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EXPLORING THE RELATIONSHIP MECHANISM BETWEEN THE DEVELOPMENT OF OUTDOOR SPORTS AND URBAN ECOLOGICAL ENVIRONMENT

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ABSTRACT

In order to promote the sustainable development of outdoor sports, it is necessary to actively advocate the development of outdoor sports that is compatible with ecological civilization. This paper summarizes the influencing factors of outdoor sports on the natural environment. The author focuses on the evaluation methods of UEE (Urban ecological environment), constructs the evaluation index system and MIEP (Maximum Information Entrepreneurial Principle) evaluation model, and makes case studies in different cities. To a certain extent, this model reflects the evolutionary dynamic mechanism and spatial-temporal evolution characteristics of UEE, which not only has great advantages in evaluation, but also has potential in the prediction, regulation and management of UEE development and change state. Good ecological environment of alkali city can improve the physical and mental health of outdoor sports personnel.

KEYWORDS: Urban Ecological Environment; Outdoor Sports; Ecological Environment; Ecology; Urban Sports.

1. INTRODUCTION

With the development of economy and social progress, the harmonious development of human and natural ecology has become an important issue. China has become the second largest economy in the world. In the process of pursuing economic growth, the ecological imbalance has already appeared. Some scholars have pointed out through investigation that outdoor sports have

become one of the important items for the public to participate in the national fitness, ranking seventh among people's favorite national fitness sports. However, because most outdoor players lack the necessary guidance of environmental protection concepts, and the corresponding national supervision and management system needs to be improved, the impact on the natural environment is becoming more and more serious. The change of ecological environment is closely related to human health. However, outdoor sports need to be completely exposed to the environment of air pollution. In the process of sports, it is inevitable that people will suffer from injuries. As a result, the urban environment changes, which has a significant impact on the development of outdoor sports. The accelerating aging of the population has brought tremendous pressure to China's pension insurance and services, social medical security and other aspects. Physical exercise is a coordinated activity of body and intelligence. According to the laws of physiological and psychological growth of human body and the improvement of human function, it constantly promotes and improves the growth and development of human body, strengthens the physique and improves the athletic ability of human body, which has a significant effect on strengthening the body for the elderly. Urban citizens can choose a wide range of sports for physical exercise, not only running, doing exercises and dancing, but also engaging in competitive events such as gateball, table tennis and badminton. Some people even take part in higher consumption items, such as bowling and tennis, and enjoy different levels of services according to the amount of consumption. The purpose of people's outdoor physical exercise is to improve physical quality, improve the functions of various organs of the body, and achieve the purpose of enhancing immunity and improving health level. Outdoor sports is a movement that returns to nature, and the active and healthy lifestyle and environmental protection concept advocated by it just coincide with the ecological civilization advocated by our party. As a cultural form, sports have a long history with the development of cities. No matter ancient cities or modern cities, there are traces of sports culture. However, with the increase of population and the arrival of an aging society, due to the wanton destruction in people's production and life and the limitation of scientific and technological level, the ecological environment is increasingly damaged, and the phenomena of air pollution, water pollution, forest vegetation and so on are becoming more and more serious. This in turn affects people's lifestyle. The way of physical exercise of the elderly is also deeply influenced by it. Based on the concept and characteristics of UEE security, this paper puts forward the unbalanced statistical mechanics model of UEE (Urban ecological environment) evaluation according to MIEP (Maximum Information Entrepreneurial Principle) from the perspective of the evolution of UEE security structure, and evaluates different UEE situations.

