homes with their gruesome secrets in the mangled forms of their owners. . . . It was indeed a year when there was plenty of food in the loess area where the population had been decimated. [Findlay, 1937: 61][12]

The second disaster was a long-term drought, which scourged Shaanxi, Gansu, and Ningxia and again took thousands of lives. Findlay wrote,

> From 1928 to 1930 there was sustained drought throughout this area which culminated in a famine in 1929/1930. Then, again, tens of thousands of inhabitants died this time from sheer starvation. . . . When the actual famine was reinforced by typhus the area was strewn with dead. In some villages there was none living to bury the dead. [Findlay, 1937: 63][13]

On the basis of the above, it should come as no surprise that Ningxia was scarcely populated, and wasteland was in ample supply. According to estimates of the early 1940s, approximately 97% of all arable farmland in Ningxia was still awaiting agricultural reclamation. The proposed solution to underdevelopment and depopulation was the distribution of wasteland for cultivation to refugees of war, landless farmers, and soldiers. To guide reclamation, the Ningxia Reclamation General Office (Ningxia Kenzhi Zongju) was established in 1933. Prior to reclamation, a cadastre had to be made, which took place in two stages. The first stage from spring 1933 until June 1936 was carried out by the Ningxia Reclamation General Office with traditional land measurement methods. The second stage started on 1 June 1936 and was completed on 10 July 1937. It was supervised by the new bureau, the Ningxia Land Administration (Ningxia Dizhengju). In contrast to the first stage, land was registered and classified by means of Western survey methods (Hu Pingsheng, 1988: 224, 227).

LAND DISTRIBUTION AND TENURE

Discussing tenancy in Ningxia Province, Hu Pingsheng argued that the "gap between poor and rich is very obvious." Data from 1922 show that 8% of all farmland in Ningxia was owned by 1.8% of the rural households in eight counties (Hu Pingsheng, 1988: 225-27).[14] However, landlords with more than 100 mu of land were concentrated on the fertile lands of only two counties. In the other counties, most

farmers were small and middle landholders. The extremely uneven land distribution Hu claimed was unlikely due to the harsh climatic circumstances, the lack of irrigation, and the saline soils. In fact, both Nationalist and Communist sources note that the "tenancy problem" was not that serious in Ningxia.[15] Most farmers were landowners (68% in 1947), while the rate of tenancy was 18% and partial tenancy 14% (Hu Pingsheng, 1988: 227).[16] This conforms to the general land tenure situation in northern China. As John Lossing Buck (1930: 145) wrote, "Over three-fourths of the farmers in North China are owners, but less than one-half in the East Central China localities. . . . Part owners operate one-ninth and tenants one-tenth of all farms in North China."

To avoid the concentration of land in the hands of a few, the Ningxia Land Administration promulgated the "Temporary Measures on the Allocation of Wasteland" at the completion of the second land survey in 1937. The temporary measures stipulated that the distributed wasteland per household should not exceed 50 mu. Moreover, if two households contested a plot of land, the plot should be granted to the household with the smallest area of land (Hu Pingsheng, 1988: 227).[17] In the Republican era, Ningxia showed a rather diverse land property rights situation. Land on the east and west banks of the Yellow River was privately owned, although much had been reclaimed without being registered for taxation. After the two land surveys in 1936 and 1937, the land register had in principle been cleared up. But because of the relatively high tax burden, many farmers relinquished their ownership rights, and land became state owned (Hu Xiping, Bao Yeqiao, and Fu Pujun, 1942: 13-14).[18] A considerable portion of land was "nobody's land"—once cultivated but abandoned when farmers fled because of war and famine. For this so-called "ripe wasteland" (*shuhuang* or abandoned farmland, as opposed to new wasteland or *shenghuang*),[19] the Ningxia government sought to

> recruit farmers from relatively densely populated townships and to urge those with many brothers to migrate. If there would be disputes about who should go, one should draw lots. . . . The fragmented plots [left behind], should be allocated to neighboring households with insufficient land for cultivation. [Ma Hongkui, 1940: 178]

In Alxa, Ejin Banner, and Dengkou County, the Mongol princes (*jasagh*) held formal ownership rights to the land. But as in Suiyuan, the jasagh had pledged large tracts of wasteland to missionaries as collateral for the Boxer Uprising indemnities. This was certainly the case in Dengkou County (Ma Hongkui, 1940: 174; Fu Zuolin, 1935: 142; Christiansen, 1992: 20-21, 47-48). The official attitude to the reclamation of pasture owned by Mongols changed over the years. Not long after the establishment of the "Great Mongol Empire" in 1911, Ma Fuxiang—brigade-general of Ningxia Brigade (*zhen*)—was faced with serious centrifugal forces in Suiyuan, which affected Ningxia as well.

With support from Mongolia, the nobility in regions close to Ningxia (Alxa, Otog, Uxin, and Ejin Horo Banners) revolted against the government under Yuan Shikai. Not until Ma Fuxiang had the ringleader of the revolt assassinated during peace talks was immediate danger averted. But to quell the desire for independence in Suiyuan, the Beiping government promulgated the "Rules for the Treatment of the Manchu, Mongolian, Muslim and Tibetan Nationalities." In particular, clause 8 was important as it stipulated that pasture beyond Chahar was for use by Mongols only, unless already under Chinese control. This clause granted a certain degree of internal (economic) autonomy to the Mongols. For any large-scale reclamation project, prior approval had to be obtained from the jasagh. In Ningxia's westernmost region—Ejin Banner—reclamation by Han Chinese had since long been prohibited (Christiansen, 1992: 43; Hu Pingsheng, 1988: 229; Chen Yuning, 1993a: II/79-80).

When the Guomindang came into power, relations between the Han and Mongols steadily worsened. Chiang Kai-shek adopted policies through which the autonomy of the Mongols was curtailed. The Suiyuan Special Zone was abolished and changed into a province under direct Chinese authority, which implied a further encroachment on Mongol interests (Christiansen, 1992: 71-72). Also in Ningxia, reclamation in the banners and Dengkou intensified in the late 1920s and 1930s. Due to its strategic position, a great number of soldiers were stationed in Ejin Banner. Malnutrition in the garrisons was widespread, as fresh fruits and vegetables were hard to get in the barren and

dry environment of Ejin, and many soldiers suffered from scurvy. One of the military commanders in Ejin, Guo Wennian, suggested developing horticulture in his region to deal with this problem. It was said that his experiments with the cultivation of crops, such as cowpea, pumpkin, cucumber, watermelon, and rape were so successful that in addition to having ample for his unit's use, several other garrisons could be provisioned as well. In addition to horticulture, the military also stimulated grain cultivation for self-sufficiency. The call for self-sufficiency caused an increasing influx of Han migrants to support the necessary reclamation work (Hu Pingsheng, 1988: 228-30).

According to the 1930 Land Law, the farmer who fulfilled his reclamation duties would automatically acquire the use rights to the plot brought under cultivation, although the ownership rights remained with the state. At this point, the Land Law broke with the "Regulation Concerning the Contracting of National Wasteland for Reclamation" promulgated in 1914, through which a tenant also gained ownership rights to the land reclaimed (Christiansen, 1992: 33, 61-65). If land did not belong to the state, it had to be expropriated before it could be allocated for reclamation. The Ningxia government saw no problems to further reclamation in areas with private land titles. The official view was that expropriation could proceed smoothly as long as an appropriate price was given for the land in line with its type, quality, and area, because "land is ample and people are few; land costs little and the people value money and not their land" (Ma Hongkui, 1940: 216).

The land allocation process, however, was more complex in regions where wasteland had been pledged to Catholic missionaries. In Dengkou County, the Reclamation Head Office of the Ministry of Agriculture and Forestry (Nonglinbu Kenwu Zongju) saw three possibilities: (1) unreclaimed land had to be expropriated first through negotiation with the Mongol nobility. (2) Reclaimed land could only be allocated when the leasehold and use rights had been transferred unconditionally to the provincial authorities after the expiration of the lease. If the Mongol nobility and the missionaries agreed to the transfer, the government would pay rent to the missionaries, and farmers could be attracted for reclamation. (3) For renewed reclamation of "ripe wasteland" (reclaimed and abandoned or untaxed "black land"), the Reclamation Head Office reported, "In this case, reclamation is

relatively easy to extend. . . . But procedures [to regain ownership rights] will be extremely difficult. It is feared that this cannot be done overnight" (Hu Xiping, Bao Yeqiao, and Fu Punjun, 1942: 50). The Reclamation Head Office did not further explain how these ownership rights could be regained (see also Ma Hongkui, 1940: 174, 216-18).

