

Article

Different Patterns of Religious Settlements Based on the Historic Landscape Approach: Cases of Buddhist Grottoes in Hexi Corridor

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Abstract: Religious settlements can reflect regional culture and social development, preserve the continuity of spatial structures over time, sustain social networks, and perpetuate traditions. Buddhist settlements, as a particular type of religious settlement, reflect the social development and daily lives of monks and common people. This study used literature research, field investigations, and GISs to construct a framework of the landscape of religious settlements based on the theory of the historic landscape approach. Buddhist grottoes from the Sixteen Kingdoms Period to the Qing Dynasty (304–1912) in the Hexi Corridor of Gansu Province were selected as a case study, and the patterns of religious settlements were identified. According to the analysis, it was found that religious settlements tended to have large religious buildings at their centre, with small buildings and attachments scattered around. They were close to central cities, with a complete transportation network, and they had relatively stable belief spaces. There were clear boundaries between believers and non-believers in the settlements. Four patterns of religious settlements were also identified according to the relationships between geography, social properties, and cultural connotations. These findings diachronically offer a new perspective on the understanding of religious settlements and steps for improving the inheritance of religious culture.



Citation: Chen, Yueying, Haichao Wu, and Wenbin Wei. 2024. Different Patterns of Religious Settlements Based on the Historic Landscape Approach: Cases of Buddhist Grottoes in Hexi Corridor. *Religions* 15: 1531. <https://doi.org/10.3390/rel15121531>

Academic Editor: Todd Lewis

Received: 24 October 2024

Revised: 11 December 2024

Accepted: 12 December 2024

Published: 14 December 2024



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Keywords: religious settlements; historic landscape; Buddhist grottoes; Hexi Corridor

1. Introduction

A settlement is a place where human beings live and assemble. These types of places were consciously exploited and transformed nature (Petrovic and Petrikovicová 2021; Wang and Chiou 2019). They record the contemporaneous situation and lives of the inhabitants. Settlements are characterised by physical aspects in space, for example, residences, as well as intangible aspects, such as everyday lives and customs (Erdem Kaya et al. 2024). Compared with general settlements, religious settlements integrate consensus into their development (Erdem Kaya et al. 2024; Pierik and van Lanen 2019), as formed by the beliefs of people over time. The settlement landscape is a type of spatial expression comprising tangible and intangible objects (Rafferty 2020). Regarding religious settlements, as a particular type of settlement, their landscapes were predominantly generated through religious beliefs. However, research on religious settlements has focused on their physical aspects, such as the integral planning, buildings, and spatial alterations, as well as the inheritance of their intangible aspects, rather than focusing on a certain type of religious settlement to conduct an integrated study or forming a systemic framework to illustrate their patterns and characteristics (Alnaim 2022; Casakin and Billig 2009; Umurtak 2023).

After the first century, Buddhism was introduced to China, and the Silk Road was regarded as a type of Buddhist Road. Silk Roads: the Routes Network of Chang'an–Tianshan Corridor was listed as a World Heritage site in 2014. The Hexi Corridor plays a distinct

role in the Silk Road due to its superior geographical location and unique historical connotations. There are a large number of Buddhist grottoes in the Hexi Corridor, and they influenced the formation of the Silk Road as essential religious elements. These grottoes were built in the Sixteen Kingdoms Period (304–439), and their basic layouts formed from the Northern Dynasty to the Tang Dynasty (439–907). Buddhist settlements were built in this corridor due to the development of these grottoes, as well as their surrounding temples and relics. However, research on this type of religious settlement has focused on analysing its physical aspects using qualitative methods; thus, research on the combination of its intangible aspects, as well as the use of quantitative methods, is lacking. The historic landscape approach can fill in this gap, providing reliable analyses and visible methods.

Thus, this study used the historic landscape approach to build a framework for analysing religious settlements. The Buddhist grottoes in the Hexi Corridor were selected as a case study, and geographic information systems (GISs) were applied for analyses. Based on the analysis, the landscape patterns of religious settlements were identified.

2. Literature Review

2.1. Historic Landscape of Heritage

Sauer gave landscape a clear definition as a combination of nature and human activities in a given territory during a certain time (1925). The landscape, as an essential part of heritage, can also be altered by human activities. Research in this field began in the 1930s (Hoskins 1999). Sauer then divided it into two parts: natural and cultural elements (Li 1985). The natural elements included climate, land, sea level, coastline, and plants. The cultural elements included population, residence, production, and communications (Sauer 1925). Whittlesey proposed the theory of sequent occupance and considered that the landscape had diachronism and synchronism based on previous research (Whittlesey 1929).

In the 1950s, with the issue of Athens Charters, the integrity of heritage was emphasised. The landscape of heritage was regarded as a type of living heritage to record the local culture (CIAM 1933), and it played an essential part in the integrity of heritage. Lowenthal integrated tangible settings with intangible memory and identity and pointed out that landscape had mental elements from the perspective of the sense of place (Lowenthal 1975). The World Heritage Committee listed cultural landscapes on the World Heritage List in 1992. A cultural landscape was defined as the interaction of nature and people, and included natural and cultural elements, as well as intangible customs and traditions. It can be divided into three types: settlement landscapes, architectural landscapes, and land-usage landscapes.

Studies on heritage landscapes have focused on their current spatial distributions, development, and planning, which can lay a solid foundation for the study of the landscape of religious settlements (Fu and Yong 2003; Wu 2021; Yan 2007). However, most studies focused on conducting an integrated evaluation of the current landscape in a certain region, concluding their genetic maps, and proposing their future development; thus, diachronic analyses and mental exploration are required (Grazuleviciute-Vileniske 2008; Min and Zhang 2024; Rössler 2006). Regarding religious settlements in particular, their landscapes are special but lack targeted and comprehensive analyses.

2.2. Landscape of Religious Settlements

The landscape of settlements comprises not only the composition of the buildings but also the social activities, economy, cultural conditions, and living styles at a certain time (Davis and Coningham 2018; Egoz and Williams 2017). The definition of the religious landscape was proposed by Semple in 1911 (Semple 1911): to maintain religions and political rights. At that time, the analysis of landscapes was conducted independent of the study of the inhabitants' lives and social development; then, it gradually integrated everyday life. They were cognised of divine or symbolic manifestations and formed the spatial centre and order during their development (Eliade 1990).

Buddhism is a major world religion. Thus, its landscape is similar to that of other religious settlements but also has its own unique characteristics. Relevant research has focused on its ancient natural landscape and cultural connotations, such as traditional geographical documents; *Commentary on the Waterways Classic* (水經注 shuǐ jīng zhù); *A Record of Buddhist Monasteries in Lo-yang* (洛陽伽藍記 luò yang jiā lán jì); and several literature materials such as poems, odes, and inscriptions (Chen 2019). While Buddhist settlements integrate various residential buildings and shrines with the local natural environment, most studies of them have neglected how landscape shapes distinctive interactions with people.

