Study on the Evolution of the Spatial and Temporal Patterns of the Three Livelihoods in Qinghai Province and Their Driving Mechanisms

[1st] Wenyi Guo[1,a], [2nd] Haifeng Zhang[1,2,3,4,b*], [3rd] Yalong Zhang[1,c], [4th] Yanyan Cao[1,d]

{[a]guowenyi0903@163.com, [b]haifzhang@126.com, [c]zhangyalong0809@163.com, [d]caosilingba@163.com}

[1]School of Geographic Sciences, Qinghai Normal University, Qinghai, China
[2] Institute of Plateau Science and Sustainable Development, Qinghai, China
[3] Key Laboratory of Surface Processes and Ecological Conservation of Qinghai-Tibetan Plateau, Ministry of Education, Qinghai, China
[4] Key Laboratory of Natural Geography and Environmental Processes of Qinghai Province, Qinghai, China

Abstract: Under the background of sustainable development and utilization of national land space, scientific cognition of the relationship between the quantitative increase and decrease of the "three living things" space and the evolution of the pattern under the long time series of the region is a prerequisite for realizing the coordination between socio-economic development and ecological protection. In this paper, the quantitative changes, spatial pattern evolution and driving mechanism of the "three living things" space in Qinghai Province from 1980 to 2020 are studied by using the land-use dynamics, land-use transfer matrix, and the traceability analysis based on land-use transfer flow. The results show that: (1) From 1980 to 2020, the living space in Qinghai Province showed a continuous increasing trend, while the area changes of production space and ecological space were in a constant state, and the differences of various types of land use were obvious in the counties; (2) Urbanization and industrialization, ecological construction, intensive use of soil and water resources, and ecological migration are the four main driving forces that promote the evolution of the spatial pattern of the "Three Lives" in Qinghai Province, accelerating the evolution of the spatial pattern of land in counties and municipalities in the region. They have accelerated the evolution of the spatial pattern of land in counties and cities in the region, and are the key factors to be paid attention to in the future regional ecological environment governance and land spatial planning.

Keywords: three living spaces; spatial and temporal evolution; driving mechanism; Qinghai Province

1 Introductory

As the degree of urbanization, industrialization and informatization is accelerating globally, the intensity and breadth of human development of national land resources are also increasing. The continuous expansion of urban and rural construction land and the continuous extrusion of agricultural production space and ecological space have led to intense competition and conflict among production, living and ecological space in the limited national land space [1], affecting the food and ecological security of the country. Therefore, in the context of ecological

PMBDA 2023, December 15-17, Nanjing, People's Republic of China

DOI 10.4108/eai.15-12-2023.2345383

civilization construction and national land space planning, based on the coordination of people and land, the identification of changes in the quantity and area of the three living spaces, the mutual transfer process and driving factors in the region is conducive to the formation of a reasonable pattern of national land development and utilization and the realization of sustainable economic and social development.

The current studies on the three living spaces are sorted out, and it is found that most of the studies focus on the connotation of the three living spaces [2], coupling coordination [3], and other aspects, as well as cross-studies with ecological and environmental effects [4], rural revitalization [5], and land-use transformation [6] and other topics. From the perspective of research scope, the existing research has included the multi-scale scope of administrative regions such as national, provincial, municipal, county and rural areas, as well as some special types of regions such as watersheds and mountainous areas [7-8]. In terms of research methodology, existing studies mostly use methods such as land use transfer matrix [9] and landscape pattern index [10] to measure the trend and characteristics of the spatial and temporal evolution of Sansheng space, and mostly use methods such as geoprobe [3] and land use transfer flow [11] to study the land use transfer driving mechanism. However, in general, due to the differences in the natural environmental conditions and development background of different regions, the law of the spatial evolution of the three living things is not consistent, and the manifestations are complex and diverse, and the identification and prediction of the trend of land use change is of great significance in coordinating the relationship between socio-economic development and ecological protection. In Qinghai Province, where ecology is the foundation, it is more urgent to study the pattern of the "three living spaces" as the "source consciousness" continues to be firmly established.

2 Overview of the study area and Research methodologies

2.1 Overview of the study area

Qinghai Province is located in the northeastern part of the Qinghai-Tibetan Plateau, and is an important national ecological security barrier, whose functions of water conservation and soil preservation have a direct impact on the ecosystem security of the central and eastern regions. Its functions of water conservation and soil preservation directly affect the security of the ecosystem in the central and eastern regions. Restricted by natural geographic conditions, the province has great geographical differences, diverse land types, unbalanced regional development, and a sensitive and fragile ecological environment.

