International Journal of Web-Based Learning and Teaching Technologies
Volume 19 • Issue 1

Universities Participate in the Study of Environmental Protection Ideology in Ecologically Fragile Areas

Xiaoxia Ye, Chongqing Vocational Institute of Engineering, China*
Jinguo Zhang, Chongqing Normal University, China
Mark Shelbourn, The University of Salford, UK

ABSTRACT

After nearly 30 years after the reform and opening up the rapid development of economy, China also had a "industrial pollution" and "poverty", mainly because of the low level of productivity, population pressure overload caused by environmental degradation, and between population pressure and environmental degradation A vicious cycle, is essentially a syndrome caused by poverty. We've been paying a lot of attention to the former for a long time At present, the environmental awareness education in colleges and universities has made great progress compared with the past. College students basically have certain environmental knowledge and awareness, and have high enthusiasm for environmental protection and environmental protection cause, and pay great attention to it. However, when problems arise or involve their own interests, their environmental awareness and behavior lag significantly. In this paper, system dynamics, neural network model and computer simulation are used to study environmental protection in ecologically fragile areas.

KEYWORDS

Ecological Fragility, Environmental Protection Idea, Higher Education, Structural Evolution

INTRODUCTION

The ecological environment is the material basis for the survival of the human social and economic systems and an important guarantee for achieving sustainable development. However, since the industrial revolution, the human society and economy have developed rapidly and material wealth has been greatly satisfied. At the same time, the consumption of natural resources has also increased significantly (Adjei et al., 2021). The increasing reduction and even depletion of non-renewable resources, the excessive use of renewable resources, and the discharge of a large number of toxic and harmful pollutants have led to the deterioration of the ecological environment in many regions, which has triggered a series of ecological and environmental problems (Boca & Saraçlı, 2019), including

DOI: 10.4018/IJWLTT.337968 *Corresponding Author

water and soil loss, expansion of desertification area, grassland degradation, forest area reduction, biodiversity reduction, etc. In the face of the deteriorating ecological environment, which has seriously affected the survival and development of human beings, governments and environmentalists of all countries are increasingly calling for the protection and construction of a beautiful and harmonious ecological environment (аронбаевет et al., 2021).

The western region of China is one of the first regions of human activity. With the continuous migration and natural growth of population since history, the population has increased rapidly, while the excessive growth of population under the trend of excessive reclamation activities, induced the ecological changes in the west, the destruction of ecological environment by agricultural (animal husbandry) activities is increasingly aggravated (Kerr, 2021). The cause of formation of ecological fragile areas in the west should be classified into natural factors and human factors. The poor ecological environment is very prominent in the western region of China. The local natural conditions are poor, the living conditions are difficult, and the infrastructure is weak, resulting in the low living standard of the people. Seventy percent of the poor in China are mainly concentrated here (Chakraborty et al., 2021). For the sake of human survival and development, coupled with some policy guidance mistakes in recent years, the excessive development and utilization of natural resources have led to the increasingly fragile ecological environment of the original evil line in the west.

China's ecological environment is quite fragile, and the fragile ecological environment area accounts for more than 60% of the land area, which seriously hinders the process of realizing sustainable development in China (Elias Roberts, 2020). The huge environmental and health costs of rapid economic growth have become a real and serious problem that the Chinese government is increasingly concerned about (Hekmatpour & Leslie, 2022). College students are a group of contemporary high-level and high-quality young citizens, who shoulder the task of future development and the historical mission of national rejuvenation. Their mastery of environmental protection awareness, environmental protection knowledge and skills, and the ability to solve environmental problems will have a significant impact on the long-term development of the nation (Alonso Fernández, & Regueiro Ferreira, 2022). At the same time, at present, there are still some deficiencies in the education of environmental awareness in colleges and universities (Shafiei et al., 2020). Therefore, the authors have chosen this topic to cultivate the contemporary college students' high sense of responsibility for the future living environment through the research on the education of college students' environmental awareness.

Oasis is the basis for human survival in arid areas, and also the carrier of economic development in arid areas (Mammies et al., 2021). Western China is a typical outflow basin oasis irrigation area, with a dry climate, sparse precipitation, temperate continental arid climate, and excessive impact of human activities on the ecological environment, which makes the ecological environment face problems, such as soil salinization, desertification, and grassland degradation (Kumar et al., 2020). The study of ecological and environmental problems in this region has become an urgent scientific problem to be solved. The research on ecological environmental vulnerability in China is mainly concentrated in the dry early inland oasis area of northwest China, Sichuan, Loess Plateau and the vast eastern region, and little research has been done on Urat Qianqi. In this paper, we use artificial neural network method to evaluate the ecological environment vulnerability of the region. The ultimate goal is to prevent the deterioration of the ecological environment in Urat Qianqi and to restore and reconstruct the degraded ecological environment in order to achieve the benign development and sustainable use of resources and environment. Using the traditional integrated research method of geography, based on previous research results, combined with field surveys, qualitative methods, and quantitative methods. The innovation of this paper is to discuss the ecological environment protection consciousness itself, and focus on sorting out the reasons for the lack of cultivation, which has some effect on solving the problems of the current college students' ecological environment protection consciousness.