The mental landscape can be regarded as the interaction between people and the physical aspects of settlements. The mental landscape refers to the cognition of the landscape of a certain place. It can be traced back to the age value of heritage proposed by Alois Riegl; this differs from the historic value because it emphasises emotional cognition based on physical alterations (Riegl 1982). The age value subsequently developed into the emotional value, emphasising the people's cognition and image of the place. The theory of genius loci proposed by Christian Norberg-Schulz and the theory of city image proposed by Lynch compensate for the contents of this definition (Lynch 1960; Schulz 1979). They also proposed that daily activities and special events were essential components of the mental aspects of a place. Religious settlements are unique compared to normal settlements because they emphasise a sacred atmosphere and beliefs. Thus, their mental landscape comprises a sacred atmosphere created through the natural and cultural landscapes (Vignato and Hiyama 2022). This formation is not a unidirectional process but an interactive result. It includes the special events, daily lives, and beliefs that spread in a place, considering its particularity.

According to the analysis above, a framework of the landscape of religious settlements was developed (Table 1), including physical dimensions and mental dimensions. The physical dimensions include natural and cultural elements. The natural elements include landforms, soil, climate, and plants. The cultural elements include central cities where grottoes are located and their transportation. The mental dimension is the interactive result between the physical landscape and the people. It can be regarded as the core of the landscape of Buddhist settlements that connect the natural and cultural elements, including relevant events, daily activities, and beliefs (Figure 1).

Table 1. Characteristics of the landscape of religious settlements.

Dimensions	Elements	Methods	Reference
Natural landscape	Landform	Elevation, aspect, slope	(CIAM 1933; Hoskins 1999; ICOMOS 1999; Pierik and van Lanen 2019; UNESCO 2005a, 2016)
	Soil	Literature research	(Patricia and Timothy 2008; Birnbaum 2012; UNESCO 2005a)
	Plant	Literature research, field investigations	(ICOMOS-IFLA 2017; Patricia and Timothy 2008; Birnbaum 2012; UNESCO 2005a)
	Climate	Literature research	(Patricia and Timothy 2008; Rafferty 2020; UNESCO 2016)
Cultural landscape	Cities	Viewshed, kernel density, urban compactness	(Corner 2020; Eliade 1990; Iranian Cultural Heritage Organization 2004; Taylor 2016; UNESCO 2014)
	Transportations	Literature research	(ICOMOS-IFLA 2017; Sahle and Saito 2021; Statzner et al. 2016)
Mental landscape	Event	Literature research	(Hoskins 1999; ICOMOS 1982; UNESCO 2005b)
	Daily activities	Literature research, field investigations	(Agency for Cultural Affairs 1994; ICOMOS 1987, 2005; Mathewson 2016)
	Beliefs	Literature research, field investigations	(Agency for Cultural Affairs 1994; CEMAT 2003; Davis and Coningham 2018; UNESCO 2003)

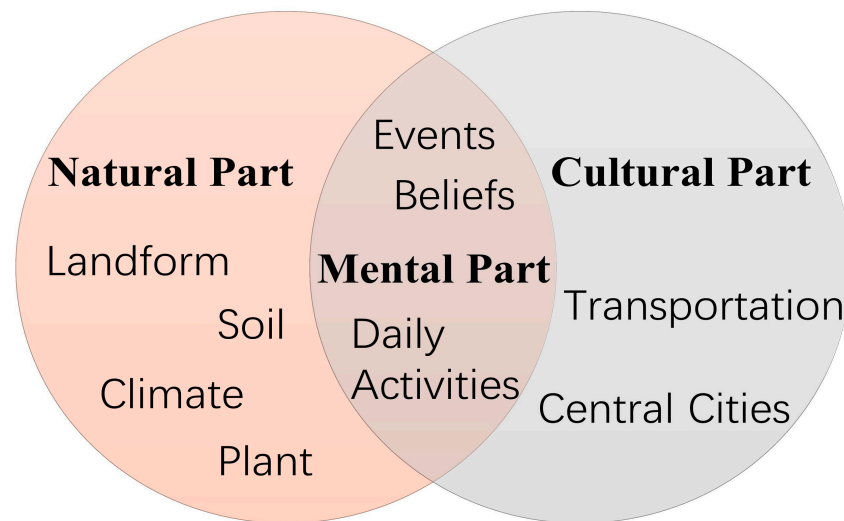


Figure 1. Landscape of religious settlements.

3. Methodology

3.1. Study Area

In general, the Hexi Corridor refers to the area west of the Yellow River. In this study, the Hexi Corridor refers to the northwestern part of Gansu Province, from $37^{\circ}15' \text{ N}$ to $41^{\circ}30' \text{ N}$ and from $92^{\circ}21' \text{ E}$ to $104^{\circ}45' \text{ E}$. It includes 6 cities and 21 counties, and it covers an area of $259,600 \text{ km}^2$.

According to the third national survey of cultural relics in Gansu (Wei 2018), there are 167 Buddhist grottoes and Buddhist carvings. Two were excavated during the Sixteen Kingdoms Period. Nineteen grottoes were carved during the Northern Dynasties Period (439–581). Four grottoes were newly carved during the Sui and Tang Dynasties (581–907). One grotto was carved during the Song and Yuan Dynasties (960–1368), and eleven grottoes were carved during the Ming and Qing Dynasties (1368–1911). The number of excavated Buddhist carvings is consistent with the development trend of the Buddhist grottoes. There are 145 temples and 116 townsites (Figure 2)¹, built from the Han Dynasty (202–220) to the Qing Dynasty (Hao and Zhang 2009; Zhao 2011).

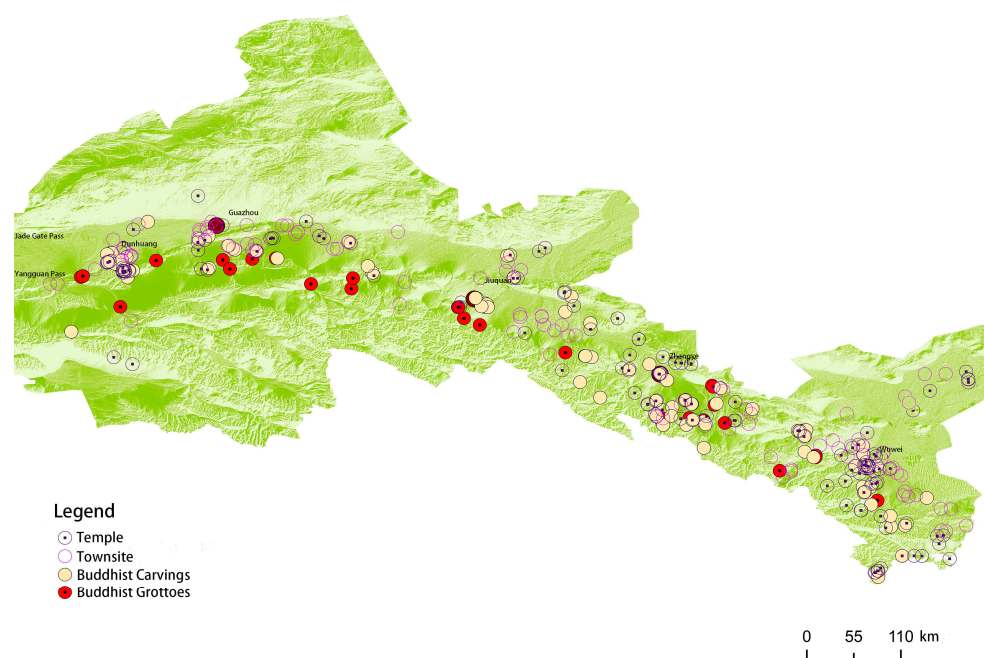


Figure 2. Distribution of Buddhist settlements in Hexi Corridor.