2. Related Work

According to the relationship between ecological environment and

human beings, it can be divided into natural ecological environment and artificial ecological environment. The natural ecological environment refers to the sum total of all natural materials and energy that have no human interference and directly or indirectly affect human beings. Literature (El-Aasar et al., 2024) talks about that with the acceleration of social life rhythm, more and more people have different degrees of psychological problems such as irritability, anxiety and fear. Literature (Yang, 2021) pointed out that in the recent period, the development of urban sports is very fast, and at the same time, the reform of sports is constantly breaking through. According to the relationship between ecological environment and human beings, the perspective of ecological environment refers not only to natural ecological environment, but also to social ecological environment. Encourage people to actively embrace the construction of community ecological stadiums and facilities. Literature (Zuo et al., 2023) holds that improper outdoor behavior in mountain areas is an important incentive to cause ecological and environmental problems, which is mainly manifested in accelerating the destruction of the ecological environment by catalysis and aggravating the encroachment and pollution of the ecological environment. Literature (Yang et al., 2023) points out that man-made ecological environment is established in the process of utilizing and transforming natural ecological environment. Including industrial ecological environment, agricultural ecological environment and settlement ecological environment (Roberts et al., 2015), etc. It is pointed out that with the substantial increase of human life span, the problem of the elderly naturally becomes a prominent social problem, which directly affects the harmony and stability of society and family. Literature holds that an environmental protection plan must be submitted. In order to reduce the ecological environment damage and influence caused by the development of large-scale sports events and the construction of sports venues and facilities (Cai et al., 2023; Yang et al., 2022). The influences of some outdoor activities on natural ground cover plants-soil environment are mainly in the forms of trampling, picking and garbage piling. Bad outdoor activities affect the population composition of ground cover plants and the external shape of soil, which changes the natural landscape appearance to varying degrees, and then affects the landscape value. Literature (Kunlun et al., 2023; Mottaeva & Larinina, 2023) discusses the measurement of UEE, but the concept of UEE has not been clearly put forward. Literature holds that the definition of UEE can be analogized according to the definition of human health. Literature (Stoddart, 2012) established UEE index system from biophysical index, ecological index and socio-economic index. Literature (Ribeiro Junior et al., 2023) Establish the UEE evaluation index system from the relationship among environment, human health, economic development and public policy. According to the principles of systematicness, dynamics and combination of ecology-society-economy (Wang et al., 2018), the method and mode of UEE comprehensive evaluation of mariculture based on index system method and analytic hierarchy process were constructed. Literature (YUAN et al., 2019) discusses the index of

farmland UEE integrity evaluation, and establishes the index system of farmland UEE evaluation, which combines environment, structure, sustainability, productivity and management. Literature (Demková et al., 2017) applies fuzzy evaluation model to UEE, and makes corresponding evaluation and research on UEE status. Literature (Li & Mao, 2022) puts forward the concept of weight spatial sensitivity analysis, tries to explore the influence trend and law of the weight of participating factors on the evaluation results, explains the sensitivity factors that affect the evaluation results more scientifically and reasonably, and puts forward profound suggestions for the subsequent planning. In UEE evaluation, in the aspect of evaluation index system: due to the complexity of UEE, it is inevitable that there will be deviations in the selection of evaluation indexes, and it is still not possible to establish a complete and comprehensive evaluation index system. In terms of evaluation criteria, there is no definite standard to define UEE or not, so the determination of evaluation criteria is subjective to some extent.

3. Research Method

3.1. Interaction between Environment and Outdoor Sports

Because outdoor sports take the natural environment as the sports venue, its spread and development are bound to be restricted by the external environment. The theory of ecology on the interaction between the subject object and the external environment can help this study to solve the problem of harmony and balance between outdoor sports and the external environment, which has certain practical significance. Therefore, it is reasonable and scientific to explore the development of outdoor sports in China from the ecological perspective. With the progress of human society and the improvement of life civilization, human beings pay more and more attention to the improvement of their own health. More and more countries in the world regard beneficial body-building exercise as an essential part of scientific arrangement of leisure time. This fully proves that sports is a means to improve people's living standard, quality of life, arrange leisure time scientifically and meet people's physical and spiritual needs, and it has become an important part of people's healthy, civilized and scientific lifestyle. At the same time, for ordinary citizens, the transformation and construction of urban infrastructure and the improvement of environment will undoubtedly improve their quality of life. The wonderful sports competitions cultivate citizens' sentiment, stimulate their enthusiasm to participate in sports, and help people to establish a good lifestyle and improve their life taste. Outdoor sports can not only strengthen the body, but also make people feel happy and help to improve people's happiness in life (DATTA & BAGCHI, 2018). Many outdoor sports are challenging, and those useless challenges are discouraged. However, it should also be realized that people are not pursuing a boring life, and those reasonable risks and challenges outweigh material needs. The main functional modules of the

outdoor information platform are shown in Figure 1.