RELATED WORKS

Research on Ecologically Fragile Areas

The term "vulnerability" first appeared in France in the 1960s. The ecological environment vulnerability is the sensitive response and self-recovery ability of the ecosystem relative to the external disturbance at a specific time and space scale and is the result of the joint action of natural attributes and human economic behavior (Nyumba et al., 2021). It contains three meanings: (1) Vulnerability is the attribute of the ecological environment itself under specific regional conditions, and the existence of this attribute is regional and objective. (2) Vulnerability can only be shown under the drive of "external interference," including the impact of human activities and the role of natural forces. (3) The degree of vulnerability is quantitatively evaluated by indicators such as sensitivity and stability (Nandy& Mandal, 2020).

Many foreign countries have carried out evaluation and research on the impact of climate change on the vulnerability of various industries at the national scale. Among them, Canada, Bangladesh, Tanzania, and other countries have carried out the vulnerability assessment of climate change on agriculture, forestry, water resources, ecological environment, and human health at the national level and made corresponding predictions based on the future economic and population development scenarios. These studies continue with the improvement of cognition level and research methods.

When the degradation of the ecological environment exceeds the level that can maintain the current human utilization and development for a long time under the existing social, economic, and technological level, it is called fragile ecological environment (Magliulo et al., 2021). It refers to environmental degradation, landscape degradation, land productivity decline, and land resource loss caused by the combination of natural and human activities (Mauro et al., 2020). According to geomorphic conditions, climatic factors, and other major reasons, China can be divided into seven types of ecological vulnerability (Chakraborty et al., 2021). Except for the North China Plain and the hilly areas in the south, these areas are concentrated in the west of China. Therefore, unless specifically mentioned, the western ecological vulnerability is generally regarded as the representative of China's ecological vulnerability. The administrative regions mainly include 12 provinces (regions and cities), including Shaanxi, Gansu, Inner Mongolia, Xinjiang, Qinghai, Ningxia, Guangxi, Yunnan, Guizhou, Sichuan, Tibet, and Chongqing (Dumak et al., 2020). This area is also the place where Chinese minorities live. Therefore, this paper uses the concept of "ecologically vulnerable area" as "the western region" and "the western ethnic region," although there are differences between the two and they are not completely equal (Aung et al., 2021).

Research on Environmental Awareness Education

As a kind of behavior, environmental protection is restricted by its thought, morality, and values. The development of its behavior depends largely on the strength of people's environmental awareness (Rogayan et al., 2019). At present, the education of ecological environmental protection awareness in universities mainly focuses on persuasion education. It has played a certain role in improving the campus environment and improving the basic quality of college students, but the effect is not obvious (Aung et al., 2021). Moreover, this kind of education has obvious disadvantages. It lacks the support of theory and practice, which is not conducive to college students' understanding of the profound connotation of ecological environment protection and realizing the all-round development of personal quality (Zeng et al., 2020).

Chinese scholars have analyzed the necessity, suggestions, contents, and other relevant research on the cultivation of college students' awareness of ecological environment protection from different directions.

Research on the necessity of cultivating college students' awareness of ecological environment protection: Li Tianyu believes that efforts must be made to improve the overall environmental awareness of the people. As the backing of cultivating college students' awareness of ecological

environment protection, colleges and universities need to take some effective measures to improve the level of ecological awareness of their students and inject strong force into the construction of national ecological civilization.

Research on the cultivation of college students' awareness of ecological environment protection: Rao Xupeng stresses that the cultivation of ecological civilization awareness must be integrated into the teaching process of ideological and political theory courses and advocates that we should adhere to a green and low-carbon lifestyle.

Research on measures to cultivate college students' awareness of ecological environment protection: Liu Zhenqing points out that the specific ways to strengthen education include, first of all, improving the awareness of ecological civilization, strengthening the concept of ecological civilization and the rule of law, integrating ecological civilization education resources into universities, and constructing a trinity mechanism of school, family, and society. Ecological civilization education involves many factors, needs a gradual process, and needs scientific planning and systematic arrangement.

Research methods in ecologically fragile areas: The development system of ecologically fragile areas is a complex and huge system, which has a large scale and a complex structure (Chi, 2021). The internal factors of the system interact, influence, and penetrate each other, showing a complex movement law (Xu et al., 2020). The vulnerability of the ecological environment shows different characteristics in different regions. Many scholars have used quantitative or semi-quantitative methods to evaluate the vulnerability of ecological environment from different aspects, mainly including principal component analysis, analytic hierarchy process, fuzzy comprehensive evaluation, layer overlay method, etc. (Liu et al., 2021). Due to the complexity of the formation of ecological environment vulnerability, it is difficult to accurately judge its vulnerability due to the artificial setting of weights when using these methods for assessment (Zhang et al., 2020).