Considering the development and characteristics of Buddhism in China, these Buddhist settlements could be divided into three parts: the early times (from the Sixteen Kingdoms Period to the Tang Dynasty), the development time (during the Tang Dynasty), and the last time (after the Tang Dynasty). Buddhism was introduced to China in the Sixteen Kingdoms Period, and grottoes have been built since then. In the Tang Dynasty, most of these grottoes were expanded. After the Tang Dynasty, Buddhism entered a recessionary period because of the conflict between Buddhism and the dominator, which influenced the development of the Buddhist grottoes. Thus, the Buddhist settlements after the Tang Dynasty altered slightly, particularly during the Song and Yuan Dynasties.

3.2. Data Analysis

This study predominantly used literature research, field investigations, and GISs to analyse the landscape of the Buddhist grottoes in the Hexi Corridor. The literature research mainly focused on ancient documents and records of Buddhist grottoes and historic geography in the Hexi Corridor. Through the literature, data on the soil, plants, and previous climates in the Hexi Corridor were collected. The transportation around the grottoes and its connection to the Silk Road were explored. Relevant historical events, activities that are currently held, and changes in beliefs were analysed.

Field investigations were conducted from March to November 2023, including at the selected Buddhist grottoes, temples, and townsites in the Hexi Corridor.

A GIS analysis tends to be used to examine the natural landscape and the landscape related to people. Thus, a GIS analysis was conducted with ArcGIS 10.7 software. The DEM data were SRTMDem 90M from <http://www.gscloud.cn/> (accessed on 10 December 2024). Analytical factors included elevation, aspect, slope, viewshed, kernel density, buffer, and urban compactness (Table 1).

Elevation refers to the vertical distance above sea level from a point on the ground (Delaney et al. 2022). Aspect refers to the degree of steepness of a surface unit and usually refers to the ratio of the vertical height of a slope to the distance from it in the horizontal direction (Zhao et al. 2021). Slope refers to the direction of the projection of the slope on the horizontal plane (Jiang and Gao 2022). These factors were used to analyse the natural characteristics of the Buddhist settlements and to explore the geographical aspects that influence the landscape of the grottoes (Bevan and Conolly 2002).

The viewshed identifies the cells in an input raster that can be seen from one or more observation points or lines (Ormsby et al. 2004). It was used to analyse the relationships between the central cities and grottoes and between the grottoes and other Buddhist attachments. Kernel density refers to the density of the features in the neighbourhood around those features (Isnan et al. 2021). Buffer measures the distance in a two-dimensional Cartesian plane, where distances are calculated between two points on a flat surface (Xiong et al. 2023). This was used to analyse the distributions and development trends of the Buddhist settlements. These three factors were useful in dividing the patterns of the settlements (Doyle et al. 2012).

Urban compactness is a measure of the relative land-use efficiency of an urban space and the quality of citizen behaviour. A higher degree of compactness indicates a tighter physical form and function of the city, as well as a higher efficiency of their operation and management (Jimenez-Espada et al. 2022). For the central cities of Buddhist settlements, compactness is not only a result of their social development but also impacts their expansion and locations. According to the analyses of viewshed, kernel density, and buffer, the representative cities, Dunhuang, Guazhou, Jiuquan, Zhangye, and Wuwei, were selected to analyse morphology and compactness. The relevant literature research demonstrated that the Sixteen Kingdoms Period and the Tang and Ming Dynasties are essential periods for Buddhism. Thus, this study selected the spatial distributions of the cities in these three periods for analysis. The analyses were conducted in four steps: First, the spatial layouts of the selected cities in the Sixteen Kingdoms Period, Tang Dynasty, and Ming and Qing Dynasties were collected from the literature or old maps. Second, ArcGIS was used to cal-

culate the compactness of the layouts individually. Finally, the layouts of the same city were assembled in a radar map with ArcGIS.

4. Landscape of Buddhist Grotto Settlements in Hexi Corridor

4.1. Natural Landscape

Figure 2 shows that the Buddhist grottoes, temples, carvings, and townsites in the Hexi Corridor are distributed in a northwest–southeast direction. The Buddhist grottoes and carvings are concentrated in the eastern and western parts of the Hexi Corridor, while they are scattered in the central part. Temples are scattered in the western and central parts of the Hexi Corridor, while they are concentrated in the eastern part. Townsites are scattered around the four central cities.

Regarding landform, the locations of the selected Buddhist grottoes can be divided into three parts: those situated in the eastern, central, and western parts of the Hexi Corridor. Most of them were carved in glutenite and conglomerate (Liu and Huang 2014), suitable for attaching murals to walls. The dry climate in this area also favoured the preservation of painted sculptures. Thus, most of the grottoes in the Hexi Corridor had murals or colourful statues. The statues tended to have giant stone cores or wooden frames. However, differences in natural and cultural influences among the areas have resulted in various levels of preservation.

Figure 3 demonstrates that the Buddhist grottoes were carved at high elevations between 1340 and 3051 m. The Buddhist grottoes in the western part were carved at the lowest elevation, while those in the eastern part were carved at a higher elevation than those in the central and western parts. The Buddhist grottoes in Jinchang and the southern part of Gansu Province were carved at the highest elevation but scattered unevenly.

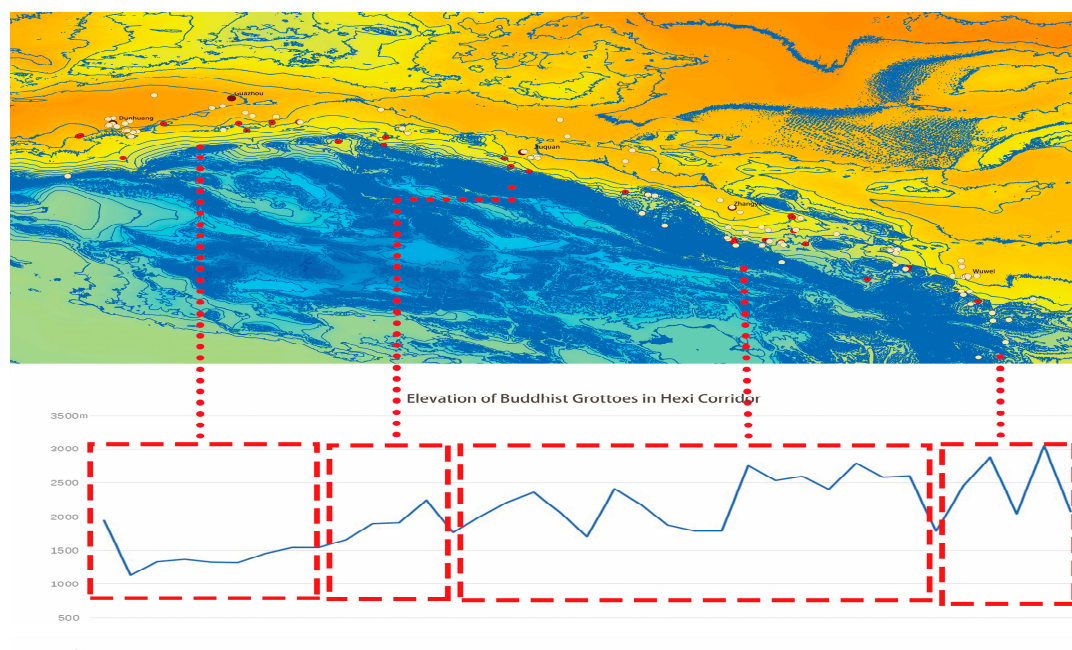


Figure 3. Elevation and aspect of the Buddhist settlements in Hexi Corridor.