2.2 Data sources

The remote sensing data of China's land use status quo in 1980, 1990, 2000, 2010 and 2020 used in this study were obtained from the Resource and Environment Science Data Center of the Chinese Academy of Sciences (RESDC), including 6 major categories with 25 subcategories, and with a spatial resolution of 30 m.

2.3 Research methodologies

This paper analyzes the spatial and temporal evolution of the "three living spaces" in Qinghai Province by using the "three living spaces" spatial classification system, land-use dynamics, land-use transfer matrix [9], and traceability analysis based on land-use transfer flow.

3 Spatial and temporal evolution of the "three living spaces" in Qinghai Province

The ecological space decreased sharply from 1980 to 2010, and then slowed down after 2010. Based on the numerical analysis: (1) production space, the most significant changes in agricultural production space, the area increased by 1222.05km^2 in 40 years; non-agricultural production space in 1980-2010 continued to grow, especially in 2000-2010 is the most obvious, and after 2010 showed a downward trend. (2) The increase of urban living space is getting bigger and bigger, and the rural living space is also expanding continuously, with a total increase of 278.39km^2 in 40 years, among which the urban living space close to the coverage of the water source is growing the most rapidly, and it is now 2.37 times higher than that in 1980. The ecological space has decreased by 0.1 times in the past 40 years, and the change is relatively small, but the age of various types of ecological land is not obvious at any time, among which, the area of forest ecological space has slightly decreased, the area of water ecological space has continued to increase and the increase has become larger, the area of grass ecological space has fluctuated, and the area of other ecological space has continued to decline (Fig. 1).

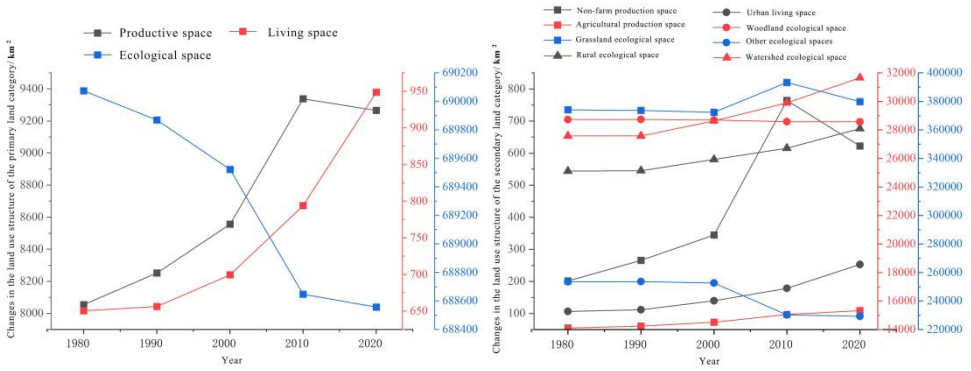

Fig. 1 Changes in the structure of the "three living spaces" in Qinghai Province

Using the data samples of 8 cities and 44 counties in Qinghai Province as the research object, we further analyzed the spatial and temporal evolution of the pattern of "three life spaces" at the county level (Fig. 2). The results show that: (1) the number of counties in Qinghai Province with rising production space accounts for 70.45% of the whole region, with Gande County in Guoluo Prefecture showing the most obvious increase in production space. Among them, the agricultural production space in addition to the main city of Xining, Tianjun County, Tongren City and Jianzha County, the rest of the counties and cities have more or less growth;

non-agricultural production space in Xining, Haidong, Huangnan three cities and states the most significant growth, negative growth in the number of counties and cities accounted for only 13.64% of the whole region. (2) The living space in the whole area of Qinghai Province shows a growing trend, and the growth of urban living space is more obvious compared with rural living space. Among the urban living space, only Dari County has a negative growth, Mangya City and Huangzhong District has the largest increase, the most rapid expansion of urbanization for Xining City, Chengbei District, 40 years of urban land area increased 26.01km2, and is located in high-altitude and ecologically poor areas in the last decade appeared in the distribution of living space; rural living space, only the West District of Xining City, Guiande County, Haiyan County, rural living space area decreased, the rest of the counties and cities showed a growth trend, Tanggula Mountain Town, Dari County, Zeku County had the most significant growth. (3) The areas of ecological space in Qinghai Province that have experienced a decrease in area over the past 40 years account for 88.64% of the total number of counties, shrinking more drastically. Among them, the green and potential ecological space shrinks 90.91% of the total number of counties, and Yushu City in Yushu Prefecture has the largest reduction in green and potential ecological space, reaching 12687.64km2; the blue ecological space grows 70.45% of the total number of counties, and Haixi Prefecture grows the most significantly, while the reduction is mainly in the source area of the Three Rivers and the Yellow River Basin in the eastern part of the province.