At present, artificial neural network (ANN) has been widely used in geosciences because of its uniqueness in solving nonlinear problems. Some scholars used BP artificial neural network method to evaluate the ecological vulnerability of the upper reaches of the Minjiang River and concluded that the ecological vulnerability of the upper reaches of the Minjiang River is Grade III, belonging to a highly vulnerable area. Some scholars used the BP artificial neural network method to evaluate the ecological environment vulnerability of Dengkou County, Inner Mongolia, and concluded that the ecological environment vulnerability of Dengkou County, Inner Mongolia is Grade II, belonging to moderate vulnerability (Pu et al., 2021).

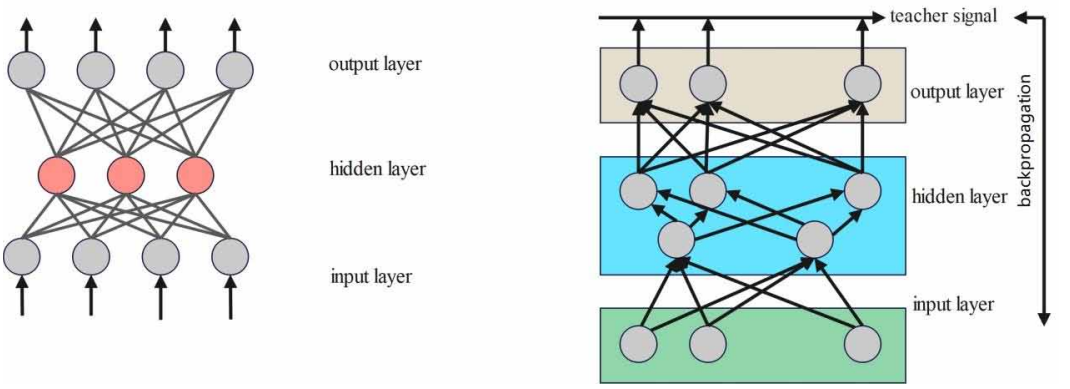
In order to accurately and objectively evaluate the vulnerability of the ecological environment in a certain area, a certain theory is needed as the evaluation basis. On the basis of comprehensive consideration of natural and social factors in the study area, system dynamics, artificial neural network theory, and sustainable development theory are adopted as the basic theories of this paper.

METHODS

BP network is a neural network with three or more layers of neurons. It consists of an input layer, hidden layer, and output layer. The input layer is used to receive external information. The output layer judges and makes decisions on the input layer information. The hidden layer, in the middle, is used to represent and store information. There is no interconnection between neurons at the same layer of the network. The neurons of each layer are fully connected, the degree of connection is expressed by weight, and its value is continuously adjusted through learning. Its structure is shown in Figure 1, which mainly includes the following features:

A multi-layer ANN network structure is usually composed of an input layer, several hidden layers (but usually one hidden layer is sufficient), and an output layer.

Figure 1. Schematic diagram of the structure and working principle of BP network model



The information of neurons is transmitted to each other through the transfer function, and the transfer function generally selects the Sigmoid function whose value is between [0,1]. It takes the form:

$$f(x) = \frac{1}{1+e^{-x}} \tag{1}$$

The learning process of BP network is controlled by the error performance function. The calculation formula for the p-th sample error is:

$$E_p = \frac{\sum_i \left(t_{pt} - O_{pt}\right)^2}{2} \tag{2}$$

where, t and O are the expected output and network output respectively.

The guiding idea of BP network learning formula derivation is to correct the network weight (w, T) and threshold (P), it is:

$$y_i = f\left(\sum w_{ij} x_j - \theta_i\right) = f\left(net_i\right) \tag{3}$$

Among them:

$$net_i = \sum_i T_{li} y_i - \theta_l \tag{4}$$

$$O_l = f\left(\sum_i T_{li} y_i - \theta_l\right) = f\left(net_l\right) \tag{5}$$

Among them:

$$net_l = \sum_i T_{li} y_i - \theta_l \tag{6}$$

$$E = \frac{1}{2}\sum_l \left(t_l - O_l\right)^2 = \frac{1}{2}\sum_l \left(t_l - f\left(\sum_i T_{li} y_i - \theta_l\right)\right)^2 \tag{7}$$

After repeated learning and training in the above process, the BP network revises the weight and threshold of the network according to the error between the network input and the actual value. If the network finally converges, its output can be infinitely close to the ideal output, the weight and threshold of the network will not change, and the learning and training of the network is completed. If the network cannot converge, it means that the structure design of the network is not reasonable or the training parameters are improperly set. When the network learning is completed, the learning results are stored in the structure of the network, as well as completing the construction of the sustainable development system model, and then the historical data of the system is used to learn and train the network. The ANN object model network is provided in the ANN Toolkit, and we can build the ANN model by setting its properties.

According to the relationship between input and output values, the BP artificial neural network model will adaptively adjust the relationship between input and output, namely the weight value, during the learning process. It avoids the error caused by human factors determining the weight value. BP network selects the corresponding evaluation parameters according to different needs to establish the evaluation model, which has strong adaptability. When evaluating the ecological environment vulnerability, we only need to train the standards at all levels of the ecological environment vulnerability assessment as samples. Once the training is completed, we can use the trained weights and thresholds to evaluate the new samples.