The aspect of the Buddhist grottoes in the eastern part of Gansu ranges from 89.98 to 89.995 degrees. Most of them are on sunny slopes and have warm colours (Figures 3 and 4). The Buddhist grottoes in Dunhuang face the southern or southeastern directions, displaying warm colours. The grottoes in Jiuquan and Zhangye face the south, and their colours are warm. The grottoes in Wuwei face the southwestern direction, and their colours are colder than those of the grottoes in the western part of the Hexi Corridor. The elevation of these Buddhist grottoes ranges from 1000 km to 3000 km. The elevation of the grottoes

in the western part is lower than that of the grottoes in the eastern part. For example, the Buddhist grottoes in Dunhuang are 1000 km to 2000 km high, while those in Wuwei are over 2000 km high.

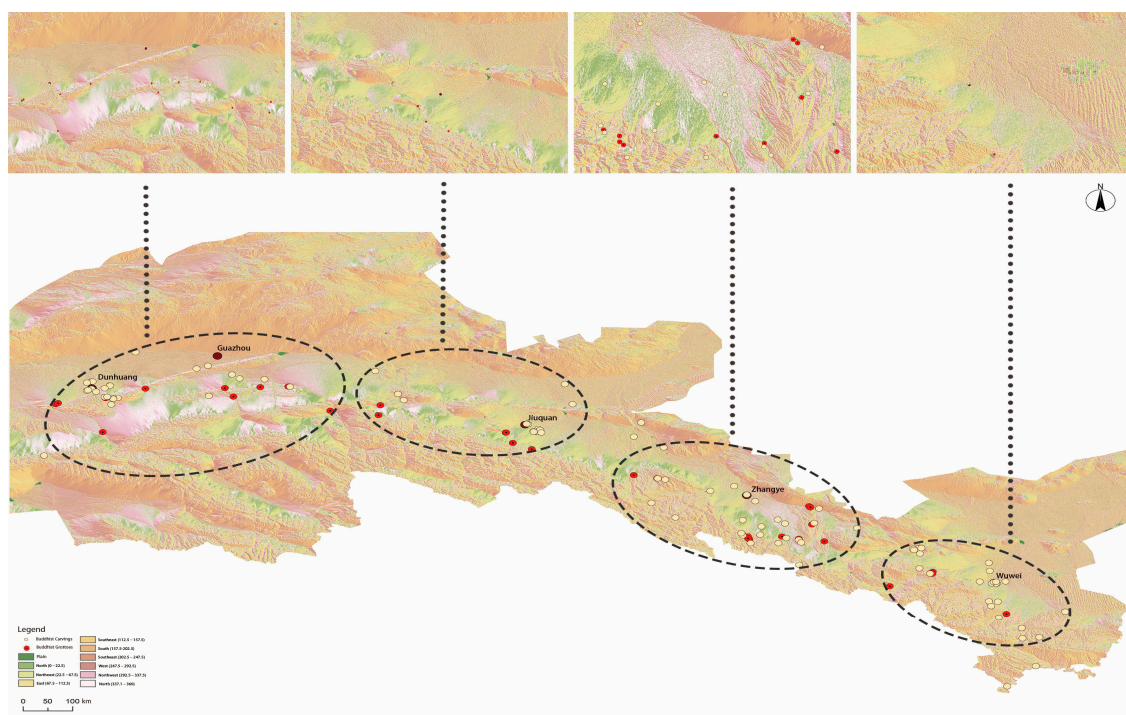


Figure 4. Slope of Buddhist settlements in Hexi Corridor.

Figure 3 indicates that the Buddhist grottoes tended to be carved to face rivers and face away from mountains (Chen 2019). This is because the mountains can block the northwest wind in winter, and the waters can change the microclimate of the local area, as well as provide convenience to the monks. From an architectural perspective, the Buddhist grottoes were built in mountains or valleys, far away from downtown, to accord with the requirements of meditation. For the Buddhist grottoes in the Hexi Corridor, an elevation lower than 1000 m would not provide enough silence or isolation to satisfy the needs of meditation (compared with the general elevation in Gansu), and an elevation higher than 3000 m would be inconvenient to the monks. Sunny slopes can also provide convenience to the monks and meet the needs of the worship of Baal and Apollo (Lin 1981). For example, the image of Aditya to the south of the west wall of the 285th Cave in Dunhuang was painted under the influence of Surya in Hinduism or Mithra in Mazdaism (He 1990; Jiang 2004), demonstrating the worship of light and the Sun.

Regarding hydrology, Ten Books of the House (陰宅十書 *yīn zhái shí shū*) recorded the following:

“The most valuable place always has waters on the left, called Qing Dragon; roads on the right, called white tiger; pool in the front, called vermilion bird; hills on the back, called Yuanwu (凡宅，左有流水，謂之青龍，右有道，謂之白虎，前有汗池，謂之朱雀，後有丘陵，謂之元武，為最貴地也 *fán zhái, zuǒ yǒu liú shuǐ, wèi zhī qīng lóng, yòu yǒu dào, wèi zhī bái hǔ, qián yǒu hàn chí, wèi zhī zhū què, hòu yǒu qū líng, wèi zhī yuán wǔ, wéi zuì guì dì yě*).” (Wang and Zheng 2017)

Thus, hydrology played an essential role during the carving and development of the Buddhist grottoes. It could not only guarantee the basic living needs of the Buddhist settlements but also affected the choice of their locations and the development of the population. The Hexi Corridor is dominated by inland rivers, including the Shule, Hei, Shiyang, and Dang Rivers (Gansu Shui Li Ting 2019). A total of 57 tributaries were generated and

run through this region. The Shiyang River system in the eastern part of the Hexi Corridor resulted in the development of the Wuwei Basin, and the Hei River system nourished Zhangye and Jiuquan. Then, many oases formed.

Dunhuang, Guazhou, and Yumen developed near the Shule and Dang Rivers. The waters, for example, basins, such as Zhangyipu Basin in front of the Tianti Mountain Grottoes and Changma Basin in front of the Changma Grottoes, and oases, such as the oasis along the Dang Spring in front of Mogao Grottoes, were essential parts of the natural landscape of the Buddhist settlements and provided them with solid living conditions (Figure 5).