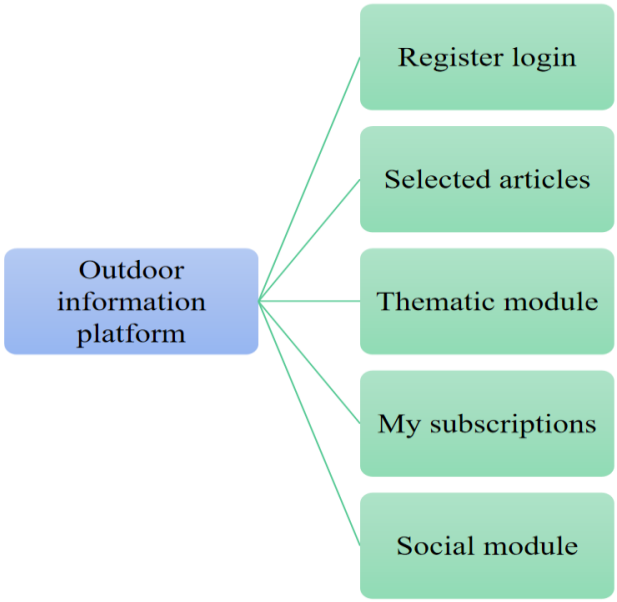

Figure 1: System Function Module

Outdoor sports information platform, our aim is to screen out high-quality articles and present them to users, so as to provide a professional platform for everyone. On the front page of the platform, what comes into people's field of vision is our selected good articles, including some articles that are well received by everyone, that is, articles with high comprehensive index of views, likes and comments. In addition to browsing articles and short videos, users can give their own opinions, praise them, reprint them to friends, and recommend some good articles. After the system administrator passes the examination, they will get certain rewards. People's traditional ideology is people-oriented, people's interests are supreme, their awareness of environmental protection is not strong, and their ideology is not enough. Media departments publicize relevant environmental protection knowledge through various means, change the traditional concept of human-centered consumption, ethics and values, and effectively curb the pollution and destruction of mountain ecological environment for a long time. Outdoor sports are carried out on the basis of ecological environment. With the improvement of ecological environment, outdoor sports will develop accordingly. At present, there are many kinds of outdoor sports events in China, and participants can make multi-directional choices according to their personal hobbies, economic status, age and physical condition. Outdoor sports provide many opportunities for communication, and mutual promotion of good environmental awareness and scientific and reasonable environmental protection concept is the sincerest respect for the natural environment. Because tourism itself puts great pressure on the environment, should reduce the burden of nature. Also, outdoor sports plans should try to avoid dangerous situations that don't make much sense,

because once a critical situation occurs, the concept of environmental protection can't occupy an important position in people's minds, which is bound to destroy the surrounding environment. People's demand for sports is not only biological, but also social. The structure and level of people's needs are constantly changing with the increase of social material wealth. People's needs are endless, the development of cities is endless, and the demand of urban residents for sports is endless. The contradictions and conflicts between cities and people constitute one of the power sources for the development of social productive forces.

3.2. UEE Evaluation

Ecological infrastructure is the natural system that cities depend on, and it is the basis for cities and their residents to obtain natural services continuously. These ecological services include providing fresh air, food, sports, recreation, safe shelter, aesthetics and education, etc. It includes not only the concept of customary urban green space system, but also all urban green space system, forestry and agriculture system, nature reserve system and cultural heritage and ecological recreation system which can provide the above-mentioned natural services. A core idea of ecological infrastructure construction is to maintain the integrity and health of the structure and function of the whole natural system, so that the city can obtain good and comprehensive ecological services. As an open complex system, there are universal interactions (mostly nonlinear complex interactions) in UEE. UEE is evolving and developing under various interactions, and its evolution rules follow MIEP. When studying UEE, we can't judge whether the system is healthy or not by studying the components of a certain UEE in isolation. The healthy development of a certain element doesn't mean that the whole UEE is healthy or the unhealthy development of a certain element, nor can we conclude that the whole UEE is unhealthy. The factors affecting UEE security are set as component x_1, $x_{2,\ldots,}$ x_n, and all interactions in the system are infinite connections and couplings between components (representing material flow and energy flow). A generalized coupling function *J* is defined to describe it, so at a certain time *t*, the average value of all possible connections and couplings in the system can be expressed as:

$$S_J = \bar{J} = \int \rho(x,t) J(x) dx = \int \rho(x,t) \left(\eta + \sum_i \gamma_i x_i + \sum_{ij} \gamma_{ij} x_i x_j + \sum_{ijk} \gamma_{ijk} x_i x_j x_k + \cdots \right) dx \quad (1)$$

