Journal of Global Change Data & Discovery. 2022, 6(4): 597-606
www.geodoi.ac.cn

Spatial Data Analysis of the Grassland Nomadic System in Ar Horqin, Inner Mongolia, a Globally Important Agricultural Cultural Heritage Site of FAO

Wang, Z. X. Min, Q. W.

Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, State Key Laboratory of Resource and Environmental Information System, Beijing 100101, China

Abstract: On May 20, 2022, “Ar Horqin Grassland Nomadic System” was recognized by FAO as “a globally important agricultural cultural heritage system”. This brings the total number of “globally important agricultural cultural heritage” to 67, including 18 in China. The heritage site of “Ar Horqin Grassland Nomadic System” includes all Bayan Wendu Sumu in Ar Horqin Banner, Chifeng city, Inner Mongolia, including 23 Gachas (villages), one national forest reserve (Hanshan Forst), and one forest protection station, with a total area of 3,375 km^2. This dataset is the spatial data part of heritage sites, including 7 categories: (1) spatial location and scope of heritage site: Ar Horqin Banner; Bayan Wendu Sumu; 23 Gachas, 1 forest reserve, 1 forest protection station; (2) Grassland nomadic system division: Winter-Spring Pasture, Hanshan forest, Summer-Autumn Pasture; (3) Landform: 30 m-DEM and 10 m-Slope; (4) Land use: 8 classes; (5) 3 main rivers and 3 nomadic routes; (6) NDVI: Sentinel-2 satellite in July 2018, 10-m of spatial resolution; (7) Classification of soil erosion intensity: classification of soil erosion intensity of forest, shrub, grassland, and bare land. The data archive format is .kmz, .shp and .tif. This data consists of 108 data files, with a data size of 740 MB (compressed into 2 files, 565 MB).

Keywords: globally important agricultural cultural heritage system; Ar Horqin Banner; Bayan Wendu Sumu; grassland nomadic system; heritage sites; soil erosion; Sentinel-2 satellite

DOI: https://doi.org/10.3974/geodb.2022.04.11

CSTR: https://cstr.escience.org.cn/CSTR:20146.14.2022.04.11

Dataset Availability Statement:

The dataset supporting this paper was published and is accessible through the *Digital Journal of Global Change Data Repository* at: https://doi.org/10.3974/geodb.2022.08.07.V1 or https://cstr.escience.org.cn/CSTR:20146.11.2022.08.07.V1.

Received: 27-09-0222; **Accepted:** 16-11-2022; **Published:** 24-12-2022

Foundation: Ministry of Science and Technology of P. R. China: (2021YFE0117300)

***Corresponding Author:** Wang Z. X. L-5255-2016, Institute of Geographic Sciences and Natural Resources, Chinese Academy of Sciences wangzx@igsnrr.ac.cn

Data Citation: [1]Wang, Z. X., Min, Q. W. Spatial data analysis of the grassland nomadic system in Ar Horqin, Inner Mongolia, a globally important agricultural cultural heritage site of FAO [J]. *Journal of Global Change Data & Discovery*, 2022, 6(4): 597–606. https://doi.org/10.3974/geodp.2022.04.11. https://cstr.escience.org.cn/CSTR:20146.14.2022.04.11.

[2] Wang. Z. X., Min Q. W. Spatial dataset of the globally important agricultural heritage system—the nomadic system of the Ar Horqin grassland in Inner Mongolia [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2022. https://doi.org/10.3974/geodb.2022.08.07.V1. https://cstr.escience.org.cn/CSTR:20146.11.2022.08.07.V1.

1 Introduction

Globally Important Agricultural Heritage Systems (GIAHS) is a new type of world heritage that FAO began to incubate in 2002; it is conceptually equivalent to the world cultural heritage. It is a unique land use system and agricultural landscape formed under the long-term evolution and dynamic adaptation of rural areas and their environment. This system and landscape has rich biodiversity, and can meet the needs of local social, economic and cultural development, and is conducive to promoting regional sustainable development[1, 2]. To obtain GIAHS certification, you must have outstanding characteristics in five areas: food and livelihood security, biodiversity and ecological functions, traditional knowledge and adaptive technology, agricultural culture, value system and social organization, outstanding landscape, and water and soil resource management [3, 4].