Construction of Training Samples Based on B-Spline Interpolation

The construction of ANN model requires a large number of learning and training samples. The larger the number of samples, the more accurate the ANN model will be and the stronger the generalization ability will be. In the actual research, the data obtained by the survey or experiment is always limited, because of the limitation of data, so the thought of using interpolation method to construct learning samples was considered. The reason why this is possible is because for ANN model, it has a strong learning and robustness, it does not require accurate learning samples, it has a strong error correction and recognition ability to learn samples, as long as the interpolation sample can generally reflect the law and development trend of the actual sample.

B-spline curve is the most commonly used spline curve in engineering. It can give a very smooth interpolation curve, and it is widely used in numerical approximation, ordinary differential equation solving, and engineering calculation. The definition of a curve of group B is: given n+1 control points Pi I = 0,1,2..., n is called the vertex of the characteristic polygon, then the parametric curve segment of degree n is called the B-spline curve segment:

$$P(t) = \sum_{i=0}^{n} P_l F_{l,n}(t) \tag{8}$$

Generally speaking, the K-order B-spline curve generated by N +1 control points in space is formed by the B-spline curve of the working section, and the shape of each curve segment is controlled by k points arranged in order in the point column. The uniform B-sample function composed of different node vectors depicts the same shape, which can be regarded as a simple translation of the

same B-spline function. The derivative of B-spline curve can be obtained by the linear combination of the difference quotient of the lower order B-spline basis function and the vertex vector, which is also the reason for the k-order B-spline curve segments to achieve the continuity of degree K 1 or 2. In order to improve the accuracy of interpolation, this paper uses cubic B-spline curve to interpolate the historical data. The interpolation principle of cubic B-spline curve is briefly described as follows: In Equation (9), when n=3:

$$F_{0,3}(t) = \frac{1}{6}\left(-t^3 + 3t^2 - 3t + 1\right) \tag{9}$$

If the B-characteristic polygon adds a vertex P4, P0, P1, P2, and P4 determine guiding quantity, and the position of the beginning point of the next curve segment, the first-order and second-order guiding quantity are only related to P0, P1 and P2, and are respectively equal, which indicates that the cubic B-spline curve is second-order continuous. In this paper, the cubic B-spline function is used to interpolate in the discrete data points, and these discrete points are transformed into a smooth interpolation curve. The sufficient interpolation points on this curve and the actual nodes are used as the training samples for ANN model construction.

Grey Relational Degree Analysis of Causal Bond Strength

The analysis steps for sample data of each factor are as follows:

On the basis of qualitative analysis of the output value growth rate of the secondary industry, a dependent variable and multiple independent variable factors are determined to form a matrix composed of:

$$\text{N +1 data: } Z = \left(X_0, X_1, \ldots, X_n\right) \tag{10}$$

Non-dimensionalization of variable series is standardized. The standardization method adopted in this paper is as follows:

$$P = \frac{p - p\min}{p\max - p\min} \tag{11}$$

Calculate the correlation coefficient and record the parent number column {x[0](r) after data transformation); Child count as {X [V] (t)), in the Nt = K, mother sequence {Z [0] (f)) and subsequence {X [f] (f)), the relationship between the coefficient of L (Oi) (K), use the type calculation:

$$L[0i](K) = \frac{\Delta[\min] + \rho\Delta[\max]}{\Delta[oi](K) + \rho\Delta[\max]} \tag{12}$$

L([Oi]k) Is the absolute difference of two comparison sequences at time K, namely:

$$\Delta[oi](K) = \mid X[0](K) - X[i](K) \mid \tag{13}$$

$\triangle$[min], $\triangle$[max] are respectively the minimum and maximum of the absolute difference at each moment of all comparison sequences. P is the resolution coefficient, which is 0.45 in this paper.

Calculate two groups of comparative series at a certain moment, as in△[min], LOi=1,△[max], then value. Therefore, the range of correlation coefficients 0<L<1. It is using the following equation:

$$R_{Oi} = \frac{1}{N}\sum_{K=1}^{N} L_{Oi}(K) \tag{14}$$

$$P = \frac{2(p - p\min)}{p\max - p\min} - 1 \tag{15}$$

STUDY AREA OVERVIEW

Located in the central part of Inner Mongolia Autonomous Region, China, is the Bayannur City under the jurisdiction of the flag. It has an area of 7476 square kilometers, and a population of 340,000 people. Wuqian Banner is located in the eastern end of the Loop Plain, under Bayannur City, east of Baotou City, west of Wuyuan, south of Ordos City Hangjin Banner, Dalat Banner across the river, and north of Ulat Central Banner border. The geographical location is between 108°11′~109°54′E and 40°28′~41°16′N, including 4,900 square kilometers in the dry mountain area and 2,500 square kilometers in the yellow irrigation area.