OUTLAWS, SOLDIERS, AND LANDLESS PEASANTS: RESETTLEMENT AND RECLAMATION

In its draft of the "Ten Year's Plan for Reclamation Work," the Ningxia Land Administration divided the province into four areas, each to be reclaimed by different social groups: refugees of war, landless peasants, Mongol nomads, and soldier-farmers (see Figure 2).

The first zone (12 million mu wasteland) was the migrants' reclamation zone (*yikenqu*) carved out in 1934 for the accommodation of refugees of war. Eighteen new villages were planned, as well as an irrigated area of 30,000 mu. An estimated 400,000 refugees could be settled here. Between 1942 and 1943, many Henan peasants, landless due to locust plagues and drought, were resettled (Hu Pingsheng, 1988: 336). Within the migrants' reclamation zone, an area (Hezhongbao, present Xinhuaqiao Township, Lingwu County) had been set apart for the settlement of criminals. The land near Hezhong Fortress was fertile and had been irrigated through the Tianshui canal. But the canal had long been silted up, and it was hoped that agriculture could be revived after restoring the irrigation system (Ma Hongkui, 1940: 178; Jiang Zhongzheng, [1936?] 1971: 5).

The second zone (8 million mu wasteland) was the Han civilians' reclamation zone (*minkenqu*) for the resettlement of landless peasants from Ningxia and neighboring provinces. This region extended over the south of Lingwu County to the north of Zhongwei.

The third region (10 million mu wasteland) was the Mongols' reclamation zone (*mengkenqu*), north to the Helan mountain range. The idea was to induce Mongol herders to engage in farming through demonstration projects. In fact, it was one of the first attempts in history to settle nomads, which would be further pursued by the government of the People's Republic.

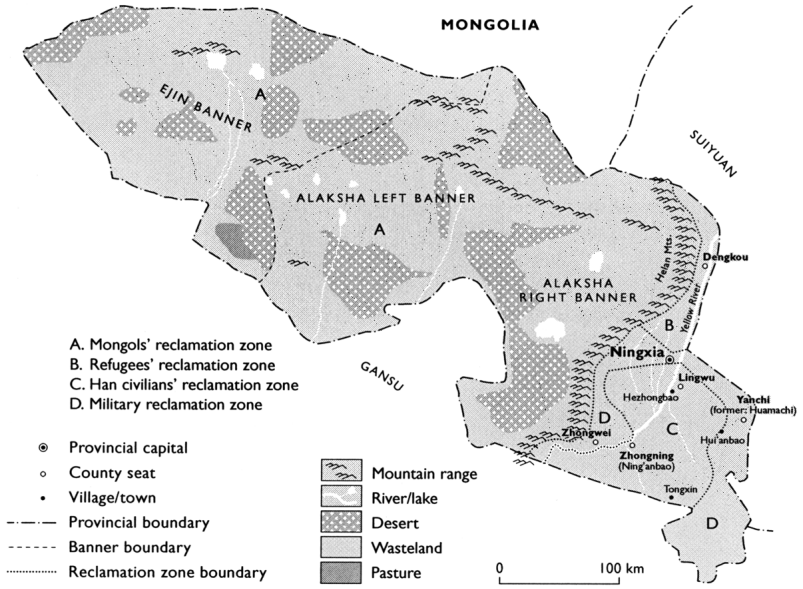

Figure 2: Reclamation Zones in Ningxia Province (1940)
SOURCE: Drawn on the basis of a 1940 map by the Ningxia Land Administration.

Primarily for national defense purposes, the fourth zone—the military reclamation zone (*tunkenqu*)—was established in strategically important areas. It covered 10 million mu of wasteland on the east and west banks of the Yellow River and on both sides of the Helan Mountains. Soldier-farmers were to be settled in newly constructed villages. Apart from the migrants' reclamation zone, each zone was estimated to accommodate approximately 200,000 people. The settlement of such a great number of colonists was planned to take place in two phases. During the first experimental phase, 2,000 people would be sent to the new villages. In the second phase, approximately 1 million people were to be settled (Ningxia sheng dizheng ju, [1940] 1943: 6-8; Ma Hongkui, 1940: 179).

Due to poor land survey methods and the political and socioeconomic instability caused by wars and natural disasters, there are

highly divergent figures on the area of arable land in the reclamation zones. For example, for the banner land (or Mongols' reclamation zone), Hu Pingsheng mentions a figure almost ten times higher than the Ten Years' Plan for Reclamation Work—namely, 96.9 million mu in the early 1940s (Hu Pingsheng, 1988: 224).[20] For Dengkou County alone, Hu quotes data from the same source and arrives at a total of 500,000 mu of arable land, of which 200,000 mu is ripe wasteland (earlier reclaimed but abandoned, or "black land"), and 300,000 mu is new wasteland. In contrast, before the first land survey was carried out, a 1935 report stated only a total area of wasteland (300,000 mu), without specifying abandoned and new wasteland (Fu Zuolin, 1935: 143). Moreover, a 1942 land survey—roughly from the same period as Hu's source—found no abandoned land in Dengkou and estimated the area of new wasteland at 177,944 mu (Hu Xiping, Bao Yeqiao, and Fu Pujun, 1942: 11). The latter figure approaches the 1935 estimate more than Hu's does but is still more than 100,000 mu removed from it. These data show that historical data on wasteland are not as unambiguous as presented in government reports and academic writings.

Flemming Christiansen (1992) also discusses the difficulties in assessing reclamation figures, noting two principal problems.[21] First, not all the land allocated for reclamation was uncultivated wasteland. Some portions were "black land," which could finally enter the tax registers through the allocation procedure (Christiansen, 1992: 29-30). Second (as noted earlier), agriculture in arid areas was generally shifting cultivation. Land designated as wasteland could well have been cultivated before but (periodically) abandoned as crop production declined.

Naturally, the expenses for the huge reclamation schemes were enormous. The total costs for the purchase of sowing seed, grain, fodder, agricultural implements, draught animals, transportation, local defense (forts, cannons, and guns), the construction of irrigation canals[22] and dwellings for the colonists, and even clothing and medicine were estimated at 50.8 million silver dollars (Jiang Zhongzheng, [1936?] 1971: 5). The government planned to finance reclamation through public loans (no interest and a four-year term) and land reclamation companies (Ma Hongkui, 1940: 176, 178).[23]

Newly arrived colonists reported to the provincial and county authorities for registration. Their data were then passed on to the Ningxia Land Administration, which issued colonists reclamation permits. The colonists then proceeded to the Reception Office (Zhaodaichu) in the region where wasteland was assigned to them. In the 1930s, three Reception Offices were planned.[24] Every mature and able-bodied man was entitled to 20 mu of wasteland, while elderly people, youngsters, and women got half that amount. The local Land Administration Office (Dizhengju Banshichu) under the Ningxia Land Administration was responsible for the preparatory work, such as the construction of villages and the provision and sale of farm implements, grain, fodder, and seed (Jiang Zhongzheng, [1936?] 1971: 5-6; Ningxia sheng zhengfu, 1936: 22-24). The actual assignment of wasteland was most likely a matter of free choice by the colonists, whereby the early and strong were able to secure the best plots.

Each new village was planned to comprise a hundred households, with less than five persons per household. Before the arrival of the first batch of colonists (2,000 people), the local reclamation office would build dwellings for them. The layout of the new villages would serve as an experiment and example for the second group of wasteland contractors (one million people), who would have to build houses themselves under government guidance.

For defense and security, households were organized according to the *baojia* system. In Qing times, the population below the district level was organized into two overlapping systems inherited from the Ming dynasty: the *lijia* and the baojia system. The former was meant to maintain social order, collect taxes, and provide other services for the local magistrate. The overlapping baojia system was established as a self-policing, local defense unit. The system was revived by the Guomindang in the areas recovered from the "red bandits" and was part of the overall local defense structure. Below the administrative level of the region (*qu*), the individual households were organized according to the baojia system: every ten households constituting one *jia*, headed by a tithing head (*jiazhang*), and every ten jia one *bao*, headed by a security head (*baozhang*) (Ningxia sheng dizheng ju, [1940] 1943: 9, 19; Ningxia sheng zhengfu, 1936: 5-6; Christiansen, 1992: 67).[25]

RANGELAND? WASTELAND? THE DAWNING OF RANGELAND MANAGEMENT AND PROTECTION

Previous sections show that apart from horse breeding at the imperial horse farms, the value of rangeland was primarily viewed in terms of reclamation. In the late 1930s and 1940s, however, more attention began to be paid to the modernization of animal husbandry. At the same time, the concept of rangeland protection for animal husbandry development entered Chinese scholarly writings and eventually the policy arena. This is not to say that there were not earlier laws and regulations providing for rangeland conservation. But the earlier law codes on rangeland conservation had completely different meanings than those of the twentieth century.