The Ministry of Agriculture launched the excavation and protection of "China's important agricultural cultural heritage" in 2012. By November 12, 2021, 138 "Important Agricultural Cultural Heritage of China"[1] certifications have been delivered in 6 batches; As of May 20, 2022, 18 Chinese heritages have been included in the FAO list of "Globally Important Agricultural Cultural Heritage"[2].

Ar Horqin grassland nomadic system, including the whole Bayan Wendu Sumu, Ar Horqin Banner, Chifeng city, Inner Mongolia, covers an area of 3,375 km^2. This heritage site was included in the list of "Important Agricultural Cultural Heritage in China" in 2014, and was recognized as "Globally Important Agricultural Cultural Heritage" by FAO in 2022. The main body of the heritage has a semi-arid continental climate. The interannual change of ecological conditions is large, and it is difficult to predict the grassland productivity. Under such volatile conditions, family-based animal husbandry (grazing) may be unable to sustain their livelihood, it may be an inevitable choice for the local people to follow water and grass (nomadic) over a large space and across different seasons.

However, everything has two sides. The boundary of nomadic grassland is not very clear, and grazing management depends on traditional customs and internal consultation[5,6]. Although the grassland nomadic system can effectively alleviate the uncertainty brought by the changing climate, it also faces issues such as boundary disputes, large-scale fencing, and "tragedy of commons" caused by the unclear property rights of the grassland[7–9]. With the increasing popularity of the heritage site, future tourism and production activities will bring new opportunities and challenges to the development and protection of the heritage site, so more scientific research is needed[10].

This dataset is the spatial data part of the grassland nomadic system in Ar Horqin, including 7 categories, which may support the management and research of the heritage site.

2 Metadata of the Dataset

Metadata for the Spatial dataset of the globally important agricultural heritage system—the nomadic system of the Ar Horqin grassland in Inner Mongolia is listed in Table 1[11].

3 Spatial Data of Heritage Sites

3.1 Overview of the Heritage Site

The heritage site is located in Bayan Wendu Sumu, Ar Horqin Banner, Inner Mongolia Autonomous Region (Figure 1a), including 23 Gachas (administrative villages), 1 forest pro-

[1] Ministry of Agriculture and Rural Affairs: List of the Sixth Batch of China's Important Agricultural Cultural Heritage [EB/OL]. http://www.moa.gov.cn/nybgb/2021/ 202112/202201/t20220104_6386254.htm.

[2] FAO. GIAHS around the World [EB/OL]: http://www.fao.org/giahs/giahsaroundtheworld/designated-sites/en/.

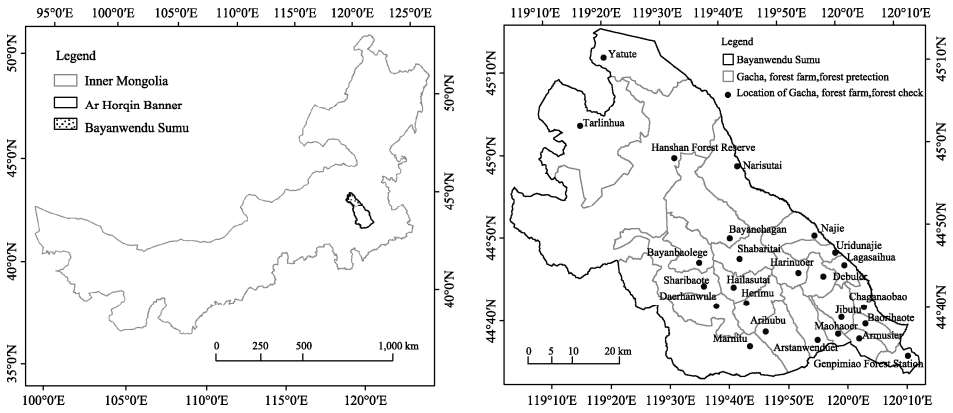
tection station (Genpi Temple), and 1 national nature reserve (Hanshan Forest) (Figure 1b), with a total area of 3,375 km^2. Based on the 25 units, the nomadic division of the grassland nomadic system in Ar Horqin is Hanshan Forest in the middle, 21 Gachas and 1 forest protection station in the south belong to Winter-Spring Pasture in the North, and Talin Hua Gacha and Yatu Te Gacha belong to Summer-Autumn Pasture (Figure 2). In 2018, there were 5,533 households with a total population of 15,103. By the end of June 2018, the total number of livestock on hand was 2.556 million (456,000 large livestock and 2.047 million sheep); At the end of December, the total number of livestock on hand was 1.792 million (305,000 large livestock and 1.443 million sheep).