$\rho(x,t)$ is the probability density, η is a constant, and γ is the interaction coefficient among the components. S_J is defined as generalized information flow (entropy), which represents a connection or coupling effect that determines the properties of a specific system. UEE will be restricted by some factors in the process of building information network, and the mode formation

process of UEE will be bound by some factors, which means that the components or nodes should satisfy certain conservation relations. In the case of insufficient information, it represents known conditions, and these constraints can be replaced by conservation relations among components. These constraints are generally expressed in the form of x_1, $x_{2,\ldots,}$ x_n (Xu et al., 2019):

$$\langle x_i \rangle = f_1, \langle x_i, x_j \rangle = f_2, \langle x_i, x_j, x_k \rangle = f_3, \langle x_i, x_j, x_k, x_l \rangle = f_4 \tag{2}$$

Where <> means to find the statistical average. Translating the potential function of UEE and diagonalizing the transformed constant term matrix:

$$\xi_k = \sum_{i=1}^{n} a_{ki} x_i \tag{3}$$

The equation can be further transformed into:

$$\overline{\Phi}(\lambda, \xi) = \xi + \sum_k \lambda_k \xi_k^2 + \cdots \tag{4}$$

ξ_k is the combination mode of UEE component x_i, which is all possible structural modes formed by the correlation of UEE components. The dynamic equation of UEE security structure evolution can be deduced as follows:

$$\dot{\xi}_k = \lambda_k \xi_k + S_k(\xi_1, \xi_2, \cdots, \xi_n) + F_k(t), k = 1,2, \cdots, n \tag{5}$$

λ_k represents the values corresponding to various possible security structure modes ξ_k of the system. When the constraints of the system are known, ξ_k is a constant. If a_{ki} is regarded as a matrix mathematically, λ_k can be regarded as the eigenvalue of this matrix. S_k is a nonlinear function and F_k is a random force function. When $\lambda_k > 0$, corresponding to UEE is active, the mode is healthy. When $\lambda_k < 0$, it means UEE is damped and will eventually be eliminated. Socio-economic factors mainly reflect the agglomeration effect brought by the developed areas of human beings, and the location close to the developed areas is the preferred choice for the layout of construction land. These three factors each derive a series of detailed factor indicators, from the internal relations among the development restrictions, development bases and development advantages of construction land, which constitute a progressive evaluation system of suitability of construction land. The multi-factor comprehensive evaluation model of regional construction land suitability is calculated as follows. Assume that m factors are selected in the evaluation, each factor contains n indicators, and the evaluation value of a factor in the evaluation unit is equal to the cumulative sum of the scores of each indicator,

namely:

$$P_i = \sum_{j=1}^{n} F_{ij} W_j \tag{6}$$

Type, P_i is the score value of factor i; F_{ij} is the score of j factor in i factor; W_j is the weight value of j factor. P is the total evaluation score of a land evaluation unit, W_i is the weight value of i factor, and the total evaluation score of this unit is:

$$P = \sum_{i=1}^{m} F_i W_i \tag{7}$$

Ecosystem is a system that emerges under the law of information conservation, constantly adjusts and develops itself, and stably exists under specific environment and space-time conditions. There is no health phenomenon in itself, but only when the ecosystem is in good condition can it provide ecological services for human beings. Therefore, UEE standard is a standard that focuses on human beings and better serves human beings. He thinks that the ecosystem that is not interfered by human beings is healthy. E evaluation index system is shown in Figure 2.