Figure 5. Landscape of Buddhist grottoes in Hexi Corridor.

A poem written in the late Tang Dynasty, “Records of a Visit to Mogao Grottoes (莫高窟記游詩 mò gāo kū jì yóu shī)”, found in Dunhuang Documents S.4654, illustrates the following:

“.....Dangquan was a place where Monk Chon visited in the past. The Moon Cave looked like the Griddhakuta Hill. The mountain Sanwei is steep, and the Yingbao Pavilion is in its middle as a window. Waters there is clean and shimmering..... (with) bowl in hand and red lotus on foot..... (.....沉宕泉勝地，昔傳公之舊游；月窟神蹤，仿中天之鷲嶺。三危峻峭，映寶閣以當軒；碧水流泉，繞金池而泛艷.....手執香積紅蓮.....kuàng dàng quán sheng dì, xī zūn gong zhījù yóu; yuè kū shén zōng, fang zhōng tiān zhī jù lǐng. Sān wéi jùn qiào, yìng bǎo gé yǐ dāng xuān; bì shuǐ liú quán, rào jīn chí ér fàn yàn shǒu jí xiāng jī hóng lián.....)” (Feng 2012)

The unique landscape formed through the connection between these Buddhist grottoes and the waters. Buddhist activities were also integrated during the formation. In addition, the meadow in the Qilian Mountains provided suitable conditions for carving the grottoes. With the rapid development of husbandry, oases, and agriculture in the Hexi Corridor after the Tang Dynasty, the population increased (Yang 1988). The administration, public, and temples began practicing husbandry, which increased the funds and labour, thereby enabling Buddhist grottoes and temples to be built and expanded.

Regarding the soil, plants, and climate, the Hexi Corridor is located in the continental arid climate zone, with windy and sandy conditions, as well as drastic changes in hot and cold temperatures. The average annual temperature is 6–11 °C, the annual precipitation is 30–160 mm, and the annual evaporation is 1500–3000 mm, making it a typical arid and very arid area. However, due to the influence of the Qilian Mountains, there are few clouds, plenty of light, and abundant snow and ice-melted water, which make it suitable for the development of seasonal irrigated agriculture. Oases formed in the inland river basin, fertilising the soil and making it suitable for agriculture and husbandry. They

made the carving of the grottoes possible by providing sufficient living resources for the residents and the craftsmen.

4.2. Cultural Landscape

Regarding the central cities, the Buddhist grottoes were carved with Shazhou (Dunhuang), Guazhou (Suoyang City in the Tang Dynasty), Suzhou (Jiuquan), Ganzhou (Zhangye), and Liangzhou (Wuwei) at the centre. Development followed the northwest–southeast direction in the Hexi Corridor, and four Buddhist settlements were formed, with the Mogao Grottoes, Tianti Mountain Grottoes, Mati Temple Grottoes, and Manjusri Mountain Grottoes at the centre (Figures 6 and 7).

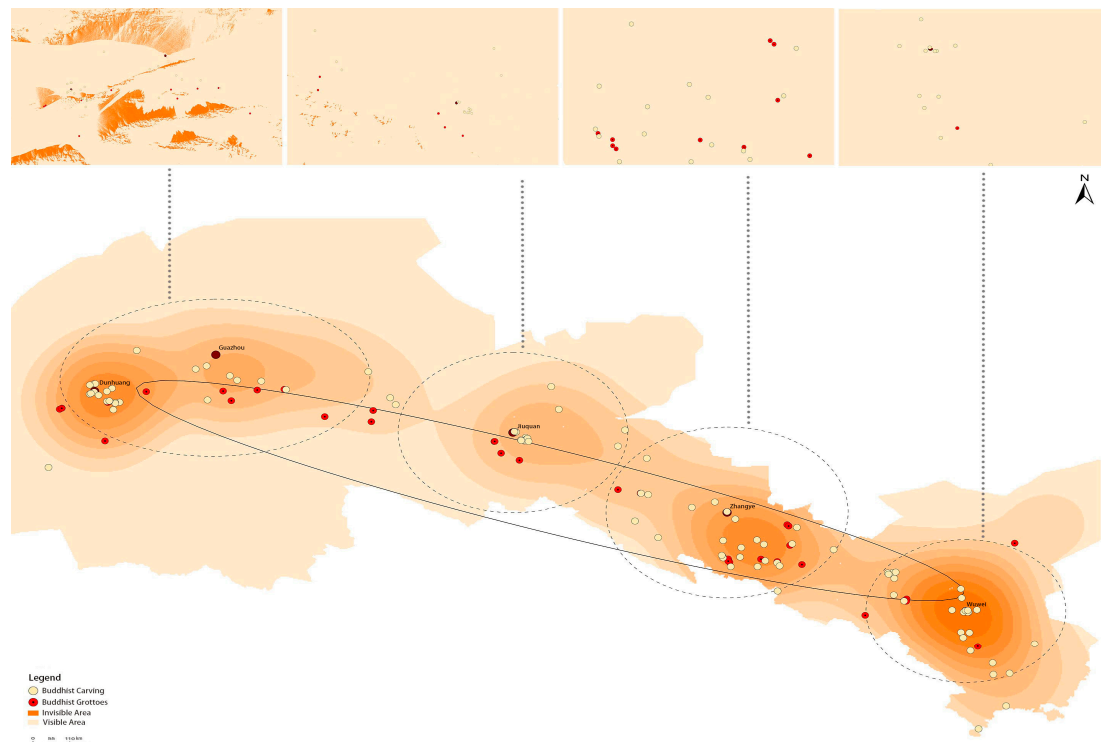


Figure 6. Kernel density, buffer, and viewshed of Buddhist settlements in Hexi Corridor.

Most of the Buddhist grottoes, temples, and townsites in Dunhuang and Guazhou were carved within the viewshed of the two cities, about 43 km away. In early times, the Buddhist grottoes were carved around the central cities. Then, with the development of surrounding counties, most of the grottoes were carved around these large counties.

Most of the Buddhist grottoes, temples, and townsites in Jiuquan were carved within the viewshed of the central city, about 45 km away. However, their distributions are scattered compared with those of the abovementioned settlements. The Manjusri Mountain Grottoes are the closest grottoes to Jiuquan, and they are known as “Small Western Paradise”. They are essential parts of the Buddhist settlement centred in Jiuquan (Suzhou). The number of Buddhist grottoes in this settlement carved in early times is relatively small and has increased since the Tang Dynasty. In particular, the Manjusri Mountain Grottoes thrived after the Western Xia and Yuan Dynasties. Then, they became Tibetan Buddhist temples.