The landform of the heritage site is characterized by open valleys and hills in the southern Winter-Spring Pasture, low mountains and medium mountains in the central and northern Hanshan Forest, and Inner Mongolia Plateau in the northern Summer-Autumn Pasture. The altitude of the heritage site spans 414–1,650 m (Figure 2a).

Slope: most of the pastures are gentle in Winter-Spring area. The altitude of Hanshan Forest is high, and most slopes are above 16 degrees. Most pastures in Summer-Autumn Area is above 1,000 m, but most slopes are below 25 degrees (Figure 2b).

Table 1 Metadata for the Spatial dataset of the globally important agricultural heritage system—the nomadic system of the Ar Horqin grassland in Inner Mongolia

Items	Description
Dataset full name	Spatial dataset of the globally important agricultural heritage system—the nomadic system of the Ar Horqin grassland in Inner Mongolia
Dataset short name	NomadicSystemAr Horqin
Authors	Wang, Z. X. L-5255-2016, Institute of Geographic Sciences and Natural Resources Research, CAS,wangzx@igsnrr.ac.cn Min, Q. W. Institute of Geographic Sciences and Natural Resources Research, CAS, minqw@igsnrr.ac.cn
Geographical region	Bayan Wendu Sumu, Ar Horqin Banner, Chifeng city:119°3′E–120°12′E,44°32′N–45°15′N
Year	2018–2019
Spatial resolution	10–30 m Data format .shp, .tif Data size 740 MB
Data files	7 folders: (1) location and scope of the heritage site: Banner; Bayan Wendu Sumu; 23 Gachas, 1 Forest Reserve, 1 Forest check; (2) grassland nomadic system division: Winter-Spring Pasture, Hanshan Forest Reserve, Summer-Autumn pasture; (3) landform: 30-m DEM and 10-m slope; (4) land use: 8 categories; (5) 3 main rivers and 3 nomadic routes; (6) NDVI: Sentinel-2 satellite in July 2018, 10m; (7) classification of soil erosion intensity of forest, shrub, grassland, and bare land.
Foundation	Ministry of Science and Technology of P. R. China(2021YFE0117300)
Data computing	ArcGIS10.8, SNAP Biophysical Processor (ESA)
Publishing and sharing platform	Global Change Research Data Publishing & Repository, http://www.geodoi.ac.cn
Address	No. 11A, Datun Road, Chaoyang District, Beijing 100101, China
Data sharing policy	***Data*** from the Global Change Research Data Publishing & Repository includes metadata, datasets (in the *Digital Journal of Global Change Data Repository*), and publications (in the *Journal of Global Change Data* & *Discovery*). ***Data*** sharing policy includes: (1) ***Data*** are openly available and can be free downloaded via the Internet; (2) End users are encouraged to use ***Data*** subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute ***Data*** subject to written permission from the GCdataPR Editorial Office and the issuance of a ***Data*** redistribution license; and (4) If ***Data*** are used to compile new datasets, the 'ten per cent principal' should be followed such that ***Data*** records utilized should not surpass 10% of the new dataset contents, while sources should be clearly noted in suitable places in the new dataset[12]
Communication and searchable system	DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS/ISC, GEOSS