The earliest law codes on rangeland conservation are the Great Law promulgated by Genghis Khan, the Tsaaziing Bichig Code (1230), and the laws by Khubilai Tsetsen Khan (1321). In general, these regulations prohibited fire on pastures and restricted hunting. This was also true of the Mongol codes of the eighteenth century, such as the Khalkh Jirum (1709) and the code by Woqilai (1728/1729). For example, the fifth law code of Woqilai Tuxietuhan[26] provided that anyone who accidentally set fire to pasture be fined one horse and five head of cattle. In addition, he must compensate for the loss of the pasture. The witness was rewarded with one head of cattle from the fine, while the one who extinguished the fire was to get the remaining four. If the offender put out the fire himself, he was exempted from prosecution.

Few early Republican-era texts dealing with rangeland conservation and control of desertification have been found so far. Instead, the steppe and desert were appraised in terms of suitability to agricultural production. Illustrative for this thinking is a 1916 text written by a Mongolian author about Inner Mongolia. He proposed developing irrigation in the desert as the "fundamental plan for agriculture." The author envisioned a great future for China's deserts and pointed to "miracles" performed in the United States and France:

> The desert in the western part of North-America was once barren land. Nowadays, various cereals and forage can be harvested due to "the fat" of well water. Also, the Sahara desert in Africa was in the past without any water and could not be cultivated. However, after it had been

> occupied by France, everywhere underground irrigation tubes were constructed and wells sunk. The natives call this "divine water" (*shenshui*). [Hualeng Linchuan, 1916: 17]

What spurred the modernization of the pastoral sector? First, the introduction of improved livestock varieties and Western veterinary knowledge. And second, the necessities of the civil and Japanese Resistance wars. New foreign cattle varieties were introduced into China for the first time from Indochina and by missionaries. At the turn of the nineteenth century, a stream of modern breeding techniques, improved animal varieties, and veterinary knowledge were imported, which influenced the Chinese livestock sector. In 1905, part of the Imperial Stud was merged with the Bureau of Communications (Chejiasi) of the Ministry of War (Bingbu) to form the Bureau of Military Livestock Raising (Junmusi). This agency set up two horse-breeding farms in Chahar for experimentation with crossbreeding English, Russian, and Mongolian horses. At the time, there was an increasing interest in foreign knowledge on crossbreeding and veterinary science.

The Nationalist administration also stimulated animal husbandry. Initially, the Bureau of Reclamation and Livestock Raising (Kenmusi) was established to continue the work of the former Junmusi. This state organ was later renamed the Bureau of Fishery and Animal Husbandry (Yumusi). Experimental breeding farms were set up in a variety of locations, such as Zhangjiakou (Hebei), Shimenshan (Anhui), Wuxian (Jiangsu), and Shanghai (Deng Yinzhang, 1991: 11-12). Chiang's government also subsidized a breeding farm in Ningxia: the General Livestock Farm. In 1939, the farm was founded at the foot of the Helan Mountains, covering an area of approximately 1,200 square kilometers on which 5,000 sheep, 370 cows, and 130 horses were raised. The main aims of the farm were crossbreeding and increasing livestock production. The latter would be achieved through improved herd management, veterinary care, and forage cultivation. Foreign livestock varieties were introduced for crossbreeding with Chinese breeds, such as the purebred Arab horse, the Hereford cow for meat production, and the Merino sheep—the latter two specifically suited to an arid environment. It was hoped that the General Livestock Farm would radiate knowledge on veterinary care and breeding to the

farmers. For this purpose, livestock extension officers were trained in animal breeding and veterinary science (Ningxia sheng xumu zongchang, 1946: 1-10; Ma Hongkui, 1940: 182, 341-43).

In addition to the governmental wish for modernization, there was another reason for the development of animal husbandry: the armed conflicts. War necessitated large-scale horse breeding for the cavalry, even more so for remote regions. A Chinese author noted,

> A motorized army needs good roads, otherwise it is hampered in its effectiveness; horses are not like this. Moreover, a motorized army needs gas, if gas supply is terminated, it will stop to move. But horses do not have this shortcoming. [Cai Wuji, 1945: 18]

More important, war had caused a great shortage of livestock, as a result of the demand for draught animals in the army. The situation was aggravated by poor veterinary conditions. A Western author remarked about livestock diseases and parasites in Ningxia: "When one-fourth to one-fifth of the cattle of a whole province are wiped out by rinderpest in one summer, it becomes a serious matter to all concerned" (Moyer, 1937: 25). Apart from rinderpest, other livestock diseases, such as swine fever and pleuropneumonia of sheep, were frequent problems. According to a report by the Ministry of Agriculture and Forestry, 2.8 million cows died from rinderpest, while another 9.2 million hogs died from swine fever in China in 1933 (Deng Yinzhang, 1991: 13). Similar conditions prevailed in Ningxia. In an incomplete record of livestock pests at the Loess Plateau, 1901, 1914, 1916, 1917, 1920, 1926, 1928, 1933, 1934, and 1939 were recorded as years during which "nine out of ten corrals were left empty." Parasitic diseases in sheep, such as scour, were notorious. In 1934, more than 32,000 sheep in Guyuan County died from scour (Yuan, 1994: 1532-34; Chen Tongming and Song Guogui, 1993: 421).

Both Communist and Nationalist camps in Ningxia recognized the importance of increasing animal numbers. In 1940, the government of the Shaan-Gan-Ning Border Region proclaimed the "Temporary Measures for the Development of Livestock." The requisitioning of draught animals for military use was limited according to age. Furthermore, it was stipulated that draught animals should be exempted from military service if the owner fully depended on them for

livelihood. The slaughter of cattle was strictly forbidden, unless permission had been granted by the relevant authorities (Shaan-Gan-Ning bianqu zhengfu, 1949: 1). On the other side, Ma Hongkui also banned the slaughter of cattle. He sought to protect and increase animal numbers by rewarding breeding efforts and setting up veterinary training courses (Jiang Zhongzheng, [1936?] 1971: 6).[27]

The main constraint encountered in the development of animal husbandry was and still is the lack of livestock feed. Spring is particularly difficult, and many young animals die from starvation. For this reason, Chinese scientists turned to Western theories of rangeland management to increase grass production. Farmers were provided with free grass seed and encouraged to cultivate forage and store hay. The occasional calls for rangeland conservation occurred within this limited context of improving forage production and were essentially different from the antidesertification measures of the 1950s. For example, to improve the area of the General Livestock Farm in Ningxia, which consisted of pockets of desert, poplars were planted as "shelter for herder and animal" (Ningxia sheng zhengfu nonglinchu, 1946: 108; Ma Hongkui, 1940: 342; Ningxia sheng xumu zongchang, 1946: 10; Cai Wuji, 1945: 21-24). Moreover, the government of the Shaan-Gan-Ning Border Region prohibited reclamation in "pure pastoral regions" unless permission was first obtained from local authorities. However, from the original text, it is unclear whether this rule was given out of concern for rangeland conservation or to protect the interests of nomadic pastoralists as was common in the past in regions such as Suiyuan and Ejin Banner (Shaan-Gan-Ning bianqu zhengfu, 1949: 1).

Although more research is needed, it seems that the first articles of the late 1930s and 1940s pertaining to rangeland management and development point to a shift in Chinese thinking about the influence of human action on the vegetation. In a manuscript (1941) on reclamation in the Northwest, a Chinese scholar noted the following about Ningxia:

> The forest of the Helan Mountains . . . is lush and thick and checks the desert. However, since the past few years, the forest has been indiscriminately cut . . . and the desert has not only eroded the plains, but also caused the silting up of irrigation canals. The situation is very serious. [Shi Zhongyun, [1942?] 1977: 36868-69][28]

The statement by this author reflects this longstanding idea about the link between human intervention in nature and the possibility of the advancement of the desert. Owen Lattimore remarked in the 1930s,

> Pastures have become overcrowded, and the decrease in real nomadism means that herds are kept too long on the same pastures with the result that the pastures become "stale." . . . The overcrowding of sheep and goats, whose sharp hoofs cut the turf, has a ruinous effect in destroying the topsoil and creating first erosion and then sand dunes that is little less wasteful than the agriculture of Chinese colonists. [Lattimore, 1962: 446]

It is noteworthy that both authors regard desertification as the outcome of factors—deforestation and the treading of the soil by animals—that are not generally accepted within the current paradigm[29] of rangeland science. For the semiarid steppe and desert, the prime causes currently identified for desertification are overgrazing and reclamation.