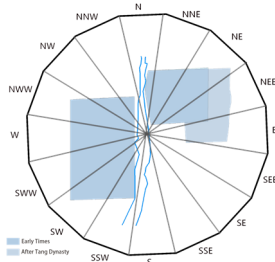
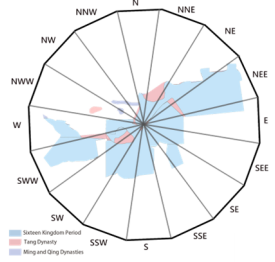
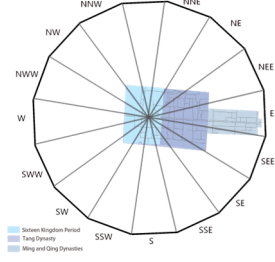
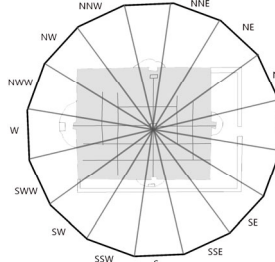
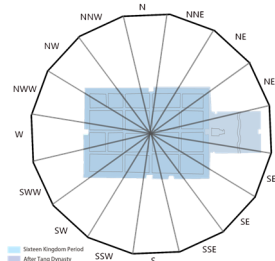
Figure 7. Distribution of counties and Buddhist settlements in Hexi Corridor.

Most of the Buddhist grottoes, temples, and townsites in Zhangye were carved within the viewshed of the central city, about 55 km away. Their distributions are concentrated but away from the central city. In addition, under the influence of the landform and elevation, the impact of the central city on the viewshed of the Buddhist grottoes and temples was reduced. In early times, the Buddhist grottoes were carved around Zhangye, and their number was small. After the Song and Yuan Dynasties, their number increased dramatically, and they were developed around the surrounding larger counties, such as Minle County (with an area of 3687.32 km²) and Shandan County (with an area of 5402.43 km²). The Mati Temple Grottoes thrived in the Yuan Dynasty. With the influence of Tibetan Buddhism, they gradually developed into Tibetan Buddhist temples. Dafo Temple in Ganzhou was built in the Western Xia Period. It was then impacted by Tibetan Buddhism and became a part of this settlement, echoing Mati Temple Grottoes.

Most of the Buddhist grottoes, temples, and townsites in Wuwei were carved within the viewshed of the central city, 47 km away. The number of Buddhist grottoes in this settlement was large. Their distribution was concentrated and near the central city. However, the viewshed from Wuwei had low impact due to the high elevation.

Regarding urban development, the western part of the Hexi Corridor was more developed than the central and eastern parts during the Sixteen Kingdoms Period and the Northern and Southern Dynasties. However, after the Tang Dynasty, the middle and eastern parts of the Hexi Corridor gradually developed (Table 2). From the Sixteen Kingdoms Period to the Tang Dynasty, emphasis was on the development of the southwestern part of Dunhuang, and then it expanded to the southeastern part. The morphology and scale of Guanzhou changed slightly. It was built in early times and then expanded to the northwestern part. The compactness of Dunhuang and Guazhou was high in early times and reduced in the Ming and Qing Dynasties, demonstrating their uneven development. Under the influence of the economy, society, and lives in these cities, the construction of Buddhist grottoes and temples was also impacted. In early times, most of them were carved around the central cities. Then, their development moved away from the cities. The direction of their development was different from the expansion of these urban morphologies, while the development of townsites followed the same direction as that of urban morphologies.

Table 2. The compactness of central cities in Hexi Corridor.

Central City	Sixteen Kingdom Period	Tang Dynasty	Ming and Qing Dynasties	Urban Morphology	Resources
Dunhuang	0.245	/	0.171		(Dunhuang Government 1999; Ji 1998)
Guazhou	0.819	0.996	0.115		(China Architecture Design & Research Group 2007)
Jiuquan	0.235	0.246	0.197		(Huang 1737)
Zhangye	0.237	0.237	0.237		(Committee of Zhangye Record 1993; Xu 2018)
Wuwei	0.222	/	0.195		(Xu 2018)

Slight alterations occurred in the urban compactness of Jiuquan, Zhangye, and Wuwei. The distributions of the Buddhist grottoes, temples, and townsites in the three cities were concentrated and even, demonstrating their close relationships with the cities. Jiuquan exhibited an eastern direction of development, and the Buddhist grottoes, temples, and townsites exhibited the same direction of development. The Buddhist grottoes and tem-

ples in Zhangye and Wuwei were concentrated in the central city and distributed evenly. Wuwei exhibited an eastern direction of development, while the development of Zhangye remained constant.

Regarding transportation, the Hexi Corridor became an essential part of the Silk Road due to its special location (Figure 8). The Silk Road in the Han Dynasty ran from Luoyang or Chang'an, and it went south to Loulan, Yutian, Darouzh, and Daqin via Hexi, Dunhuang, and the Jade Gate Pass. It went north to Cheshi, Qiuci, Shule, and Daqin (Gao 1995). After the Han Dynasty, the Silk Road extended to Yiwu and Xihai through the Jade Gate Pass and Yangguan Pass. In the Tang Dynasty, the Silk Road began from Chang'an to Ganzhou and Dunhuang via Liangzhou, Yongchang, Shandan, and Zhangye. Then, it was divided into southern and northern parts. Many branches have developed since then, such as the South of Qinlong Road, Henan Road (Tuyuhun Road), Qiangzhong Road, Tangbo Ancient Road, Dadoubagu Road, and Hongchi Hill Road (Li and Ma 2010).

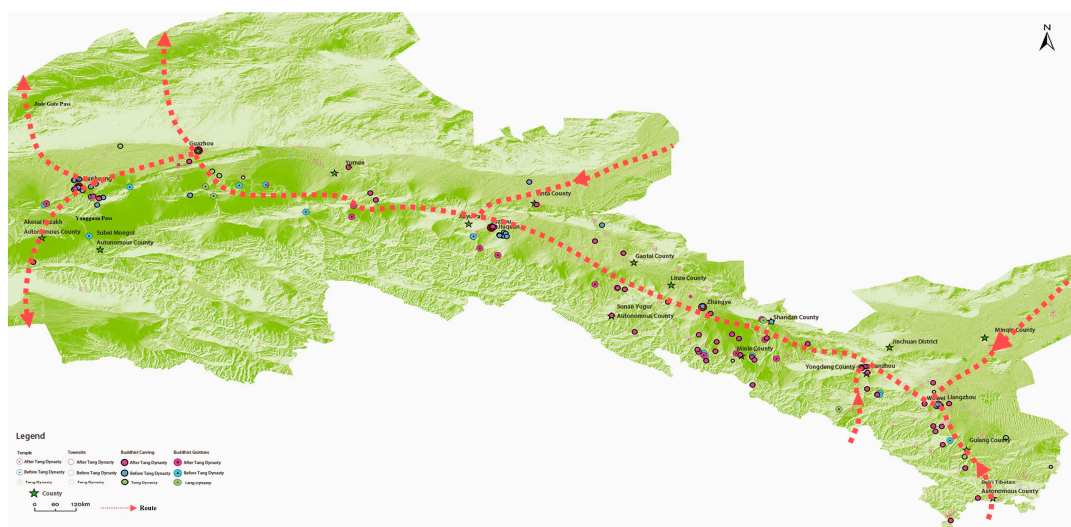


Figure 8. Transportation in Hexi Corridor.