(a) Bayan Wendur Sumu (b) Distribution of Gacha

Figure 1 Maps of Bayan Wendur and distribution of Gacha in the heritage site

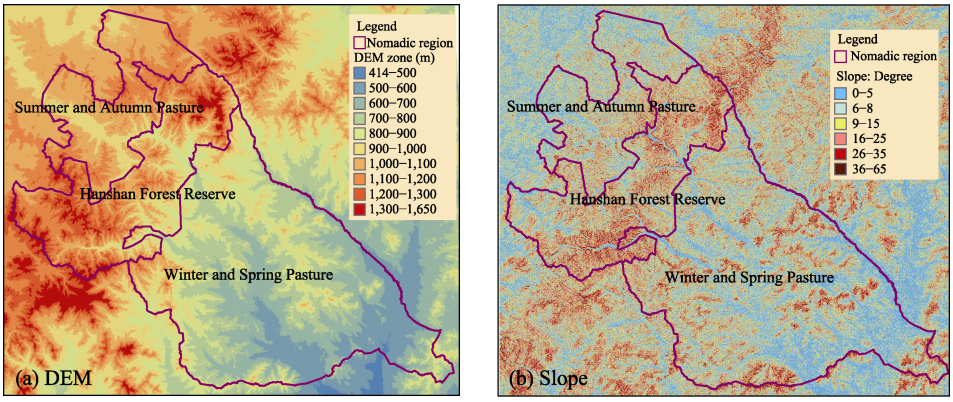


Figure 2 Maps of DEM Zone and Slope of the Heritage Site

3.2 Land Use and Nomadic System of Heritage Sites

3.2.1 Land Use

According to 2018 land use data, the total area of the heritage site is 337,523.4 ha: grassland 51.32%, forest 26.96%, shrub 15.07% (Table 2, Figure 3). Among them, the area of Winter-Spring Pasture in the south is the largest, 195,699.68 ha; The area of Hanshan Forest Reserve in the middle is 84,910.68 ha; The area of Summer-Autumn Pasture in the north is the smallest, 56,913.04 ha.

(1) Winter-Spring Pasture: the proportion of grassland, forest and shrub forest is close to that of the whole heritage site. Although the proportion of “farmland” and “construction land” is less than 4%, this is the most obvious feature of the region, reflecting the relatively developed economy of Winter-Spring Pasture.

(2) Summer-Autumn pasture: it has the advantages of wilderness and biodiversity. First, because the land directly affected by human activities only accounts for 1.33% (0.73% of farmland, 0.17% of buildings, 0.43% of roads), while the proportion of other landscapes with more natural characteristics is as high as 98.67%. This makes the region have a resource that is scarce in modern society—wilderness or nature, which is of great significance to the development of ecotourism. This kind of wilderness has improved the diversity of ground plants: there are nearly 300 species of herbage plants, including more than 30 kinds of medicinal plants commonly used by Mongolian people. The livestock products produced

by the Summer-Autumn Pasture with diversified herbivores have better quality. This natural and diversified herbivorous resource, as well as the length of feeding time, is also an important indicator for the selection of quality mutton in Europe[13].

(3) Hanshan Forest Reserve. As grazing is prohibited in this area, this area mainly provides ecological services: providing water and soil conservation, and biodiversity provenance for the north and south pastures. It provides three safe passages for nomadic travel, ensuring grazing and rest on the way. In winter-spring period when forage resources are scarce, appropriate grazing can be carried out in the "experimental area" at the outermost periphery of the nature reserve. The forest ecosystem of Hanshan Mountain and the Summer-Autumn Pasture have their own characteristics and complement each other, which is a complete system for the future development of ecotourism.

3.2.2 Main Roads and Nomadic Routes

The roads related to nomadism in the heritage site are mainly as shown in Figure 4. At the end of May and the head of June, 21 Gachas in Winter-Spring Pasture start to organize cattle and sheep for transfer, set out at each Gacha distribution center, and go north along the roads. When crossing Hanshan Forest Reserve, it is mainly divided into three routes: east line, middle line and west line. After entering the Summer-Autumn Pasture, continue to move to their respective grazing areas according to the traditional conventions. In addition to the traditional conventions, more detailed spatial zoning map is required for the cattle and sheep of 21 Gachas (forest protection station) in Winter-Spring Pasture to make better use of the grassland of 2 Gachas in Summer-Autumn Pasture.