One of the first Chinese articles that contains all the elements and theoretical underpinnings of China's current rangeland policy was written in 1946 by Li Zhigan. He is among the earliest to indicate the relationship between government-induced reclamation and desertification. He wrote,

> In Yulin [North Shaanxi], and in Xuanhua [Chahar] there is yellow sand everywhere outside the towns, while the sand dunes reach as high as city-walls. . . . Fifty years ago there was not such a situation. . . . It is said that during the Ming, the southern movement of the desert had not expanded beyond the Great Wall. This phenomenon has little to do with forests [deforestation], but all the more with reclamation. [Li Zhigan, 1946: 33][30]

In his view, two questions had to be tackled: (1) how to improve animal production and (2) how "to persuade Mongols and Tibetans to collaborate with Han migrants in reclamation and to cause their eventual voluntary sedentarization." To solve the first problem, said Li, it is essential to combat desertification, implement soil conservation measures, and promote rational rangeland management. For the theories on rangeland management, Li turned to the United States for inspiration. He mentioned the Taylor Grazing Act, which is based on the principle of the carrying capacity or a "proper use factor" of rangeland de-

pending on climate, soil properties, and ecological factors. This notion of carrying capacity is at the very basis of China's Rangeland Law, proclaimed almost 40 years after Li Zhigan wrote his article. That he mentions the carrying capacity is not surprising. Its underlying theory was already known by that time, as it was developed by Cowles and Clements at the end of the nineteenth century and at the start of the twentieth century (Li Zhigan, 1946: 32-33).

Li (1946) warned that "the southern movement of the desert will be one of the future great perils of China." Like other authors, Li suggests continuity in the desertification process since the Ming dynasty. However, at the time of his writing, 97% of all arable land in Ningxia awaited reclamation due to wars, rebellions, and natural disasters (Hu Pingsheng, 1988: 224, 227). If such a vast area of land in Ningxia was still reclaimable pasture, then why were neighboring Shaanxi and Chahar desertified to the degree claimed by Li? His contention is more plausible if border regions such as Shaanxi and Chahar suffered from the same socioeconomic instability that caused the peasants in Ningxia to leave the land fallow, but Li Zhigan offers no explanation for this. Was his description of an advancing desert in the Northwest based on actual desertification? Or are his conclusions the result of the perception colored by his time? It is essential to have a clearer idea of what Li Zhigan could and could not know about rangeland ecology to understand his and other early Chinese writings on desertification and land degradation.

An article by A. L. Englaender, published by the Royal Asiatic Society in 1928, may help with this. He wrote,

> Most deserts are increasing; their formation is continuing. . . . The more ancient the civilization in a country is, the more the same country is a desert. Some cultures create deserts rapidly, others very slowly; the most rapidly are those of the Arabs and the Turks. . . . The principal cause of the creation of deserts is deforestation. [Englaender, 1928: 155]

On the basis of this logic, he concludes for the Chinese situation that

> the Chinese invasion came from the north. . . . It is quite natural that it should approach desert conditions; but all China down to Hongkong and Canton, shows indubitable signs of doing the same. Look at the

> mountain slopes around Hongkong and Kowloon. Look at the provinces of northern China. All of these are on different steps of the ladder which leads to desert. [Englaender, 1928: 168]

This article about desertification, published in a renowned journal, would today be judged scientifically unfounded. This should warn us of the historical shifts in the paradigms of environmental science and tells us to carefully approach the conclusions of articles of that period.

The war years prompted efforts by the Ningxia government to modernize and develop animal husbandry, combined with an emerging awareness for rangeland management and conservation. At the same time, reclamation of the more fertile pastures had gradually pushed pastoralists to the arid fringes of the steppe. The main question is the following: did the government react to an actual expansion of the desert as a result of ongoing reclamation, or were modernization plans influenced by newly introduced Western theories about rational rangeland management, coupled with the difficulties in improving livestock production on the inferior soils to which the pastoral sector was confined? Before turning to this question, I briefly describe the rangeland protection and antidesertification measures that emerged after the Second World War.

LOCKING UP THE YELLOW DRAGON: RANGELAND CONSERVATION AND ANTIDESERTIFICATION MEASURES AFTER THE SECOND WORLD WAR

In 1947, the newly established Inner Mongolia Autonomous Region adopted the policy to "protect the range, prohibit reclamation" (*baohu muchang*, *jinzhi kaihuang*). Elaborating on the same theme, the central government proclaimed the "1953 Fundamental Summary of Animal Husbandry in Pastoral Regions Such as Inner Mongolia, Suiyuan, Qinghai and Xinjiang." In line with the fundamental summary, other pastoral regions also adopted local norms of rangeland protection. The fundamental summary provided for the practice of rotational grazing, as well as pasture protection and improvement (Shi Wenzheng, 1996: 17; Ba Tu and Lin Tai, 1993: 48-49).

The early 1950s witnessed the emergence of labor-intensive mass movements for afforestation, the combat against desertification, and soil and water conservation measures (mostly in hilly areas). These mass movements were the forerunners of those typical for the Great Leap and the Cultural Revolution. The movement for halting the desert (in some communes in Inner Mongolia titled "locking up the yellow dragon"—*suo huang long*) were a prelude to the Dazhai movement in the pastoral areas: "learn from Wushenzhao Brigade." This rally against the advancing desert would in later years become known as "agriculture learns from Dazhai, animal husbandry learns from Wushenzhao" (*nongye xue Dazhai, xumuye xue Wushenzhao*) (Zhonggong Neimenggu Zizhiqu Weiyuanhui Diaochazu, 1960: 203-7; Yang Xin, 1960: 215-21; Long Taizhong, 1972: 12-27).

The extreme cold spring of 1951 was a setback for Ningxia's pastoral sector as a great number (290,000) of livestock died. This tragedy stimulated the introduction of a series of measures to protect pasture and increase forage production. For example, rotational grazing was practiced to relieve grazing pressure on pastures. In 1952, it was reported that 88 plots of rangeland with a total of 10,885 square Chinese miles (approximately 3,600 square kilometers) had been delimited for rotational grazing. Yanchi County took the lead in experiments with rangeland management, which it continues to date. The Ningxia government also heavily promoted the cutting and storage of grass as fodder in the winter and spring (Zhang Zhongge, 1953: 238-39, 241; Shanqu jianshe de yimian honqi, [1963] 1988: 678-80).

The forage problem also induced changes in Inner Mongolia. Among the more remarkable measures—as the later period saw a contradictory trend—was the attempt to increase herder mobility by promoting the transboundary movement of animal herds. In the past, herders were generally limited to pastures within one banner on penalty of a fine or confiscation of animals. As this hampered an efficient use of rangeland, the provincial government proclaimed "free grazing" and "breaking the banner boundaries." In addition, each administrative village (then named *baga*) was divided into two or three "disaster prevention mutual aid teams" (*fangzai huzhuzu*), while each team encompassed two to four natural villages (*haote*). The haote was the smallest herding unit. But in times of emergency, the baga mobilized

the various disaster prevention teams to provide forage and build snow barriers (Zhang Zhongge, 1953: 239-40).

VALIDATING THE ADVANCEMENT OF THE DESERT

PRC government efforts at rangeland management and conservation in the 1950s can be regarded as a continuation of the Nationalist drive for pastoral development. The most obvious reason for this is an intensified deterioration of rangeland and desertification. But as we will see, the emergence of rangeland management and protection during the Republican period (late 1930s and 1940s) cannot be reconciled with the then current demographic and socioeconomic conditions. To support this argument, I scrutinize the main factors currently believed by Chinese scientists and officials to lead to rangeland degradation and desertification: (1) reclamation, (2) overgrazing, and (3) population pressure (an indirect factor that is not necessarily directly related to overgrazing).

RECLAMATION

Ramon Myers (1986) argues that the war years had a devastating effect on China's agriculture. The entire period between 1920 and 1949 is labeled as the "agricultural crisis." Apart from the civil war and bad weather conditions, the loss of the Manchurian market in 1932 and the outflow of silver in 1933 and 1934 due to rising silver prices in the United States constituted major blows to the Chinese farmer. Myers writes that total farm production (including livestock and special crops) fell over the period from 1937 to 1949. His observations appear to be confirmed by reports of Communist investigation teams that visited villages in the north to check on the progress of land reform. These teams reported a great decline in livestock, tools, cultivated area, and crop yields between 1937 and 1949 (Myers, 1986: 56-69).