These branches pass through the central cities, such as Liangzhou (Wuwei), Ganzhou (Zhangye), and Suzhou (Jiuquan), as well as important military citadels and states. The well-developed road network consisted of complex transportation, which was conducive to the connection of different places, the preaching of monks, and the spread of Buddhism. However, it remained a potential military danger (Zhang and Wang 2021). Thus, the administration in the Hexi Corridor used the landform to set up passes and protect the cities. The stabilisation of the cities and towns improved their economic and social development and laid a foundation for the construction of Buddhist grottoes and temples. Large Buddhist grottoes and temples were built along these traffic routes and around the central cities, such as Mogao Grottoes and Yulin Cave near Guazhou and Shazhou, the Mati Temple Grottoes near Ganzhou, the Manjusri Mountain Grottoes near Suzhou, Shifo Temple near Jiuquan (excavated Buddhist statues in the Sixteen Kingdoms Period and the Northern Wei Dynasty), Dafo Temple in Ganzhou, the Tianti Mountain Grottoes near Liangzhou, and Dayun Temple in Liangzhou.

4.3. Mental Landscape

The Buddhist settlements in the Hexi Corridor from the Sixteen Kingdoms Period to the Qing Dynasty were concentrated in Dunhuang, Suzhou, Ganzhou, and Liangzhou. They had ritual spaces, buildings with different functions, regular monks and believers, and temples with a certain economic scale. People carved caves to carry out ritual activities, and these caves became essential places of preaching or worship, particularly for the local people. These activities also improved the local religious economy in verse.

Table 3 summarises the relevant events and activities that took place in the settlements. These activities can be traced back to the Han Dynasty, when Chinese Buddhism developed in China. Table 3 shows that the four central cities were developed due to political reasons, and they facilitated the spread of Buddhism. For example, the Tibetans have been settled in Wuwei since the Discussion in 1247. Tibetan culture was introduced to Wuwei and influenced the Buddhist architecture. Uighur entered Zhangye in the late 9th century and influenced local Buddhism.

Table 3. Mental landscape of Hexi Corridor.

Religious Settlements	Historic Events	Daily Lives	Represented Activities
Dunhuang–Guazhou	Visit to the western region by Qian Zhang (138 BC); setup of Dunhuang County (121 BC); immigration to protect the border (119 BC); expulsion of the Tubo people by Yi Zhang and the Guazhou Army (848)	Preaching; everyday life; sacrifice; worship	Hanshi Festival; Double-Seventh Day; Sezee; Temple Fair
Jiuquan	One of the four essential counties in Hexi Corridor (121 BC); managing of the western region by Banchao (73); search for Buddhist scriptures by Xuanzang (629); one of the essential nine military towns (1372)	Preaching; everyday life; sacrifice; worship	Shehuo; Miao Dance; Tibetan Dance; Traditional Hui Banquet
Zhangye	Setup of the county (111 BC); conquering of the western region by Qubing Huo (121 BC); setup of the capital by Qianliang, Qianqin, Houliang, and Beiliang (318–460); World Fair (609); one of the essential nine military towns (1372)	Preaching; everyday life; sacrifice; worship	Aobao Festival; Sehuo; Daolaoye; Niuwazi Banquet; Recitation of the Hexi Scroll
Wuwei	Setup of the county (121 BC); conquering of the western region by Qubing Huo (121 BC); Liangzhou Great Music by Jingshu Yang (714); discussion in Liangzhou with Tibetans (1247)	Preaching; everyday life; sacrifice; worship	Prayer Meeting; Sun Buddha Festival; Chant Sutras; Dharma Assembly

Dunhuang and Liangzhou became the centres of Buddhism. Temples have existed in Dunhuang since the Han Dynasty, named Futuli. This type of temple was supposed to be a Buddhist settlement centred around a stupa. Zhufahu² built temples and taught Buddhism, which attracted many monks and believers. In the Northern Dynasty, the group of monks in Liangzhou, such as Tanwuchen, Xuangao, and Tanyao, had become one of the largest Buddhist groups in the northern region of China. Additionally, there were other eminent monks in the Hexi Corridor, including Zhiyan, Baoyun, Huilan, Songyun, Jvqujingsheng, Tanxue, Xuande, Xuanchang, Fahui, and Huilan (Du 1982). They not only spread Buddhism in the local area but also in the eastern and southern regions of Gansu. These temples and attachments changed the layouts of these settlements.

With the increase in the number of temples and monks, Buddhism developed, and the number of believers also increased. They used the grottoes to meditate and carry out religious activities. These grottoes facilitated the living needs of migrating monks and improved local cultures and the development of the central cities. The activities that took place there reflected the connotation of Buddhism and the local beliefs, such as sutra preaching, carving statues, and making offerings. Sutra preaching and cantillation had begun in the Sixteen Kingdoms Period. The monks in the Jin Dynasty, Zhufaya, and Kang-

falang invented Geyi (格義 géyì) to preach the sutra³ (Tang 2000). Sutra preaching thrived in the Tang Dynasty, and this is reflected in the large number of written scriptures excavated from the Cangjing Cave in Dunhuang.

Meanwhile, Buddhism had become secularised. Many activities conducted by the public, such as writing sutras, praying for blessings, and building caves, emerged gradually (Du 2009). These activities promoted the development of Buddhism, for example, praying and collecting karma for oneself, loved ones, or the departed. Buddhist statues and murals are more than just behavioural manifestations of Buddhist offerings; they are invaluable to the ancient Chinese art of sculpture and painting and important for the promotion of traditional Chinese culture.

In addition, some Buddhist activities are also essential for the local Buddhist landscape. The fair in the Manjusri Mountain Grottoes from the first to the eighth day of the fourth month of the lunar calendar is still currently held. It is the most important gathering activity in the eastern region of Gansu. Officials in Dunhuang tend to visit Mogao Grottoes to chant and worship Buddha during the Lamp Festival (Bibliothèque nationale de France 2002). The Bianwen of Mulian Rescuing His Mother was excavated in Cangjing Cave. The murals in Mogao Grottoes also demonstrate the Obon Festival and filial obedience, spreading Chinese traditions in various ways. These festivals have influenced several surrounding countries, such as Korea and Japan, thus reflecting the global influence of traditional Chinese culture.

Some local festivals are still currently held in the grottoes. For example, the Temple Fair and Shehuo reflect the integration of Buddhism with the locals' lives. Buddhist grottoes are not only a place of worship but also a place of entertainment.

Under the influence of tangible and intangible aspects, the Buddhist grottoes in the Hexi Corridor formed a unique Buddhist culture and beliefs. These beliefs integrated with folk religions, resulting in the development of a particular atmosphere and mental landscape.

5. Discussion

The development of the Buddhist grottoes in the Hexi Corridor is closely related to the environment, central cities, and surrounding transportation. The analysis demonstrates that most of these settlements are located in front of mountains and face waters, with a high elevation and a southern slope. They tend to be concentrated in large cities and near transport networks and important passes, rivers, and oases. In the settlements, a large grotto would be the core building, and small grottoes, temples, and townsites were scattered around. Many religious activities were held there. Most of them were integrated with everyday life, local cultures, and other religions to form featured mental landscapes.

Table 4 displays the four patterns of religious settlements.