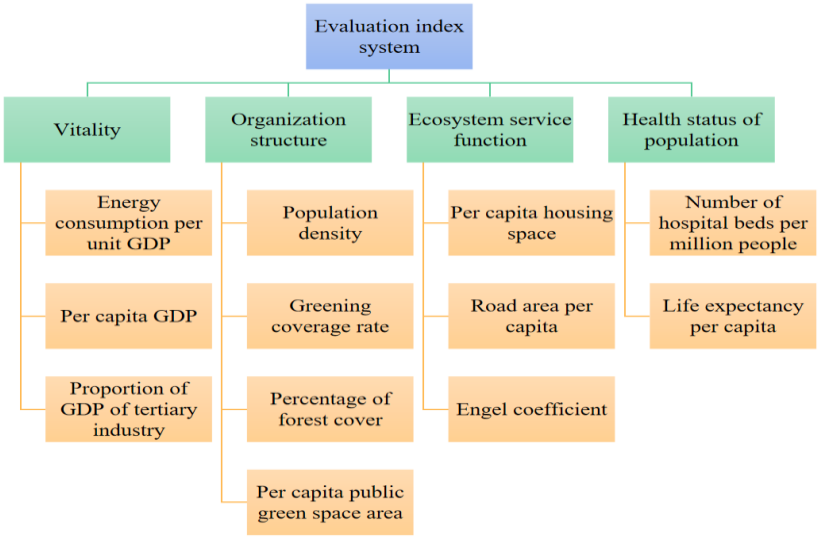

Figure 2: UEE evaluation Index System

The research shows that there is a significant correlation between land use change and economic growth, industrial upgrading, urbanization development, consumption structure change and population growth, and socio-economic development is the main driving factor of land use change. The influence of socio-economic environment on land use mainly comes from human activities. Population density, proportion of built-up areas and accessibility of roads respectively reflect the level of regional socio-economic

activities from the perspectives of population, development density and traffic convenience.

3.3. Results Analysis and Discussion

3.3.1. Analysis of the Influence of UEE on the Development of Outdoor Sports

At present, outdoor sports and leisure products in the tourism industry are still scarce, which makes the demand of outdoor sports and leisure guests unsatisfied. Therefore, it is imperative to broaden the width of tourism industry and adjust tourism products. The consumption pattern of outdoor sports and leisure has changed to fashion and individuality. Various fashionable and unique outdoor sports and leisure activities are gradually coming into people's vision, and are increasingly becoming a part of the holiday life of residents who prefer outdoor sports and leisure. Outdoor sports are activities directly related to outdoor environmental resources, and natural conditions such as mountains, valleys and rivers are the preconditions for developing outdoor sports. Therefore, outdoor environmental resources have become the potential demand of outdoor sports participants in a certain sense. With the increasing number and frequency of trips, more and more professional tools will be needed, and the sales of outdoor products will be greatly increased accordingly. The consumption of outdoor sports includes the consumption of outdoor products and participation in outdoor sports, and the outdoor industry will be gradually standardized when it develops to a certain stage, forming a benign and healthy market environment and promoting the sales of outdoor products. These consumptions will eventually promote the development of urban outdoor sports. In this paper, seven public places in city A are taken as the research objects, UEE level is tested, and the influence of people who carry out outdoor sports activities in various places is studied by using the article method. The air quality of city A in 2019 was counted by the article method, and the results are shown in Figure 3.

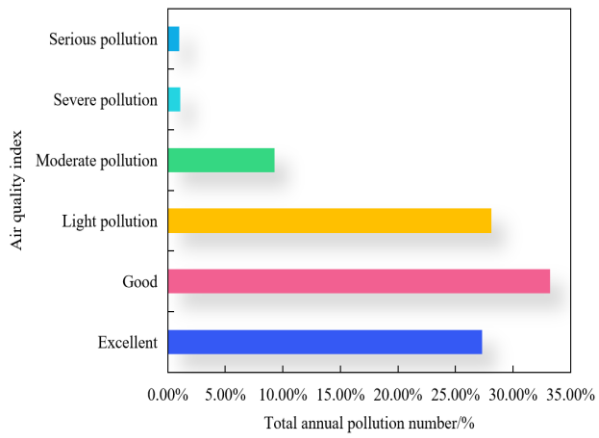

Figure 3: Air Quality Status of City A in 2019

It can be seen that UEE has a great influence on the development of outdoor sports, and a good air quality index is conducive to the development of outdoor sports. The level of vegetation greening in public places such as parks has improved, the environment has been improved, and more and more citizens are actively participating in outdoor sports. Therefore, it can be seen that the level of UEE greening will also affect the development of outdoor sports, and good UEE can attract more people to participate in outdoor sports. As a part of UEE, noise also has a great impact on UEE. See Figure 4 for the average traffic noise in 2019.