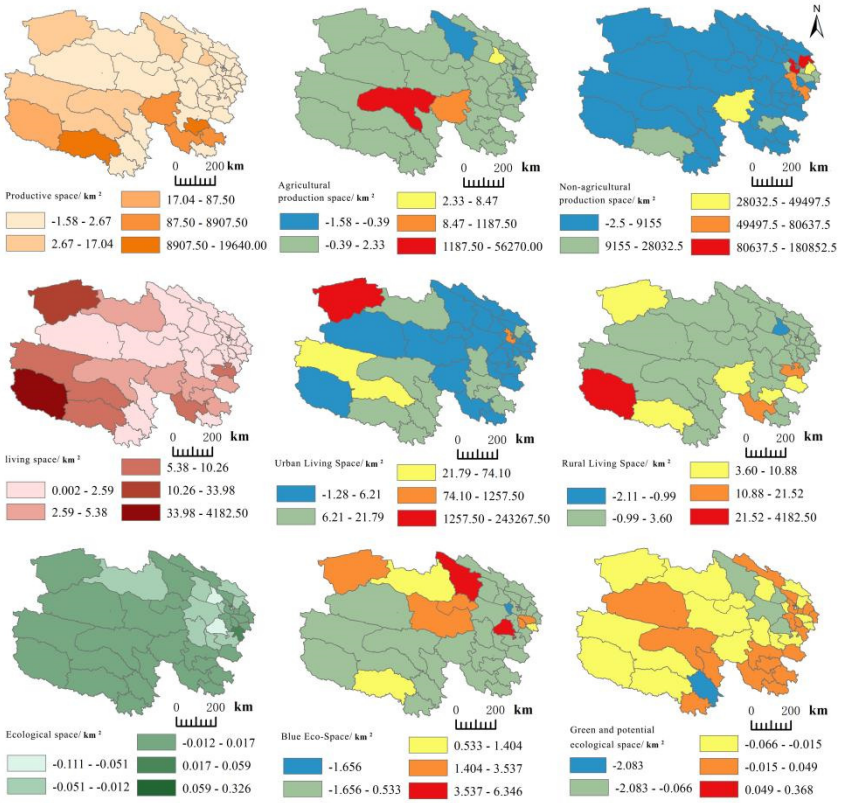

Fig. 2 County differences in changes in the structure of the "three living spaces" in Qinghai Province

4 Drivers of the spatial evolution of the "three livelihoods" in Qinghai Province

The driving factors such as ecological migration and rural construction, urbanization and industrialization, ecological construction, industrial structure adjustment and intensive use of water and land resources are proposed to analyze the evolution of the spatial pattern of " production-livi1g-ecological " in Qinghai Province. The results are shown in Table 1.

(1)From 1980 to 2020, ecological construction is the primary driving factor affecting the evolution of the pattern of "three living spaces" in Qinghai Province, with a driving contribution rate as high as 52.46%,Mainly, the Government has carried out ecological construction actions such as soil and water erosion control in key areas, which has led to a significant increase in the vegetation cover and a significant increase in the functions of water conservation and biodiversity protection.

(2)Soil and water resources intensive use of the second, drive contribution rate of 43.51%, mainly in the shallow mountains and Huangshui River area, through the use of improved farming systems and dry farming technology, optimize the valley bottom on both sides of the three-dimensional agricultural space pattern, "draw large Jijie Huangshui River" and other measures to improve the conditions of agricultural production, enhance the level of intensive use of soil and water resources.

(3)Urbanization and industrialization on the three life spatial pattern driving contribution rate of 2.39%,This is mainly due to the lack of significant urbanization and industrialization in Qinghai Province.

(4)The contribution rate of ecological migration and rural construction is only 1.74%, and it should be noted that soil erosion is still an important driving force for the conversion of various types of land to unused land, accounting for 33.6%, and it is still necessary to manage the problem of soil erosion in the future.