Table 2 Area and percentage of 8 land cover types in heritage site

	Winter-Spring		Summer -Autumn		Hanshan Forest		Total	
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Farmland	7,784.8	3.98	414.16	0.73	0.2	0.00	8,199.16	2.43
Forest	47,107.6	24.07	1,584.76	2.78	42,317.92	49.85	91,010.28	26.96
Shrub	32,770	16.75	250.72	0.44	17,836.76	21.01	50,857.48	15.07
Grassland	98,193.84	50.17	51,348.92	90.23	23,675.24	27.88	173,218	51.32
Built-up land	1,141.36	0.58	98.16	0.17	12.36	0.01	1,251.88	0.37
Transportation	920.28	0.47	242.56	0.43	62.44	0.07	1,225.28	0.36
Wetland	2,987.4	1.53	627.84	1.10	324.12	0.38	3,939.36	1.17
Bare land	4,794.4	2.45	2,345.92	4.12	681.64	0.80	7,821.96	2.32
Total	195,699.68	100	56,913.04	100	84,910.68	100	337,523.4	100

3.3 Land Degradation Assessment of Nomadic System

3.3.1 Land Degradation Assessment Method of Nomadic System

(1) Spatial scope of assessment: land degradation assessment is only conducted for four land uses directly related to nomadic system, namely "forest, shrub, grassland, and bare land".
(2) Temporal scope of assessment: vegetation coverage data (here, proxied by Sentinel-2 NDVI) is required for both water erosion assessment and wind erosion assessment. NDVI closely follows the increase of precipitation, so it is necessary to make a compromise: NDVI is better (not necessarily the largest), and it is sufficient to use sunny data to synthesize the whole pastoral area. The comparison results show that there are many clouds and fogs in August 2018, and it is impossible to obtain enough sunny data. In September, the vegetation coverage in the north of Hanshan Forest Reserve has decreased significantly. July is the best month, so July 2018 is taken as the reference time (Figure 5).
(3) Assessment indicators and method: the Classification and Grading Standards of Soil Erosion[14] of the Ministry of Water Resources was selected as the quality indicator of grazing land. As the heritage site is located in the transitional area of water erosion and wind

erosion, the grazing land is first classified into water erosion and wind erosion, and then the "Max" of the pixel is represented by a more serious level.

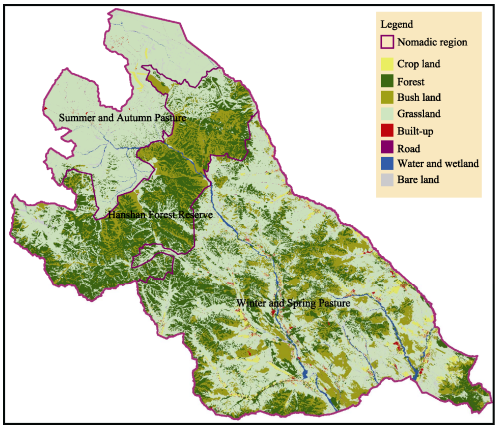


Figure 3 Land use of heritage sites (2019)

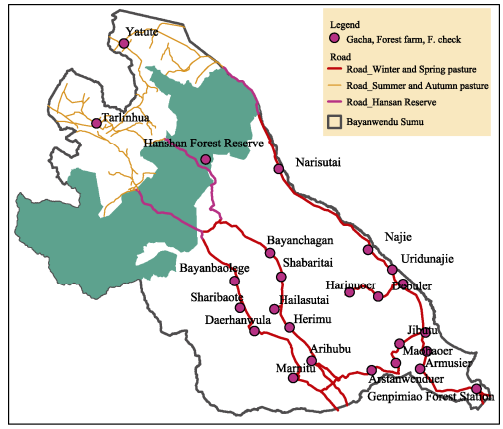


Figure 4 Main roads and nomadic routes of the heritage

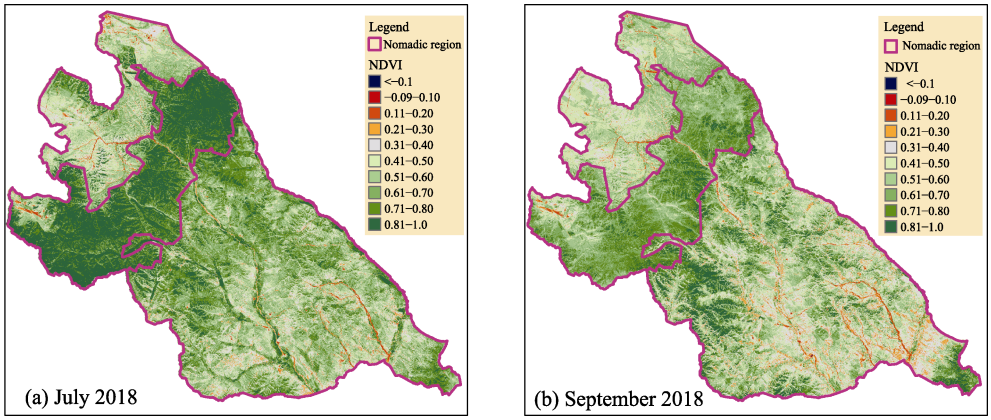


Figure 5 Maps of NDVI of heritage site in 2018 (Sentinel 2 satellite)