The multicentre pattern: This type of settlement has two central cities, a core Buddhist grotto, and some small surrounding grottoes and temples. The grottoes, temples, and relics have a concentrated distribution, with landform having low influence. Most of the Buddhist grottoes are located within the viewshed of the central cities. In early times, the number of grottoes was small. Most of them were located away from the central cities. Then, the number of grottoes reached its peak and began to decrease. The number of grottoes in the Tang Dynasty was the largest and has decreased since then. The relationships with the central cities were weak, while the relationships with the surrounding counties were strong. This religious settlement pattern is exemplified by the Mogao Grottoes. It could be regarded as the core build with some small surrounding grottoes. Its elevation is low, and its buffer area is small. It had a close relationship with the central cities in early times, while the surrounding counties have been cut off from these grottoes since the Tang Dynasty.

The single-centre pattern: This type of settlement has one central city and one core building. The core building and other attachments were distributed around the central city, with a small buffer. Then, with development, the number of Buddhist buildings and

attachments increased, and their distribution became scattered. This religious settlement pattern is exemplified by the Manjusri Mountain Grottoes. The central city of this pattern is Jiuquan. In early times, the Manjusri Mountain Grottoes and other small Buddhist grottoes were carved around Jiuquan. Its buffer area is larger than that of the first pattern. Its elevation is also higher than that of the first pattern. Due to the influence of the landform, the impact of the viewshed from the central city is weaker than that of the first pattern. However, the grottoes were built away from the central city, and they increased in number during the Western Xia Period and the Yuan Dynasty.

Table 4. Patterns of religious settlements.

Patterns of Religious Settlements	Central Cities	Representative Buddhist Grottoes	Elevation from Sea Level	Slope	Buffer	Viewshed	Relationship with the Central Cities
Multicentre Pattern	Dunhuang, Guazhou	Mogao Grottoes	1100–2000 m	South and southeast	43 km	Within the viewshed	High compactness; concentrated with the central city in early times, then scattered with surrounding counties; temples and townsites concentrated in the central cities
Single-centre Pattern	Jiuquan	Manjusri Mountain Grottoes	1700–2300 m	South	45 km	Part of them within the viewshed	Low compactness, which gradually decreased; most of them carved around the central city
Scattered Patter	Zhangye	Mati Temple Grottoes and Dafo Temple	1800–2800 m	South	55 km	Out of the viewshed	Slight alteration of compactness; most Buddhist grottoes and temples carved around the central city; scattered around the counties in the late period; counties were far away from the central city
Complex Pattern	Wuwei, Gulang, Minqin, and so forth	Tianti Mountain Grottoes	1800–3100 m	Southwest	47 km	Out of the viewshed	Slight alteration of compactness; developed around the central city in early times; scattered around the counties in the late period; counties were close to the central city

The scattered pattern: This type of religious settlement tends to be located at a high elevation with a large buffer. Although some settlements with this pattern have a core building, the integral layout became scattered with urban and Buddhist development. This religious settlement pattern is exemplified by the Mati Temple Grottoes and Dafo Temple. Its central city is Zhangye County. The Buddhist grottoes and attachments in these settlements were concentrated in the central city in early times, while they became scattered around the counties in later times. These counties are far away from the central city. Thus, the impact of the viewshed from the central city on the grottoes is the weakest.

The complex pattern: This type of settlement tends to be developed and concentrated with a central city and some attached counties. In this settlement, the counties are close to the central city. Thus, the Buddhist grottoes near the counties also have close relationships with the central city. This settlement pattern tends to have a core and several centres, located at a high elevation with a large viewshed. In early times, the Buddhist grottoes, temples, and townsites were developed around the core, and then they were carved around the surrounding counties. This religious settlement pattern is exemplified by the Tianti Mountain Grottoes, and its centres include a central city, such as Wuwei (Liangzhou), and surrounding counties, such as Gulang and Minqi.

6. Conclusions

In this work, the patterns of religious settlements were analysed using the historic landscape approach. The outcome of the analysis validated different patterns of religious settlements in terms of their natural, cultural, and mental landscapes, both diachronically and synchronically. The analysis was not limited to the geographical space but also involved religious connotations, social properties, and human activities. The analytical methods included quantitative and qualitative methods. This comprehensive analysis, as a sys-

tematic approach, helps to support the validation of the landscape of religious settlements, particularly for Buddhist grottoes, and it provides a new perspective for research on religious settlements and heritage landscapes.

Through the analysis, the patterns of religious settlements were divided into four types: a multicentred pattern, a single-centre pattern, a scattered pattern, and a complex pattern. The religious settlements were influenced by environmental, political, economic, social, and cultural elements, and they were built facing waters and facing away from mountains. Most of them were concentrated in central cities, with traffic networks, and near essential passes and rivers. A large number of monks could pass through these places, allowing for religions to be widely spread. In the settlements, a large Buddhist grotto sits as the core building, with small grottoes, temples, and townsites scattered around it. These physical aspects form a unique belief space under the influence of mental elements. However, the different patterns have particular characteristics, such as the viewshed, buffer, and the relationships of the Buddhist grottoes and their attachments with the central cities and counties. These patterns are not only applicable to the grottoes in the Hexi Corridor but are also suitable for other Buddhist grottoes. For example, the patterns of the Yungang Grottoes and water-curtain grottoes in Tianshui are similar to those of the Mogao Grottoes.

However, this research is in the primary stages. Future work should therefore detail the analytical framework and the application of other techniques to enhance the understanding and comparison of different types of religious settlements. Quantification methods should be applied to the mental landscape. The integration of natural, cultural, and mental landscapes also needs exploring in order to achieve a reliable and comprehensive analysis.

Author Contributions: Conceptualization, Y.C.; methodology, Y.C.; software, Y.C.; validation, Y.C. and W.W.; formal analysis, Y.C.; investigation, Y.C. and H.W.; resources, H.W.; data curation, Y.C.; writing—original draft preparation, Y.C.; writing—review and editing, Y.C. and H.W.; visualization, Y.C.; supervision, W.W.; project administration, Y.C. and W.W.; funding acquisition, Y.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by [Open project of Gansu Provincial Research Center for Conservation of Dunhuang Cultural Heritage] grant number [GDW2021YB16] y.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The authors declare no conflict of interest.

Notes

¹ Data were obtained from the third cultural heritage survey in Gansu. Temples, excavated Buddhist carvings, and townsites were selected for analysis because they played essential roles in Buddhist settlements and influenced the distribution and characteristics of the landscape of Buddhist grottoes. The relics of temples may have a large number of Buddhist carvings. Temples took up the largest space in the Sixteen Kingdoms Period and the Sui and Tang Dynasties. They were also essential parts of urban settlements at that time. For example, Dayun Temple in Wuwei and Jiumoluoshi Temple in Liangzhou can be regarded as small settlements in cities. The Buddhist grottoes outside the central cities connected the cities and the holy world, and they had close relationships with urban settlements. They can also be considered as extensions of urban landscapes and cultures. The diachronic development of the cities influenced the development of the Buddhist settlements. For example, Mogao Grottoes in the Gui-yi-jun Period thrived due to the development of the Hexi Corridor.

² Dharmaraksa, a famous translator of the Buddhist sutra.

³ Confucian and Taoist thoughts are used to explain Buddhism.

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