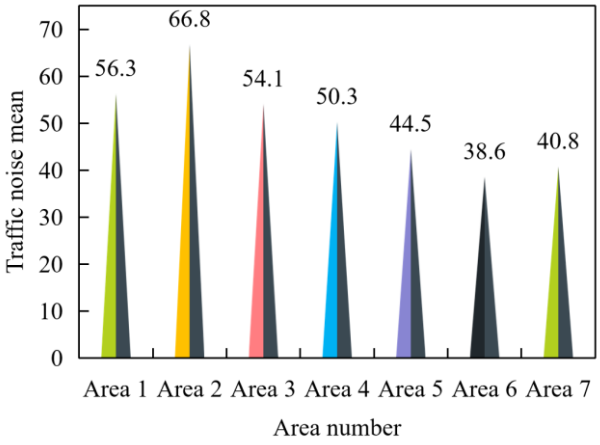

Figure 4: Traffic Noise Mean

According to the noise evaluation standard, all of them are Grade I, at a good level, which shows that the seven places studied in this paper have good ecological environment and are suitable for outdoor sports. On the whole, the number of people whose physical and mental health has been improved in outdoor sports in the ecological environment of city A is higher than that in other situations. According to the statistics of the article methods, the research objects generally indicated that outdoor sports generally improved physical and mental health in the ecological environment of city A, and they were satisfied with the ecological environment of city A. It shows that UEE has an important influence on the development of outdoor sports. The development of outdoor sports market can also rely on the organization of large-scale events and events. As the organizer, the existing full-time and part-time coaches of outdoor clubs mainly come from amateurs, but there are still some problems such as lack of professionalism and quantity. This situation will inevitably directly affect the safety and sustainable development of outdoor sports. Outdoor clubs should also deeply understand the needs of members and provide targeted services, including providing members with essential knowledge of outdoor sports and basic self-help and mutual-help knowledge; Carry out some popular sports activities to enhance physical fitness; Develop new outdoor sports, etc. to meet the increasing needs of outdoor sports enthusiasts.

3.4. UEE Evaluation Analysis

UEE problem, especially the ecological environment problem with water as the core, has become the number one problem of urban ecological security in China. Taking water environment as an example, although urban development objectively brings pressure to water resources and water environment, the deterioration of urban water environment to a great extent stems from the lack of systematic and comprehensive understanding and solutions of this problem in society, one-sided and single-objective decomposition of water system, discussion of water problems in terms of water problems, separation of water from land, life and human processes, one-sided reliance on process technology to solve problems mechanically and singly, and as a result, the water system of life and its ecology. UEE and its evaluation is a field of development and "evolution". Academic circles have not reached consensus on its concept, evaluation theory and method, and many problems need to be further studied and solved, especially for UEE, a specific type of health research. Therefore, there is still much room for research and development of UEE, and many levels of research are still blank, and the corresponding theories, methods and technical means need to be further improved. By integrating UEE into an emergy system, all kinds of ecological flows such as material, energy and capital in the process of urban metabolism can be uniformly accounted and simulated by emergy analysis, and the characteristics of UEE in terms of energy level, environmental capacity, eco-economic efficiency and other aspects can be discussed, thus reflecting the status of UEE. At the relatively micro level, the ecological system is described from the perspective of material energy metabolism, and the implicit internal driving mechanism of UEE is paid attention to. Figure 5 shows the subsystem security of city C from 2010 to 2020.