3.3.2 Soil Erosion Assessment Results

(1) Water erosion

All pastures: no erosion accounted for 32.23%, and slight erosion accounted for 50.49%, accounting for 82.72% in total. moderate erosion is 15.86%, and severe erosion is 1.42%. The grazing land is mainly subject to slight water erosion.

3 PastureZones: in terms of slight and below water erosion, Hanshan Forest accounts for 94.10%, with the highest quality. The southern Winter-Spring Pasture accounts for 80.79%, with medium quality. The proportion of summer-autumn pasture in the north is 71.75%, which is the worst among the three pastoral areas (Figure 6a, Table 3).

(2) Wind erosion

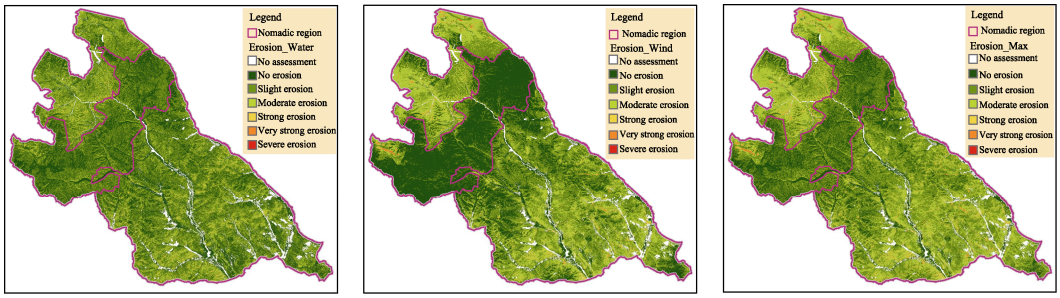
In all nomadic areas, no erosion accounts for 37.25%, and slight erosion accounts for 36.15% (Figure 6b, Table 4).

In 3 nomadic zones: in term of the proportion of mild and below wind erosion in the area of the whole region, the Winter-Spring Pasture in the south is 70.26%, the Summer-Autumn Pasture in the north is 49.18%, and the Hanshan Forest is 96.07%.

Summer-autumn pasture: since the grassland in Summer-Autumn Pasture accounts for 90.22%, the degree of wind erosion of the grassland can reflect the quality of pasture. The proportion of grassland free from wind erosion is only 7.68%, the proportion of light wind erosion is 41.47%, the proportion of moderate wind erosion is 47.60%, and the proportion of strong and above wind erosion is 3.24%.

(3) Max soil erosion

All nomadic systems: in all three zones, no erosion accounts for 19.94%, and slight erosion accounts for 47.39%, both accounting for 67.33% in total. Moderate erosion accounts for 31.80%, and strong and above erosion accounts for 0.86%. Three pastoral zones: in terms of the proportion of Slight and below soil erosion, Winter-Spring Pasture accounts for 63.58%, Hanshan Forest accounts for 91.73%, and Summer-Autumn Pasture accounts for 42.59% (Figure 6c, Table 5).



(a) Water erosion (b) Wind erosion (c) Max SoilErosion

Figure 6 Maps of Land Erosion Intensity of Pasture in the Heritage Site

Table 3 Classification of water erosion of grassland in nomadic system of heritage site (%)

Soil erosion class	1-No	2-Slight	3-Moderate	4-Strong	5- Extremely strong	6-Severe	Total
Winter-Spring Pasture	30.10	50.70	17.48	1.44	0.27	0.02	100
Summer-Autumn Pasture	19.24	52.51	26.06	1.81	0.33	0.05	100
Hanshan Forest	45.38	48.71	5.63	0.25	0.02	0.00	100
Total	32.23	50.49	15.86	1.19	0.21	0.02	100

Table 4 Classification of wind erosion of grassland in nomadic system of heritage site (%)