The landscape is "three mountains, two rivers, and a sea, a thousand miles of plains and two beaches." Wula Mountain, Chashi Tai Mountain, Baiyin Chahan Mountain, an area of 2303 square kilometers, accounts for about 30.8%. Mingan River and Xiaoshetai River, with an area of 889 square kilometers, accounts for 11.3%. Wulangsu Sea, with a water area of 440,000 mu, is one of the eight largest freshwater lakes in China. The plain within the set, the Clover Hey Beach and the Middle Beach, with an area of 1,811 square kilometers, accounts for 24.2%.

EXPERIMENTAL RESULTS AND ANALYSIS

Based on the 50-year "Statistical Yearbook of a City in Inner Mongolia," this paper selects 20 indicators and relevant statistical data that affect its ecological environment vulnerability as the data source to establish the basic information database of ecological environment vulnerability. This paper takes a city in Inner Mongolia as the research area and the ecological environment as the evaluation target. In this paper, taking Urat Qianqi of Inner Mongolia Autonomous Region as a case study and selecting its indicators. These indicators are composed of main cause indicators and result performance indicators. The main cause indicators include rainfall, evaporation coefficient, proportion of sand dune area, forest coverage, and proportion of water and sea area. The results performance indicators include the per capita GDP, the per capita net income of farmers and herdsmen, the per capita total power of agricultural mechanization, the ratio of the output value of grain per unit area, the secondary industry to GDP, and the ratio of the number of primary and secondary school students to the total population.

This paper uses the value range of various indicators in China and Inner Mongolia Autonomous Region and previous studies to form the following standards. Level I represents mild vulnerability. Level II represents moderate vulnerability. Level III represents severe vulnerability. The higher the level, the greater the degree of vulnerability. According to the value range of the evaluation standard, the corresponding value is selected for the ecological environment vulnerability level. Level I represents mild vulnerability. Level III represents severe vulnerability, and the upper and lower limit values are adopted. Level II represents moderate vulnerability, and takes random values within the value range to obtain a group of data as the network input for the ecological environment vulnerability assessment in the study area. Since the evaluation criteria are of three levels, the desired output of

BP network is also selected as the target output of BP network through learning. Before using BP artificial neural network to evaluate the vulnerability of ecological environment, the data should firstly be normalized. The direct calculation of the brother index of evaluating the vulnerability of ecological environment will affect the accuracy of the results, so the data should be normalized before calculation. Firstly, MATLAB correlation function is used to pre-process the data so that they have zero mean and uniform standard deviation, and the new data obtained are used for calculation. The normalized data are distributed in the interval [-1, +1].

$$p_n = \frac{p - p_{min}}{p_{max} - p_{min}} \tag{16}$$

Using net=newff(p,t,[23,3],{'tansig','logsig'},'traingdx'). newffis the function to build BP neural network, p, t denotes the network output and output value after preprocessing the sample data, [23, 3] denotes the number of nodes in the hidden layer is 23, the number of nodes in the output layer is 3, 'tansig','logsig ' indicates that the activation function 'tansig' is used for the neurons in the hidden layer and 'logsig' is used for the output layer, 'traingdx ' denotes the selected learning function.

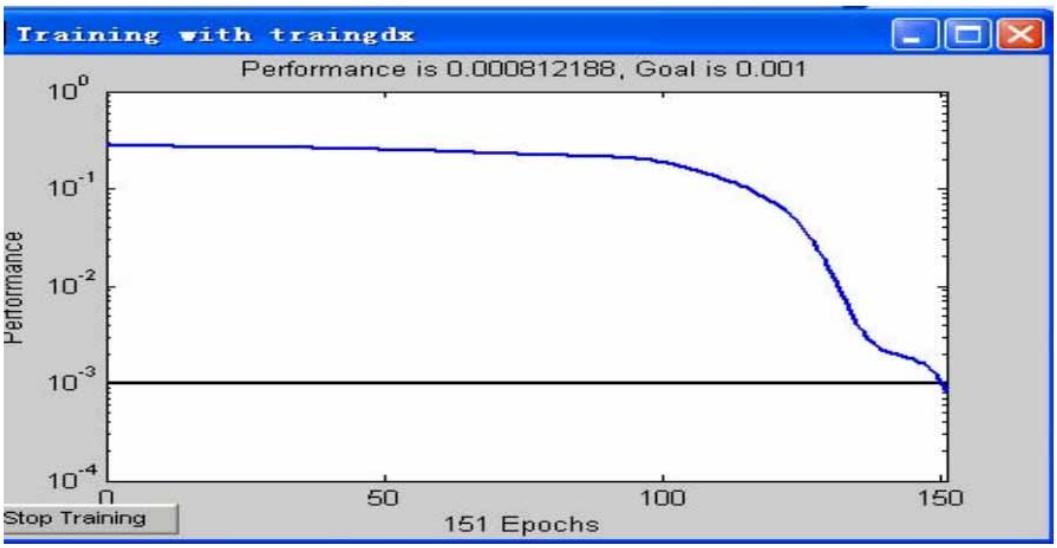
After 151 training, the network performance meets the requirements, as shown in Figure 2. The main reason for the fast convergence rate is that the set value of learning rate is large.