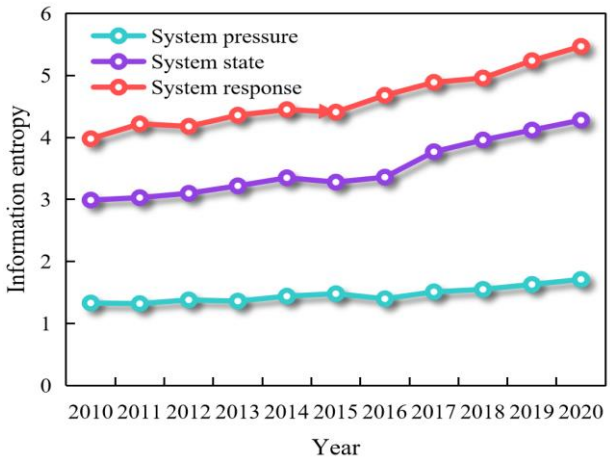

Figure 5: Trend of Subsystem Security State Change

The above situation shows that the pressure system is the main constraint subsystem to improve the ecological security level of city C, mainly

due to the rapid population growth, low per capita GDP and low energy utilization rate. Response system is the main supporting subsystem of ecosystem security in city C. With the increase of investment in scientific research and environmental protection and the improvement of ecological environment quality, the system security has been restored to some extent. Integrating the concept of urban life and emergy analysis method, relying on the framework of urban vitality index, including emergy density, emergy-money ratio, electricity emergy ratio, input-output emergy ratio, per capita emergy, per capita fuel emergy, emergy self-sufficiency rate, emergy use intensity, population carrying density of renewable resources, waste-renewable emergy ratio, environmental load rate and other emergy indexes, and common UEE evaluation indexes. Build the city emergy-vitality index together to comprehensively reflect UEE status.

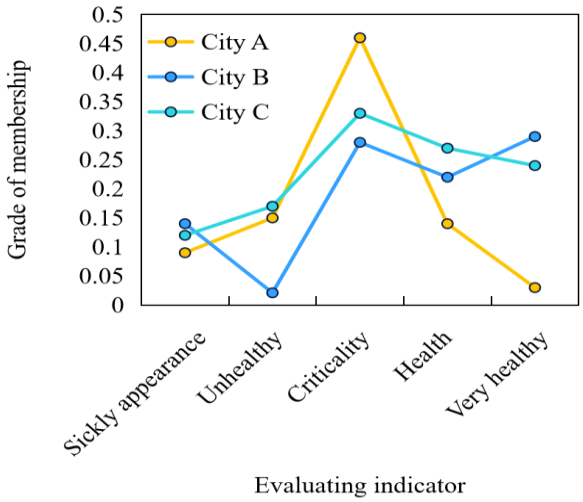

Figure 6: Compares UEE Conditions in Three Major Cities.

On the whole, the status of urban A UEE is inferior to that of city b and city c, and the sum of its membership degree to healthy and very healthy levels is only 0.23, which shows that the ecosystem of city a has a good development potential. As long as effective ecosystem management measures are taken and the limiting factors affecting UEE are changed, UEE can develop in a healthy and orderly direction. Although the development of the city promotes the development of urban sports, it also imposes many unfavorable factors on sports. Urban sports have a great dynamic effect on cities, and many cities are using the function of urban sports to serve cities. However, the blind development of urban sports also has a negative impact on the development of cities. Modern urban construction should fully consider citizens' demand for sports. At the same time of increasing sports construction, in line with the principle that sports serve the public and cities, to achieve a benign interaction between the city and sports. From Figure 7 and Figure 9, learn more about the specific situation of each UEE, especially the contribution of each evaluation

index to UEE and the structure of UEE mode. Where x represents the index in Figure 2 above.