However, on the basis of the official data of rice and wheat production over the period from 1931 to 1946, released by the National

Agricultural Research Bureau (NARB), it cannot be ascertained that the war led to stagnation in the rural economy as a whole. If we review the data for grain production for seven provinces (Qinghai, Gansu, Ningxia, Shaanxi, Shanxi, Hebei, and Shandong), we cannot conclude that grain production was declining across the board over 1931 to 1946, on the condition, of course, that the figures are reliable. The effect of civil war on the accuracy of data collection must not be neglected.

From Table 1, it can be calculated that the average wheat production of Gansu and Shaanxi during 1931 to 1936 was lower[31] (Gansu: 440,000 tons; Shaanxi: 996,000 tons) than during the period of the Japanese Resistance War from 1937 to 1945 (respectively, 552,000 tons and 1,290,000 tons). For Shanxi and Hebei, the NARB provides no data over this particular period. If we compare wheat and rice production of 1946 with 1950, we see—in contrast to the picture of a stagnating rural sector—that the production for wheat and rice of Qinghai, Shanxi, Hebei, and Shandong was lower after than during the civil war (1946-1949). For Shaanxi, this includes wheat but not rice. It should be noted that low grain production in 1950 might be attributed to natural disasters in Shanxi (frost), Hebei (plague of locust larva), and Shandong (hail and plague of moth larva) (Zhongguo guojia tongjiju and minzhengbu, 1995: 369-70).[32]

The agricultural sector of Ningxia during the Japanese Resistance War and the civil war was certainly caught in a crisis. From Table 2, we can see that Ningxia's grain production in the 1930s and 1940s was exceptionally low compared with the later period. This is not surprising because much land had been abandoned for a long time or never been reclaimed at all. In 1946, the wheat acreage was only 373,000 mu, whereas rice occupied 115,000 mu. In 1950—one year after the end of civil war—wheat acreage had sharply risen to 1,903,000 mu and rice to 350,000 mu (NARB, 1947: 87, 89; Ningxia Statistical Bureau, 1989: 222).

After Nationalist forces under Ma Hongkui lost to the People's Liberation Army (PLA) and he fled to Taibei, Ningxia was left behind in a deplorable state. In an optimistic atmosphere, the new authorities swiftly implemented measures to build a "new Ningxia."

The Production Commission of the Ningxia Military Region (Ningxia Junqu Shengchan Weiyuanhui) heavily pushed reclamation

of wasteland. In the early 1950s, the soldiers stationed in Ningxia (the PLA's 65th Army) were deployed to open up land, dig irrigation ditches, and develop sidelines. Divisions and brigades had to provide their own grain ration for three months, whereas the regiments, squadrons, and platoons were charged with a grain ration for four months. Moreover, every individual soldier had to cultivate 3 mu of land. In 1950, the magazine *Our Own Army* **[*AUTHOR: PLEASE PROVIDE CHINESE NAME*]** reported that the 65th Army had opened up 68,000 mu of wasteland, while another 13,000 mu was planned for reclamation (Zhonggong Ningxia dangshi ziliao weiyuanhui, 1988).[33] In April of the same year, the Lingwu State Farm was established, covering an area of more than 100 square kilometers. This state farm had land reclamation as its main aim and was the first of many more to be established in postwar Ningxia. By the end of the year, the acreage of wheat was more than fivefold of that in 1946, while rice had tripled over the same period (Ningxia nongkenzhi bianzhuan weiyuanhui, 1995: 90-91).[34]

After the completion of land reform in 1952, land reclamation gained momentum as it was carried out collectively, initially by the mutual aid teams (MAT) and later by the lower and higher agricultural production cooperatives (LAPC and HAPC). A government report on the progress of the collectivization movement estimated that most LAPCs in 1953 and 1954 had expanded their original area of cultivated land by 25% since their founding (Zhonggong Ningxia shengwei [1952] 1988; [1954] 1988; 1988a; 1988b). In the first half year of 1956, more than 880,000 mu of wasteland was opened up in Yinchuan Prefecture, which exceeded the total of reclaimed land of the six years before. About a year later, the prefectural government sought to control private reclamation by imposing a limit of five *fen* (0.5 mu) per person (Ningxia nongye hezuo jingji dashiji, 1988: 1040, 1043). The cultivated land area continued to expand until 1960, after which an overall but gradual decline took place (most obvious in the early 1980s), albeit with occasional interruptions. However, the total cultivated area in any period after 1949 was many times higher than the historical lows during the war (Ningxia Statistical Bureau, 1989: 207).

TABLE 1: Official Data of Wheat and Rice Production in 1,000 Tons for Seven Provinces (1931-1958)

	Ningxia		*Qinghai*		*Gansu*		*Shaanxi*		*Shanxi*		*Hebei*		*Shandong*	
Year	*Wheat*	*Rice*	*Wheat*	*Rice*	*Wheat*	*Rice*	*Wheat*	*Rice*	*Wheat*	*Rice*	*Wheat*	*Rice*	*Wheat*	*Rice*
1931	29.46	—	—	—	370.26	—	713.52	266.22	791.10	—	2,307.90	179.34	4,619.94	—
1932	36.72	—	—	—	344.64	—	512.58	206.64	1,001.10	—	2,526.12	169.86	4,779.12	—
1933	16.92	—	—	—	347.94	5.70	654.60	199.62	1,103.88	4.02	2,947.56	135.30	4,545.60	9.54
1934	17.40	5.10	—	—	585.66	3.42	1,412.10	151.32	721.44	5.10	2,324.34	168.90	4,408.20	10.68
1935	12.90	5.88	258.42	—	535.08	5.58	1,447.74	127.26	1,035.90	4.20	2,266.14	98.34	4,037.82	8.46
1936	22.20	6.30	214.62	—	473.22	5.76	1,065.48	181.74	1,149.06	3.18	1,839.36	109.44	4,261.26	12.66
1937	28.44	6.72	239.46	—	502.92	6.84	565.74	158.28	770.10	3.54	3,466.38	92.88	3,466.38	10.68
1938	23.64	6.24	210.06	—	619.86	7.62	1,688.04	194.16	—	—	—	—	—	—
1939	33.48	6.48	245.76	—	565.44	9.12	1,434.48	192.72	—	—	—	—	—	—
1940	30.84	4.62	181.80	—	537.18	8.46	1,323.42	117.90	—	—	—	—	—	—
1941	31.32	6.12	218.46	—	504.66	9.36	1,012.56	117.60	—	—	—	—	—	—
1942	35.64	7.20	227.52	—	544.62	8.28	1,402.38	123.90	—	—	—	—	—	—
1943	30.66	8.16	245.94	—	567.78	8.64	1,078.92	126.90	—	—	—	—	—	—
1944	31.02	8.40	237.96	—	649.80	8.40	1,988.16	109.62	—	—	—	—	—	—
1945	30.60	7.62	159.12	—	454.80	8.76	1,093.92	133.80	—	—	—	—	—	—

1946	24.18	8.34	234.48	—	664.20	8.64	1,492.08	161.34	1,340.10	11.28	1,419.54	263.10	4,597.08	53.88
1947	29.04	11.04	243.84	—	541.20	9.60	1,526.94	194.46	1,225.40	10.32	1,695.60	372.72	4,154.40	58.20
1948	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1949 (*)	—	—	77.30	—	720.00	9.40	1,336.00	309.00	607.60	—	864.40	30.80	2,215.00	20.00
1950 (*)	68.80	50.10	85.40	—	760.00	10.50	1,356.00	207.00	684.90	—	1,169.90	70.50	2,355.00	20.00
1951 (*)	114.80	59.00	91.20	—	850.00	12.20	1,578.00	236.00	912.80	—	923.50	76.80	2,485.00	25.00
1952 (*)	110.00	98.80	115.10	—	920.00	15.00	1,328.00	118.00	612.70	16.98 (**)	1,155.50	97.40	3,205.00	30.00
1953 (*)	113.20	88.40	105.40	—	830.00	19.20	1,772.00	525.00	992.90	—	999.50	102.20	2,705.00	30.00
1954 (*)	182.30	90.00	170.60	—	1,160.00	18.10	2,120.00	539.00	1,001.60	—	1,600.80	116.50	3,570.00	40.00
1955 (*)	179.20	111.50	197.50	—	1,120.00	18.30	1,814.00	496.00	978.40	—	1,498.80	157.80	3,130.00	50.00
1956 (*)	258.50	112.20	245.50	—	1,440.00	22.30	2,340.00	541.00	1,214.40	—	1,784.30	189.50	3,665.00	65.00
1957 (*)	193.30	103.20	206.10	—	1,140.00	19.90	1,659.00	589.00	892.40	16.45 (**)	1,617.10	225.10	3,370.00	50.00
1958 (*)	198.20	122.20	190.20	—	1,150.00	22.80	1,603.00	554.00	962.70	—	1,382.20	221.10	3,150.00	125.00

SOURCE: Data marked (*) from Ningxia Statistical Bureau (1989: 222); data marked (**) from Shanxi Statistical Bureau (1995: 313). The rest are from the National Agricultural Research Bureau (1947: 87-90; 1948a: 90-91; 1948b: 96).