Next, test the trained network. Take three evaluation grade indicators as the test input data of the network to evaluate the feasibility of the network. The normalized eco-environmental vulnerability evaluation index p is used as the input value of the simulation network to obtain the output value of the network simulation:

The target output of class I is 1, and the actual network output is 1.267. The target output of fragile class II is 1, and the actual network output is 1.0695. The target output of fragile class III is 1, and the actual network output is 0.7173.

The simulation output of the actual value of the ecological vulnerability evaluation index is 0.3485 for level I, 0.6184 for level II, and 0.1444 for level III, of which 0.6184 is the largest and closest to

Figure 2. The training result of network's simulation about eco-environment fragility in the study area



the target output 1. Therefore, the ecological vulnerability level of Utra Banner that is previously mentioned is level II, which is moderately vulnerable.

To further verify its correctness. According to the output value of the network simulation, the corresponding neuron error analysis is carried out for the results.

It can be seen from the error surface and contour map in Figure 3 that the total variance of network training is very small when it is at level II. From the error surface and contour map, we can see that the total variance of network training is very small, close to zero. Therefore, it further shows that the ecological environment in the study area is moderately fragile.

From the simulation results of the model, it can be seen that the trained BP artificial neural network model has a high fitting degree and meets the preliminary set evaluation requirements through the test of three evaluation grade indexes of grade I, II and III.

Constraints on Carrying Capacity of Ecologically Fragile Areas in Western China

Environmental carrying capacity, as the basis for judging the coordination between human social and economic activities and the environment, has different characteristics in different regions, and there are obvious differences in resource carrying capacity between different regions in China. The scholars selected land resources and water resources as the carrying index of natural resources, and GDP as the carrying index of economic resources, with the whole country as the reference area, compared the regional differences of the east, middle, and west of China in 2003, as shown in Figure 4 below.

In the increase of population quantity, population quality, and people's living standards, the progress of various social undertakings has occurred at the same time, and the impact on resources and the environment is seen in the strengthening and increasing of living water, life sewage, and life rubbish emissions every year. The growth is on the rise, and the present order from big to small is:

Figure 3. The error surface and contour of BP network

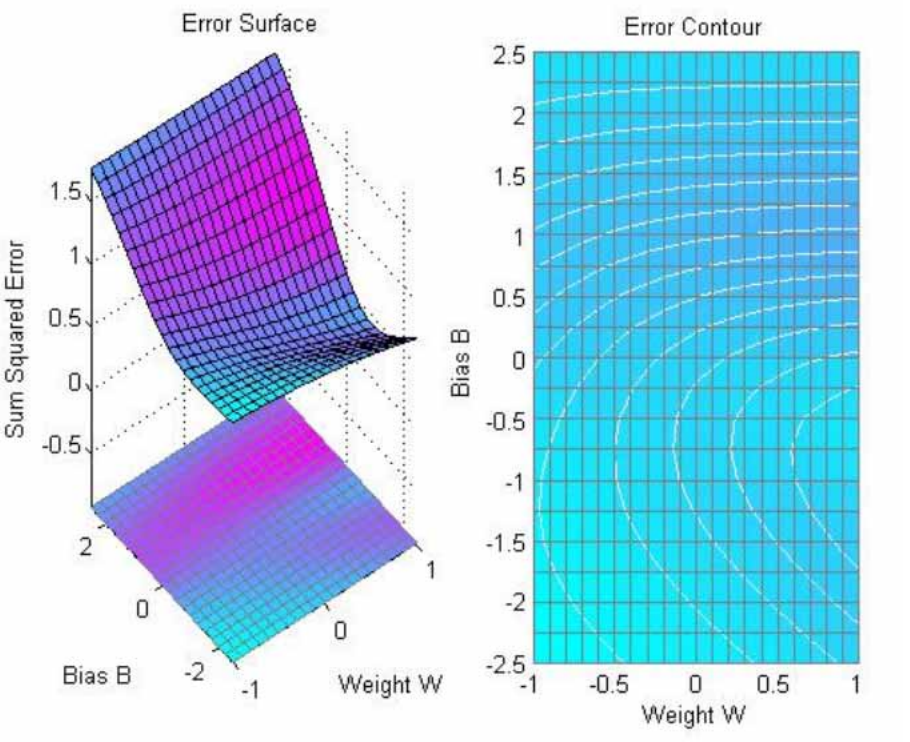
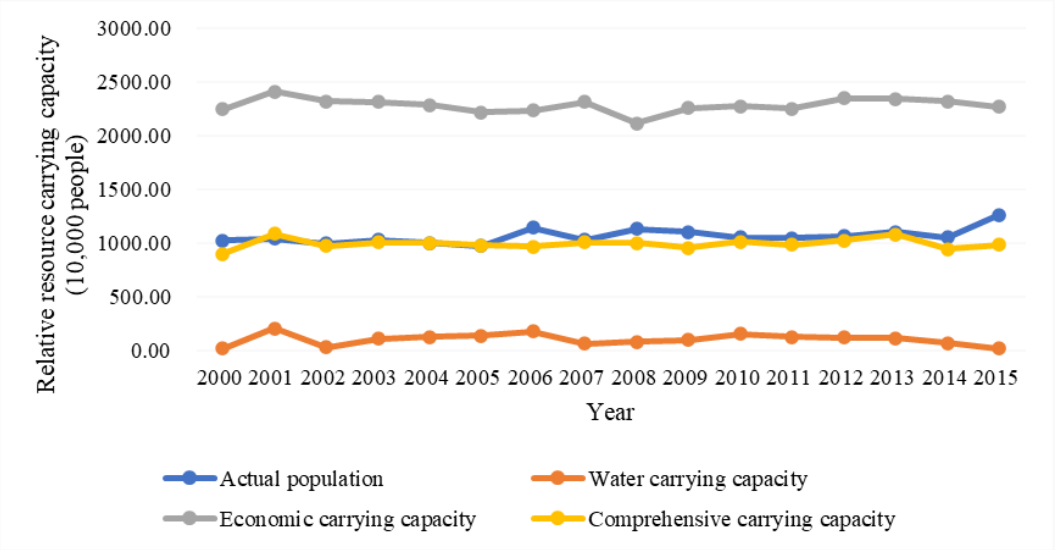