Soil Erosion Class	1-No	2-Slight	3-Moderate	4-Strong	5- Extremely strong	6-Severe	Total
Winter-Spring Pasture	25.84	44.43	26.90	2.34	0.48	0.01	100
Summer-Autumn Pasture	9.73	39.45	45.95	3.29	1.42	0.16	100
Hanshan Forest Reserve	80.02	16.05	3.20	0.37	0.36	0.01	100
Total	37.24	36.15	23.97	1.99	0.61	0.04	100

Summer-Autumn Pasture: only 5.39% of the pasture land in summer-autumn pasture is not eroded, 37.20% is slightly eroded, and 51.14% is moderately eroded. This shows that the quality of Summer-Autumn Pasture is poor, and the pressure of grassland restoration is great in the future.

3.4 Ground Investigation

In order to verify the applicability of soil erosion assessment, we visited the west line (Hundulun area) and the middle line (Tallinghua area) of the summer-autumn pasture

(Figure 7) in July 2019, our findings are summarized below.

Table 5 Max of water and wind soil erosion severity of pasture in nomadic system (%)

Soil Erosion Class	1-No	2-Slight	3-Moderate	4-Strong	5- Extremely strong	6-Severe	Total
Forest	27.59	55.91	15.66	0.74	0.10	0.00	100
Shrub	5.45	45.50	43.27	4.87	0.87	0.04	100
Grassland	11.33	48.70	36.02	3.49	0.44	0.02	100
Bare soil	2.56	23.91	42.12	18.49	12.54	0.36	100
(1) Subtotal of Winter-Spring Pasture	14.24	49.34	32.23	3.42	0.74	0.03	100
Forest	36.91	52.35	9.06	1.21	0.44	0.03	100
Shrub	40.65	52.13	6.88	0.31	0.02	0.01	100
Grassland	4.45	37.85	53.09	3.68	0.84	0.09	100
Bare soil	1.01	11.07	41.74	21.90	21.45	2.83	100
(2) Subtotal of Summer-Autumn Pasture	5.39	37.20	51.14	4.36	1.70	0.21	100
Forest	48.64	49.66	1.63	0.06	0.01	0.00	100
Shrub	34.80	53.39	11.21	0.53	0.07	0.00	100
Grassland	35.92	48.55	14.13	1.07	0.32	0.01	100
Bare soil	10.22	17.74	23.36	15.01	33.06	0.61	100
(3) Subtotal of Hanshan Forest Reserve	41.85	49.88	7.33	0.56	0.38	0.01	100
Total	19.94	47.40	28.97	2.83	0.81	0.05	100

3.4.1 Slope System

The 10 m Sentinel-2 satellite data can quantitatively describe the areal (surface) erosion of different degrees, from no erosion to severe erosion. However, Sentinel-2 satellite failed to detect small gullies developed on the slope with deep parent material layer. Some gullies are less than 1 m wide, yet 3–4 m deep and more than 10 m long (Figure 7a–7d).

(a) Moderate erosion (b) Severe erosion (c) Gully erosion on Slope (d) Gully erosion on road

(e) The road is cut off by streams (f) The subgrade is washed out by streams (g) The road is buried by sand sediment (h) Seasonal road

Figure 7 Photos of Main types of soil erosion in Summer-Autumn Pasture

3.4.2 Land degradation in valley and flat land systems

The flood and sediment from the slope system converge into the valley, and the most direct impact is on the road system: flood may wash the pavement (Figure 7d), break the road

(Figure 7e), and wash out the subgrade (Figure 7f). Sediment may bury the road (Figure 7g). In flat areas, some self-indulgent drivers take all good grass as roads. For example, in Hundulun Ranch, more than 20 pairs of parallel ruts were found in grassland (Figure 7h).

4 Discussion and Conclusion

4.1 Spatial Data of Ar Horqin Grassland Nomadic System

Ar Horqin grassland nomadic system will face more opportunities and challenges after it is selected as the FAO "Global Important Agricultural Cultural Heritage System" in May 2022. This dataset is the spatial data part of the application document developed in 2019, which may be used as the baseline data for future research. In addition to the basic spatial data, the land degradation of nomadic systems was assessed. According to the classification and grading standards of soil erosion of the Ministry of Water Resources of China, the soil erosion assessment was conducted on the pastures of the heritage sites using Sentinel-2 satellite data in July 2018。

(1) The moderate and above water erosion and wind erosion account for 17.28% and 26.61%, respectively. The moderate and above soil erosion accounts for 32.67% of the total grazing land.