TABLE 2: Ningxia Acreage of Wheat and Rice in 1,000 Mu (1931-1958)

Year	*Wheat Acreage*	*Rice Acreage*
1931	369	92
1932	425	92
1933	215	106
1934	193	94
1935	217	87
1936	266	95
1937	315	92
1938	337	79
1939	360	83
1940	349	91
1941	396	95
1942	409	97
1943	414	103
1944	375	110
1945	375	116
1946	373	115
1947	388	114 (**)
1948	—	—
1949	—	—
1950 (*)	1903	350
1951 (*)	2039	377
1952 (*)	2182	510
1953 (*)	2236	533
1954 (*)	2502	590
1955 (*)	2422	608
1956 (*)	2841	848
1957 (*)	2753	780
1958 (*)	2762	916

SOURCE: Data marked (*) from National Agricultural Research Bureau (1947: 87, 89). The rest are from the Ningxia Statistical Bureau (1989: 222). Figures marked (**) pertain to harvested acreage.

OVERGRAZING

Overgrazing is frequently stated as a reason for desertification and rangeland degradation. Unfortunately, the data on livestock in the Republican period are fragmentary, relatively unreliable, and at times difficult to compare between provinces, which hampers a balanced assessment of the stocking rates of this period. But one may get an idea of general trends by piecing together the information that does exist.

As regards the trend in livestock numbers at the national level,[35] two things can be observed: first, the numbers of sheep and goats increased steadily between 1949 and 1956; second, the level reached in 1956 (91 million) is well below the level reached in the 1960s—110 million in 1960 and 140 million in 1969—not to mention current stocking levels (230 million in 1993 and 240 million in 1994). Most important, stocking levels in the 1960s are far above those during the 1930s and the Second World War (see Figure 3). Xinjiang, Qinghai, and Gansu show a similar situation, although there are no data for 1936 (see Table 3).

Aggregate data for Ningxia Province are missing. There is only a rough estimate of the average number of livestock over the period from 1930 to 1936 of two million head based on oral communication by Ma Hongkui. But this figure includes sheep, goats, camels, cattle, and horses (Moyer, 1937: 23). If we limit ourselves to the ruminants that constitute the greatest grazing pressure on rangeland—sheep and goats—the number after the war (889,200) was lower than the figure mentioned in Ma's report. However, by 1954, the number of sheep and goats alone (2,059,200) equaled the estimate of total livestock from 1930 to 1936. And after a gradual decline over 1954 to 1958, sheep and goat numbers steadily increased to a historical record in 1965 (3,343,500), which nears a quadrupling of the 1949 level (see Figure 4). Detailed figures at the county level (Yanchi and Tongxin Counties) show that the number of sheep and goats in 1933 was just a fraction of that of 1956 and thereafter (see Table 4).

In sum, it seems highly unlikely that stocking levels during the Republican era in Ningxia could have posed a serious threat to rangeland. In line with the reclamation data, the stocking levels indicate that the pastoral sector was seriously affected by the civil war and the Second World War and recovered only after peace and socioeconomic stability were guaranteed in the 1950s and thereafter.

POPULATION

The third factor to which desertification is ascribed is population pressure. According to Hu Pingsheng, the population of Ningxia in the 1940s hovered around 700,000 people. He states that the sudden peak in 1931 (see Table 5) must be seen as a probable outcome of poor

TABLE 3: Livestock Figures in 1,000 Heads at the National Level and for Three Provinces (1936-1966)

	National		*Xinjiang*		*Qinghai*		*Gansu*	
Year	*Cattle*	*Sheep and Goats*	*Cattle*	*Sheep and Goats*	*Cattle*	*Sheep and Goats*	*Cattle*	*Sheep and Goats*
1936	50,727.0	31,893.0	—	—	—	—	—	—
1943	—	—	3,135.9	11,726.6	—	—	—	—
1945	—	—	—	—	158.0	539.0	1,272.0	3,796.0
1946	38,191.0	21,263.0	—	—	124.0	598.0	1,204.0	3,420.0
1956 (*)	87,730.0	91,650.0	4,049.1	12,956.6	3,866.8	9,904.0	3,630.0	6,570.0
1966 (*)	87,400.0	138,080.0	4,506.6	20,719.6	3,771.9	12,734.6	3,180.0	9,260.0

SOURCE: Data marked (*) from State Statistical Bureau (1990: 13, 838, 870, 929). The rest are from the National Agricultural Research Bureau (1945: 79; 1946: 99) and Li Zhigan (1947: 17-19).

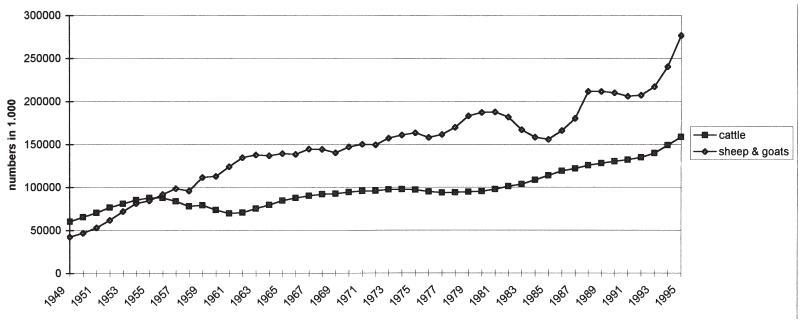

Figure 3: National Livestock Statistics (1949-1995)
SOURCE: State Statistical Bureau (1990: 13; 1997: 378).

TABLE 4: Sheep and Goat Numbers in Yanchi and Tongxin Counties (1933-1966)

Year	*Yanchi County*	*Tongxin County*
1933	150.000	60.000
1956	381,000 (*)	317,000 (*)
1966	657,000 (*)	448,000 (*)

SOURCE: Fu Zuolin (1935: 10). Data marked with (*) provided to author by Ningxia Statistical Bureau.

and inadequate data sampling methods. The population figures over the period from 1929 to 1948 do not include the population of Alxa and Ejin Banner, which, estimated by Hu, could not have exceeded 50,000 people. It is unknown whether the data over 1936 to 1948 include the population of Yanchi County, which then partly belonged to the CCP's soviet border region. The difference could not have been great as the Ministry of Internal Affairs (Neizhengbu) of the Nationalist government estimated the Yanchi population at 6,342 people in 1943 (Hu Pingsheng, 1988: 342).

Hu's assertion that Ningxia's population in the 1940s oscillated around 700,000 inhabitants seems a bit awkward if we consider the sudden leap in 1949 (see Table 5). At this point, we face a population growth of 55% in one year, which is demographically impossible

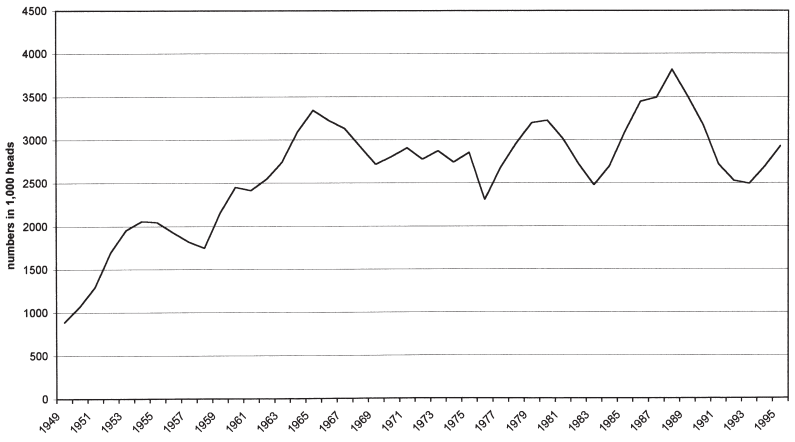

Figure 4: Sheep and Goats Figures for Ningxia (1949-1995)
SOURCE: State Statistical Bureau (1990: 897; 1997: 378); Ningxia Statistical Bureau (1989: 156).