Figure 4. Comparison of the Relative resource bearing status between eastern, central, and western China from 2000 to 2015



TDS, HES, EECS, SEPS. The rapid increase of population, the increasing needs of human beings, and their number must lead to the aggravation of the bearing burden of the natural environment, resulting in the depletion of natural resources in the oasis and the decline of environmental quality. Ecological restoration is to take various measures to reduce and eliminate the factors and processes that are not conducive to human survival and development in the ecological environment.

College students are an important force in the development of society, and it is more conducive to the protection of fragile ecological areas to strengthen college students' environmental protection education and raise their awareness of environmental protection. Doing well in environmental protection education is an important way to fundamentally realize environmental protection, and it is also a practical need for colleges and universities to adapt to social development and better promote the progress and development of education. China has put forward the construction of ecological civilization, and the contemporary college students are the main force to realize the construction of ecological civilization. The ecological civilization thought of college students, the concept of environmental protection, and the ability of environmental protection of college students will affect the development of ecological civilization construction. Because of this, the strengthening of the education of environmental protection of college students in colleges and universities and improving the environmental protection skills of college students are the inevitable requirements to promote the construction of ecological civilization.

The cultivation of college students' awareness of ecological environment protection plays an important role in the process of national and social development and progress. First of all, in the face of the current severe environmental situation, the formation of college students' awareness of environmental responsibility needs the support of social practice, which is a dynamic process of transforming the awareness of ecological environmental protection into environmental behavior. In addition to paying attention to environmental policy makers, college students can also learn about environmental protection knowledge through online tools, actively participate in activities beneficial to environmental protection, take more care of the environment, and consciously improve environmental awareness. In addition, we must strengthen our understanding of the legal system of environmental protection, which is the most powerful guarantee of environmental protection and the basis of all environmental protection activities. Therefore, in future studies, we should also learn to master the

environmental protection system through various channels, gradually form the awareness of the rule of law in the process of learning legal knowledge, and finally externalize this awareness into action.

CONCLUSION

From the results of the BP artificial neural network model for the simulation and analysis of Urat Qianqi, it can be seen that: 1. From the model training results, the expected envisioned criteria were achieved and the evaluation model fully met the requirements. 2. From the evaluation results, the output values (0.3485, 0.6184, 0.1444) were the closest to the initial value of 0.6184, so the study area is moderately vulnerable.

As an important social ideology, society must attach importance to improving college students' awareness of ecological and environmental protection. It is of practical significance for the harmonious development of humans and nature in the western region to carry out the research on the construction model of ecological civilization in the ecologically fragile and poverty-stricken areas. This paper takes a city in the Inner Mongolia Autonomous Region as the research area, takes the ecological environment vulnerability of the research area as the research object, uses BP artificial neural network method to analyze and study, and provides research methods for the coordinated development of the fragile ecological environment in the northwest. By using BP artificial neural network method to evaluate the ecological environment vulnerability, the result shows that the ecological environment vulnerability level in the study area is II, indicating that the ecological environment in Wulatqian Banner is currently moderately fragile. The ecological environment vulnerability of the study area is the result of the joint action of nature and human. Among them, natural factors such as geology, landform and climate are the main natural factors that affect the fragile ecological environment of Wulat Front Banner, while unreasonable human activities such as over-reclamation, over-grazing and abuse of water resources are the main factors that cause the fragile ecological environment.

Because BP neural network itself has weak generalization ability, this paper uses different functions to debug. The generalization ability of the network has been improved, but there are still some defects. In the future research, we will continue to improve the stability of the simulation results in order to further improve the model accuracy.