Table 1 Contribution rate of driving forces for the spatial evolution of the three lives of counties in Qinghai Province

driving factor	Three life space land transfer	Transfer area/km^2	Transfer ratio/%	Driver contribution/%
Ecological Migration and Rural Development	Conversion of productive agricultural land to rural living land	136.8	0.57	0.84
	Ecological land to rural livelihoods	145.12	0.6	0.9
	Subtotal	281.92	1.17	1.74
Urbanization and industrializatio n	Conversion of agricultural production land to urban land and other construction land	77.36	0.32	0.48
	Conversion of rural subsistence land to town land and other building land	7.98	0.03	0.05
	Conversion of ecological land to urban land and other building land	301.59	1.25	1.86
	Subtotal	386.93	1.6	2.39
Intensive utilization of	Conversion of ecological land to productive agricultural land	6997.03	29.02	43.19

soil and water resources	Conversion of rural subsistence land to productive agricultural land	51.32	0.21	0.32
	Subtotal	7048.35	29.23	43.51
ecological construction	Conversion of productive agricultural land to ecological land	7072.95	29.33	43.66
	Conversion of rural subsistence land to ecological land	59.31	0.25	0.37
	Conversion from low-functioning to high-functioning land use within productive land use	1351.05	5.6	8.43
	Subtotal	8483.31	35.18	52.46
	aggregate	16200.51	67.19	100

5 Conclusions

(1) The changes in the spatial pattern of the three living things in Qinghai Province between 1980 and 2020 cover both quantitative characteristics and spatial distribution. In terms of quantitative characteristics, the living space shows a trend of continuous increase, while the changes in the area of production space and ecological space are in a constant state. In terms of spatial distribution, there are obvious differences between various types of land use in counties, with the most significant growth in production space in Gande County, Guoluo Prefecture, the most rapid expansion of urban living space in Xining City, the largest decrease in green and potential ecological space in Yushu City, and the decrease in blue ecological space mainly in the Sanjiangyuan area and the Yellow River Basin.

(2) Ecological construction is the most important driving force for the evolution of the spatial pattern of land and soil in Qinghai Province, followed by the intensive use of soil and water resources; urbanization and industrialization are the fundamental driving force for the extrusion of ecological space; and soil erosion is still an important driving force for the transformation of various types of land into unutilized land, which still needs to be treated in the future.

References

[1] Yanan Wang, Xiao Xiao, Jinfang Pu, etc . Spatial and spatial evolution characteristics of the "three living things" space in the Yangtze River Economic Belt over the past 40 years[J]. Journal of Agricultural Machinery,2022,53(11):215-225.

[2] Jilai Liu, Yansui Liu,Yurui Li . Classification evaluation and spatial-temporal pattern analysis of "three living spaces" in China[J]. Journal of Geography,2017,72(07):1290-1304.

[3] Cheng Wang, Ning Tang . Spatio-temporal characteristics and pattern evolution of the coupled spatial functions and coordination of the three living spaces in rural Chongqing[J]. Geography Research,2018,37(06):1100-1114.

[4] Jianhong Dong, Zhibin Zhang, Benteng Liu, etc. Geodetection of ecological environment quality differentiation mechanism in Northwest China under the spatial perspective of "three lives"[J/OL]. Arid Zone Geography:1-14[2023-01-01].

[5] Yunlu Zhang, Xiong Li, Songlin Sun. Evaluation and optimization of rural spatial suitability based on the spatial coordination of "three lifetimes"--Taking Beishakou Township of Xiongan New Area as an example[J]. Urban Development Research,2019,26(01):116-124.
[6] Xing Gao, Zewei Liu, Chenxi Li, etc. Study on the functional transformation of land use and ecological and environmental effects in Xiongan New Area based on "three life spaces"[J]. Journal of Ecology,2020,40(20):7113-7122.
[7] Cilliers S, Cilliers J, Lubbe R, et al. Ecosystem services of urban green spaces in African countries-perspectives and challenges [J]. Urban Ecosystem, 2013, 16(4): 681-702.
[8] John J，Chithra N R，Thampi S G． Prediction of land use /cover change in the Bharathapuzha River basin，India using geospatial techniques．Environmental Monitoring and Assessment，2019，191(6) : 354．
[9] Fan Yang, Suwen Xiong, Ting Lei, etc. Evolution and driving mechanism of "three life space" pattern in Dongting Lake area during urbanization[J]. Journal of Ecology,2022,42(17):7043-7055.
[10] Ye Du, Junjun Lei, Xingzhi Lu. Evolution of the spatial pattern of "three living things" in Changzhutan urban agglomeration from 2000 to 2018[J]. Urban Architecture,2022,19(01):90-94+126.
[11] Caihong Ma, Sven An, Qi Wen, etc. Study on the evolution of land space pattern and its driving mechanism based on land use transfer flow--Taking Yuanzhou District of Ningxia as an example[J]. Arid Zone Geography,2022,45(03):925-934.