TABLE 5: Population Figures of Ningxia (1929-1959)

Year	*Population*	*Year*	*Population*
1929	704.884	1948	773.657
1931	1,450,000	1949	1,197,501 (*)
1935	1,002,876	1950	1,259,619 (*)
1936	987.993	1951	1,331,867 (*)
1937	990.724	1952	1,424,152 (*)
1938	662.110	1953	1,510,483 (*)
1939	772.808	1954	1,584,056 (*)
1940	725.765	1955	1,651,118 (*)
1941	729.996	1956	1,720,221 (*)
1943	717.676	1957	1,793,807 (*)
1946	737.536	1958	1,935,163 (*)
1947	773.325	1959	2,088,556 (*)

SOURCE: Hu Pingsheng (1988: 337-39, 342-43). Data marked (*) from Ningxia Statistical Bureau (1989: 147).

considering the conditions at the time. As the first national census of 1953 provided more reliable data, one can assume that the population

approximated one million people during the war (the data from 1949 to 1952 are extrapolated from the 1953 census).

In the ten years after 1949, Ningxia's population virtually doubled, which fits with the trend in animal stocking levels described above. A large boost in population growth occurred at the end of the 1950s (99,000 in 1958 and 137,000 in 1959). This increase can be attributed to rural migration from the coastal areas and government-supported migration of engineers and technicians for the development of Ningxia. In 1958, the exploitation of the enormous coal reserves in the Shizui Mountains was initiated. The Lanzhou-Baotou line—Ningxia's first railway constructed in the same year—transported the multitude of migrants attracted by the new opportunities in the booming mine industry. Migrants came from as far as Zhejiang, Shanghai, and Wuxi (Lan Yupu, Du Xiaohua, and Jiang Yunji, 1990: 31-32; Li Huihe, 1990: 389-91).

DESERT EXPANSION: THE QUEST FOR DATING

In this article, I focused on whether government-induced agricultural reclamation led to desertification in Ningxia Province over the period from 1929 to 1958. Examining the three main factors to which desertification is ascribed by Chinese scientists and officials—reclamation, overgrazing, and overpopulation—I found no empirical evidence to support one of the pillars of the historical desertification thesis: the continuity of environmental pressure. What can be inferred from the examination of these three prime causes?

As regards the first cause, the scale of reclamation after the war period far exceeds that of the time before. More than some other provinces, Ningxia's rural sector was severely damaged by the incessant fighting between various armies. Both the low acreage and the low production of wheat and rice in the 1930s and 1940s confirm this. The stocking levels and census data are a tougher nut to crack. Data on stocking levels are fragmentary, and there are no reliable aggregate figures for Ningxia Province. However, from estimates and the county-level data, it can be stated with a fair degree of certainty that stocking levels during Ma Hongkui's reign of the Ningxia Province were low and only picked up after the Communists took control of the

area. It is said that Ningxia's population oscillated around 700,000 people from 1938 to 1948, but inexplicable—and impossible—jumps in the population data occurred in 1929-1931 and 1948-1949. Due to the unreliability of the data, it is difficult to assess the relation between population growth and rangeland degradation. If we take the more reliable census data after the founding of the People's Republic as a reference point, the total population might have approximated one million inhabitants in the 1940s. A steep increase in population occurs in the late 1950s—much later than the period when rangeland management and protection emerged as policy issues—as a result of massive immigration when coal reserves were exploited and the first railway was built.

In conclusion, based on the figures presented above, it seems unlikely that the demographic and socioeconomic conditions of the Republican period could have posed a substantial threat to pasture because (1) a very limited area of wasteland was reclaimed and remained cultivated for a sustained period, (2) pre-1949 stocking levels were well below those that caused the extent of overgrazing as observed in the 1950s and thereafter, and (3) the level of population pressure was comparatively low. The main explanatory factor for this is that a frontier region such Ningxia suffered frequently during this era of armed conflicts, lost huge numbers of people and livestock, and had many abandon their land to take flight. This socioeconomic instability was worsened by natural disasters such as drought, hail, earthquakes, and livestock diseases. It appears that the origin of desert expansion in Ningxia Province must be sought in a later period when socioeconomic and political stability were safeguarded in a once war-stricken frontier region. The data on reclamation, stocking levels, and population point to the late 1950s. Eyewitness accounts by older farmers, who describe rangeland as "vast and abundant" as late as the early 1950s, substantiate this view (Ho, 1998: 203).

A vexing question remains: why did texts specifically dealing with desertification occur before this period? The dawning of rangeland management and conservation as policy issues was not propelled by desertification per se but as a result of the efforts by the Ningxia government at modernizing a traditional, extensive livestock sector. The governmental reports of the Republican era found to date call for rangeland management but within the limited context of furthering the

cultivated acreage in grazing areas and improving forage supply. The academic writings on desertification of the same period are embedded in a paradigm different from the current one. Indications for this are a different conception of the causal factors that play a role in desertification, the bewildering logic (to present-day scientists) of an article published by the Royal Asiatic Society, and the lack of scientific rigor in furnishing empirical data on the causes believed to lead to desertification. Today, the prevailing paradigm of rangeland science is challenged by the theory on nonequilibrium ecology. This new theory questions the phenomenon of desertification altogether. Michel Foucault (1972: 169) stated that "succession is an absolute: a primary, indissociable sequence to which discourse is subjected by the law of its finitude," which might be a nice reminder for both the author and the reader that paradigms tend to shift.

NOTES

1. For works on the distinction between nomadic (Mongol) and Han spatiality, see also Williams (1996: 665-91); Humphrey, Mongush, and Telengid (1993: 51-61); Mearns (1993: 73-103); and Germeraad and Enebisch (1995).

2. The Department of Physical Geography at the University of Lund is currently undertaking research by means of the National Oceanographic and Atmospheric Administration (NOAA) satellite sensor to examine desertification for the 1980s and 1990s in Ningxia, Shaanxi, and Inner Mongolia.

3. On 1 January 1929, the Nationalist government ordered the Ningxia Province carved out from parts of Gansu Province and Inner Mongolia. This administrative situation lasted until May 1936, when the People's Liberation Army occupied Tongxin and Yanchi Counties, which were annexed to the Shaan-Gan-Ning Border Region. After the Nationalists under warlord Ma Hongkui were driven out of Ningxia in 1949, the Ningxia Provincial People's Government was proclaimed on 22 December. The total area of Ningxia then covered more than 270,000 square kilometers. By September 1954, Ningxia had become largely a part of Gansu Province, while Ejin, Alxa Right and Left Banner, and Dengkou County were allocated to the Inner Mongolia autonomous region. On 25 October 1958, Ningxia was declared an autonomous region, governing two cities and seventeen counties with a total surface of 66,400 square kilometers (actually 51,800 square kilometers). From 1969 until 1979, a part of Inner Mongolia—Alxa Left Banner—was once more annexed to Ningxia (Li Huihe, 1990: 3-5).

4. Also from 1969 to 1979, when Alxa Left Banner was administrated by Ningxia.

5. Before the first counties and commanderies were established during the spring and autumn (722-481 B.C.E.) and the Warring States periods (453-221 B.C.E.), Ningxia was inhabited by tribes designated as the Rong and Di. During the Qin (221-206 B.C.E.) and Han (206 B.C.E. to 220 C.E.) dynasties, the Rong and Di gradually disappeared from the Chinese accounts of frontier affairs and were replaced by "new barbarians" referred to as the Xiongnu or Hu. Following Lattimore (1962), Barfield argues that despite the change in names, the tribes were probably the

same but had adopted new military tactics from fighting on foot to combat by cavalry. See Barfield (1989: 28-30).

6. The distinction between Chinese and nomads is frequently portrayed and romanticized as a contrast between a rigid, Confucianist culture and a free, pastoral culture. However, the difference is not that absolute and clear-cut. Throughout history, the lives of agriculturalists and pastoralists everywhere in the world have often been interdependent through the trade of animal and agricultural products. Moreover, the nomads at the Chinese frontier have at times erected powerful empires that copied many aspects of Chinese culture and administration. See Barfield (1989).

7. Qin Shihuang ordered General Meng Tian to "let soldiers and exiles build watch towers in order to expel the Rong people for the beginnings of a county." The walls and fortifications thus erected are among the earliest parts of the Great Wall. Meng Tian also had older defense walls strengthened. The walls and fortifications that were newly built in Ningxia are located in present-day Wuzhong City and Taole County. The other stretches of the Great Wall that were reinforced lie in Guyuan Prefecture—the earliest parts of which can be dated back to 324 B.C.E. The parts of the Great Wall that are best preserved in Ningxia belong to the Ming period (1368-1644). See Lu Renyong, Wu Zhongli, and Xu Zhuang (1993: 1-2, 9); Chen Yuning (1993a: I/34-35); and Li (1990: 24-26).