(2) The proportion of moderate and above soil erosion of the three pastures in the total pastures is 36.42% in Winter-Spring Pasture, 57.41% in Summer-Autumn Pasture, and 8.27% in Hanshan Forest Reserve. This shows that the grassland degradation in Summer-Autumn Pasture is relatively serious.

4.2 Future Spatial Data Development

Now, when the cattle and sheep from 23 Gachas in Winter-Spring Pasture come to the Summer-Autumn Pasture, how to use the two Gacha pastures mainly depends on the village rules and regulations formed over the years, and there is no clear grassland boundary. In the future, in order to achieve the balance between grass and livestock on a fine scale, it is necessary to develop a clearer division of Summer-Autumn Pasture.

Author Contributions

Wang, Z. X. was responsible for the case spatial dataset and completed the first draft of the manuscript. Min, Q. W. refined the text.

Acknowledgements

The author thanks Wang, B., Qian, H. Y., and Fang, X. Y. of the government of Ar Horqin Banner for their strong support in field investigation.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Min, Q. W. Globally Important agricultural cultural heritage—a new type of world heritage [J]. *Resource Science*, 2006, 28 (4): 206–208.

[2] Min, Q. W. Interpretation of the selection criteria for globally important agricultural cultural heritage and its inspiration [J]. *Resource Science*, 2010, 32 (6): 1022–1025.

[3] Min, Q. W., Zhang, Y. X. Comparative study on agricultural cultural heritage and agricultural landscape heritage [J]. *Journal of China Agricultural University* (*Social Science Edition*), 2016, 33 (2): 119–126.

[4] Min, Q. W. Problems and suggestions in the declaration of China's important agricultural cultural heritage [J]. *Heritage and Conservation Researc*h, 2019, 4(1): 8–11.

[5] Behnke, R. Open access and the sovereign commons: a political ecology of pastoral land tenure [J]. *Land Use Policy*, 2018, 76: 708–718.

[6] Green, S., Cawkwell, F., Dwyer, E. Cattle stocking rates estimated in temperate intensive grasslands with a spring growth model derived from MODIS NDVI time-series [J]. *International Journal of Applied Earth Observation and Geoinformation*, 2016, 52: 166–174.

[7] Engler, J. O., Von Wehrden, H. Global assessment of the non-equilibrium theory of rangelands: revisited and refined [J]. *Land Use Policy*, 2018, 70: 479–484.

[8] Fetzela, T., Petridisa, P., Nolla, D., *et al*. Reaching a socio-ecological tipping point: overgrazing on the Greek island of Samothraki and the role of European agricultural policies [J]. *Land Use Policy*, 2018, 76: 21–28.

[9] Zweifel, L., Meusburger, K., Alewell, C. Spatio-temporal pattern of soil degradation in a Swiss Alpine grassland catchment [J]. *Remote Sensing of Environment*, 2019, 235: 111441. https://doi.org/10.1016/j.rse.2019.111441.

[10] Li, W. H. Strengthen the scientific, professional and normative work related to China's important agricultural cultural heritage [J]. *Leisure Agriculture and Beautiful Countryside*, 2014(8): 6–7.

[11] Wang. Z. X., Min Q. W. Spatial dataset of the globally important agricultural heritage system—the nomadic system of the Ar Horqin grassland in Inner Mongolia [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2022. https://doi.org/10.3974/geodb.2022.08.07.V1. https://cstr.escience.org.cn/CSTR:20146.11.2022.08.07.V1.

[12] GCdataPR Editorial Office. GCdataPR data sharing policy [OL]. https://doi.org/10.3974/dp.policy.2014.05 (Updated 2017).

[13] Erasmus, S. W., Muller, M., Hoffman, L. C. Authentic sheep meat in the European Union: factors influencing and validating its unique meat quality [J]. *Journal of the Science of Food and Agriculture*, 2017, 97(7): 1979.

[14] Ministry of Water Resources of the People's Republic of China Standard for Classification and Grading of Soil Erosion (SL190—2007) [S]. Beijing: China Water Resources and Hydropower Press, 2008.