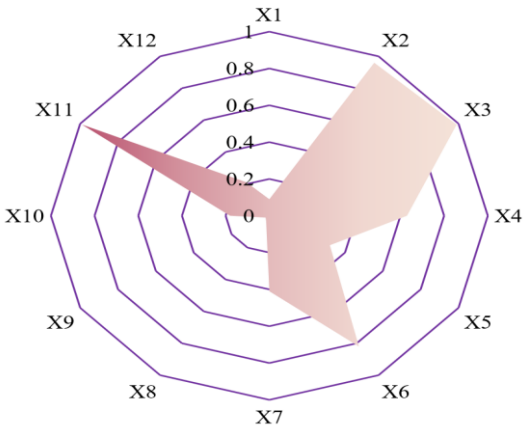

Figure 7: 2010-2020 City A UEE

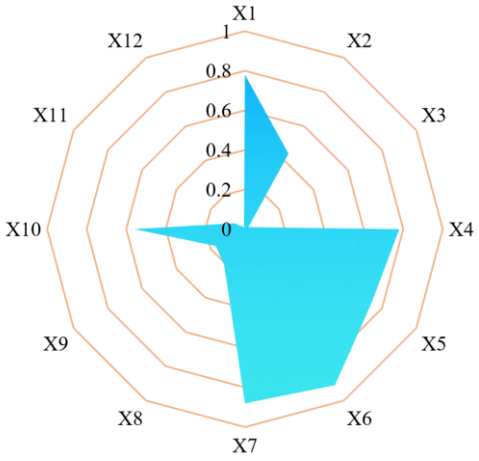

Figure 8: 2010-2020 City B UEE

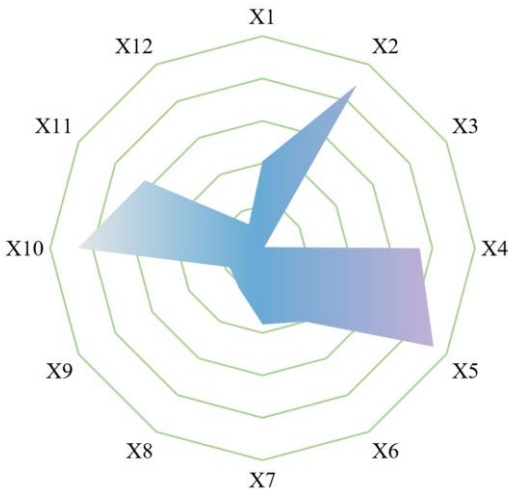

Figure 9: 2010-2020 City C UEE

The larger the spread area of radar map structure, the greater the

interaction between evaluation indexes and the contribution of evaluation indexes to the formation of UEE model. It can be seen from the figure that the spatial spread area of UEE mode in three cities increases year by year with the change of time. The biggest feature of UEE is that it not only emphasizes the rational structure, high efficiency and integrity of the ecosystem from the ecological point of view, but also emphasizes that the ecosystem can maintain the service function for human beings, and human health and social and economic health are not damaged. Ecosystem changes can affect human health in many ways, and human health itself can be a reflection of UEE. For UEE, where people are the main body, human health is more worthy of attention. The overall health of urban population can be reflected from two aspects: physical health and cultural level. Recognizing the benign interaction between ecological environment and outdoor sports is an important guarantee for the sustainable development of outdoor sports. Only by fully grasping the relationship between them can truly integrate ecological civilization into the development of outdoor sports. Combined with the characteristics of China's ecological environment in the new period and the development of outdoor sports at present, it is recognized that no matter whether it is mass outdoor sports, school outdoor sports or outdoor sports industry, the concept of environmental protection has been integrated in the process of continuous improvement and development, which has contributed to the sustainable development of outdoor sports. Those who intentionally destroy the ecological environment, maliciously hurt or buy or sell wild animals should be actively stopped and reported to relevant environmental protection departments. If you find that others have destroyed the natural environment, do your best to remedy it if conditions permit, and finally inform the relevant departments to solve it.

4. Conclusion

The influence of outdoor sports on people is obvious. When people go outdoors, they face the simple scenery of nature and various magical creations, and the impact on vision is very strong. With the continuous improvement of material living standards, people not only pay attention to economic development, but also get more and more attention to UEE. Under the influence of air quality index, vegetation coverage index, traffic noise means and other factors in UEE, the development of outdoor sports is affected to varying degrees. MIEP model of UEE security evaluation reveals the evolution process of urban ecosystem security structure under the interaction of components, and the action weights are obtained independently by stimulating neurons, which ensures the accuracy and objectivity of the evaluation results to a certain extent, and overcomes the subjectivity of UEE evaluation index selection and index weight determination to a certain extent, which is conducive to objective evaluation of UEE status. Insufficient data limits the application of MIEP model in UEE evaluation. How to get as much information as possible about urban ecosystem is the key to construct its integrity.

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