8. The exact figure is 39,193 soldiers (Ningxia nongye hezuo jingji shiliao bianxiezu, 1988: 85).

9. A mu is one-fifteenth of a hectare.

10. For example, in Mali, farmers sow the maximum area of land, but the eventual care for the fields depends on the rainfall. The fields that do not develop well are simply left fallow. For more on strategies farmers use to deal with insecurity in dry regions, see Hudson and Cheatle (1993).

11. Jinji, Lingwu, and Yanchi Counties were one garrison region (*jingbeiqu*), with the headquarters at Wuzhong. Zhongwei, Zhongning, and Tongxin had their headquarters in Zhongning. And head command for Ningxia, Ningsuo, Pingluo, Dengkou, and Taole was established in the provincial capital. Each county (*xian*) was renamed a company (*zongdui*), each region (*qu*) a brigade (*dadui*), and each township (*xiang*) a regiment (*zhongdui*). Note that the Republican township is not necessarily equal to the present township. Depending on the area, a township then is equal to a present township or administrative village (*xingzhengcun*). A region is generally equal to a present township (Chen Yuning, 1993a: II/129-30).

12. Peasants in the loess area live in caves, which, as Findlay (1937: 63) relates, proved to be "veritable death traps when the 'quakes' came."

13. For information on the natural disasters in the 1920s, see Chen Yuning (1993a: II/343) and Yuan (1994: 581).

14. The counties were Ningxia, Ningsuo, Zhongwei, Pingluo, Lingwu, Jinji, Yanchi, and Yuwang.

15. According to a (Nationalist) rural survey done in 1940, the landlord class (owning more than 100 mu of land) was not more than 0.7% of the total rural households (Dong Zhengjun, 1947a, 1947b). A communist source states that 20.9% of all land was owned by 3.2% of the rural population before land reform (Zhu Min, [1950] 1988: 48-49; Zhonggong Ningxia shengwei, [1952] 1988; [1954] 1988; 1988a; 1988b). For an overview of tenancy in China in the Republican era, see Feuerwerker (1983: 77-85).

16. At this point, Hu Pingsheng contradicts himself.

17. Also, the national 1930 Land Law was specifically geared toward limiting land speculation and equalizing land ownership. Christiansen (1992: 63) writes that the Land Law "did not set any fixed quantity of mu per household, but stated that every household was to be allocated an

area that could feed ten mouths or be cultivated by the members of the household themselves. The number of mu needed to sustain a family varies from place to place."

18. There is no information on how ownership rights were relinquished and what title farmers might have kept.

19. The terms *shenghuang* and *shuhuang* are described in *Ningxia nongkenzhi bianzhuan weiyuanhui* (1995: 87).

20. The Mongols' reclamation zone is actually larger in size than the banner region denoted by Hu because the greater part of Dengkou County is included as well. However, the total area of arable land in Dengkou is only 500,000 mu and could never account for such a big difference.

21. Christiansen (1992) actually gives three reasons, but the third and the second are so interrelated that I have put them together. Hu Xiping and another government report also mention the laundering of black land through reclamation assignment (Hu Xiping, Bao Yeqiao, and Fu Pujun, 1942: 14; Ningxia sheng zhengfu, 1936: 23).

22. In Lingtingqu in the migrants' reclamation zone, the colonists were, together with the soldiers, organized into regiments of 1,500 men. Each regiment divided into three camps, each camp into four companies. Each two companies were allotted one piece of heavy artillery. The companies in turn consisted of nine squads of 10 to 12 men per squad. The reclamation duty per squad was 2,000 mu. Each squad lived in one small fort (Jiang Zhongzheng, [1936?] 1971: 5). As regards the construction of irrigation facilities, it was estimated that for the construction of a canal of 200 *li* (1 li = 0.5 km) with a width of 2 *zhang* (a fathom, 1 zhang = about 4.23 m), and a depth of 8 *chi* (foot, 1 chi = 0.3 m), 1,800 workers were necessary at a total cost of 180,000 silver dollars for salary and lodging. For Ningxia as a whole, the expenses for irrigation were assessed at 4.55 million dollars (Ma Hongkui, 1940: 175).

23. For more information on land reclamation companies in Suiyuan, see Christiansen (1992: 25-32).

24. It is uncertain whether the three reception offices were actually created. They were to be in Guangxingyuan (Dengkou County), Ning'anbao (Zhongning County), and Hui'anbao (Yanchi County). The region around Hui'anbao is the scene of one of the largest reclamation projects in present-day China. The so-called "1236-project" plans to migrate 746,000 farmers from poverty regions in the south of Ningxia to this area, which will be opened up through irrigation from the Yellow River.

25. For the administrative classification into regions, brigades, and so on, as well as for the local defense structure above the baojia system, see note 11. The Qing baojia system differed from the Republican version, under which ten households were organized into a registration unit (*pai*), ten registration units into a tithing (*jia*), and ten tithings into a security group (*bao*), each with designated heads. See Hucker (1985: 90).

26. The name Tuxietuhan Woqilai (with the clan name coming first) would likely be "Tüsiyetü Ochir" in modern Mongol transcription. The term *Tüsiyetü* (meaning "providing support to the ruler") is an honorific title, in former times equal to a counsellor of a monarch. However, in the eighteenth century, this term could also have been the clan name of the person or even the name of a place. Ochir comes closest to the Chinese transcription but leaves the ending "-ai" unsolved, which could be a genitive case here (Nugteren, personal communication, 1997).

27. Before the establishment of the Ningxia General Livestock Farm, policies for the development of the pastoral sector were rather limited. People were encouraged to increase their herds through rewards, while courses were organized for veterinary instructions (Jiang Zhongzheng, [1936?] 1971: 6).

28. I have not found any other Chinese sources that blame desertification in the Northwest directly on human action. I would welcome any suggestions and comments in this respect.

Zhongyun Shi wrote in the early 1940s or later. See also page 36866, where the author mentions the year 1941 (no later date has been found in the book).

29. The sociophysical character of rangeland sciences is actually on the edge of the natural and social sciences. Thus, it is somehow misleading to speak of paradigms in the Kuhnian sense. Thomas Kuhn's paradigm or exemplar is "a concrete piece of research which all practitioners accept as an example of the right way to proceed. Paradigms function directly through the practices of those who have been trained to see, think, and act in terms of them" **[*AUTHOR: PLEASE PROVIDE SOURCE OF QUOTE*]**. Better is the use of the term *discourse*, developed by Michel Foucault, because Kuhn's account only works for normal sciences such as physics, where there is general agreement among those involved as to what counts as a good piece of work. The human sciences are precisely not normal sciences in Kuhn's sense. There are always a number of conflicting schools, each with its own pseudoparadigm. However, as *discourse* is less known, I have chosen to employ *paradigm*, which may cause some confusion. See also Dreyfus and Rabinow (1982: 78).

30. Li (1946: 33) also noted the shifting frontier between agriculturalists and pastoralists: "The expansion of immigration and reclamation diminishes the area for nomadic pastoralism. In addition, the land reclaimed is the best rangeland in the pastoral region. As a result, animal numbers and pasture decrease day by day, which influences the life of nomadic people. Many nomads have undergone such a pressure and have silently left the plains for the mountains."

31. This was a result of the population decline (and thus the decrease in the labor force) of the 1929 to 1931 famine in Gansu and Shaanxi.

32. Village case studies in Shanxi did show a growth in wheat production.

33. The Border Region Government had already made a start with reclamation work in the region under its rule. On 29 December 1942, it issued the "Draft Version of Regulations on Land Tenancy in the Shaan-Gan-Ning Border Region." To promote reclamation, article 30 stipulated that persons who reclaimed abandoned land would be exempted from land tax for three years ("Shaan-Gan-Ning bianqu tudi zudian tiaoli cao'an," [1942] 1988).

34. Unfortunately, the sources do not clarify whether this pertains to re-reclamation of old farming areas or the opening up of new agricultural land. Nor is it clear if these are data on sown or harvested acreage.

35. The national figures of livestock for 1936 and 1946 from the National Agricultural Research Bureau exclude Jehol (Rihe), Jilin, Heilongjiang, Xinjiang, Outer-Mongolia, Xikang, Tibet, Taiwan, and Guangxi. To make the figures for 1956 and 1966 comparable with those of 1936 and 1946, the livestock numbers of Liaoning, Jilin, Heilongjiang, Xinjiang, and Guangxi have been subtracted. The provinces Tibet and Taiwan (and naturally Outer Mongolia) were not included in the data for 1956 and 1966. Note that the data have not been adjusted to account for a part of present Sichuan Province, which has been left out (Xikang included a part of Tibet and Sichuan).

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