DATA AVAILABILITY

The figures used to support the findings of this study are included in the article.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

FUNDING STATEMENT

This work was supported by the Western Program of National Social Science Foundation (21XDJ005); and the Special Program of Humanities, Social Sciences, Ideological and Political Affairs of Chongqing Municipal Education Commission (20SKSZ089).

ACKNOWLEDGMENT

The authors would like to show sincere thanks to those techniques who have contributed to this research.

REFERENCES

Аронбаев, Д., Аронбаев, С., & Исакова, Д. (2021). monitoring Monitoring of environmental objects using ecologically clean electrodes. *Eurasian Union Scientists*, *2*(1 (82)), 54–63. doi:10.31618/ESU.2413-9335.2021.2.82.1205

Adjei, R., Addaney, M., & Danquah, L. (2021). The ecological footprint and environmental sustainability of students of a public university in Ghana: Developing ecologically sustainable practices. *International Journal of Sustainability in Higher Education*, *22*(7), 1552–1572. doi:10.1108/IJSHE-08-2020-0318

Alonso-Fernández, P., & Regueiro-Ferreira, R. M. (2022). Extractivism, ecologically unequal exchange and environmental impact in South America: A study using Material Flow Analysis (1990–2017). *Ecological Economics*, *194*, 107351. doi:10.1016/j.ecolecon.2022.107351

Aung, T. S., Overland, I., Vakulchuk, R., & Xie, Y. (2021). Using satellite data and machine learning to study conflict-induced environmental and socioeconomic destruction in data-poor conflict areas: The case of the Rakhine conflict. *Environmental Research Communications*, *3*(2), 025005. doi:10.1088/2515-7620/abedd9

Boca, G. D., & Saraçlı, S. (2019). Environmental education and student's perception, for sustainability. *Sustainability (Basel)*, *11*(6), 1553. doi:10.3390/su11061553

Chakraborty, D., Başağaoğlu, H., Gutierrez, L., & Mirchi, A. (2021). Explainable AI reveals new hydroclimatic insights for ecosystem-centric groundwater management. *Environmental Research Letters*, *16*(11), 114024. doi:10.1088/1748-9326/ac2fde

Chakraborty, S., Sarkar, K., Chakraborty, S., Ojha, A., Banik, A., Chatterjee, A., ... & Das, M. (2021). Assessment of the surface water quality improvement during pandemic lockdown in ecologically stressed Hooghly River (Ganges) Estuary, West Bengal, India. *Marine pollution Pollution bulletinBulletin, 171*, 112711.

Chi, M., Zhang, D., Zhao, Q., Yu, W., & Liang, S. (2021). Determining the scale of coal mining in an ecologically fragile mining area under the constraint of water resources carrying capacity. *Journal of Environmental Management*, *279*, 111621. doi:10.1016/j.jenvman.2020.111621 PMID:33187778

Dumack, K., Fiore-Donno, A. M., Bass, D., & Bonkowski, M. (2020). Making sense of environmental sequencing data: Ecologically Ecologically important functional traits of the protistan groups Cercozoa and Endomyxa (Rhizaria). *Molecular Ecology Resources*, *20*(2), 398–403. doi:10.1111/1755-0998.13112 PMID:31677344

Elias-Roberts, A. (2020). Balancing environmental protection and offshore petroleum developments in Guyana. *Global Energy Law and Sustainability*, *1*(1), 1–27. doi:10.3366/gels.2020.0004

Hekmatpour, P., & Leslie, C. M. (2022). Ecologically unequal exchange and disparate death rates attributable to air pollution: A comparative study of 169 countries from 1991 to 2017. *Environmental Research*, *212*, 113161. doi:10.1016/j.envres.2022.113161 PMID:35367231

Kerr, J. T. (2021). Science integrity and environmental decision-making in Canada: a fragile renaissance. In *Conservation Science and Advocacy for a Planet in Peril* (pp. 73–97). Elsevier. doi:10.1016/B978-0-12-812988-3.00001-6

Kumar, S., Singh, D. R., Singh, A., Singh, N. P., & Jha, G. K. (2020). Does adoption of soil and water conservation practice enhance productivity and reduce risk exposure? empirical Empirical evidence from semi-arid tropics (SAT), India. *Sustainability (Basel)*, *12*(17), 6965. doi:10.3390/su12176965

Magliulo, P., Cusano, A., & Russo, F. (2021). Land-Use changes in the Sele River Basin landscape (Southern Italy) between 1960 and 2012: Comparisons and implications for soil erosion assessment. *Geographies*, *1*(3), 315–332. doi:10.3390/geographies1030017

Mammides, C., Goodale, E., Elleason, M., & Corlett, R. T. (2021). Designing an ecologically representative global network of protected areas requires coordination between countries. *Environmental Research Letters*, *16*(12), 121001. doi:10.1088/1748-9326/ac3534

Mauro, F., La Monaca, U., Marino, A., & Bucci, V. (2020). A simulation model for a hybrid-electric craft in restricted waters. *Journal of Advanced Transportation*, *2020*, 1–13. doi:10.1155/2020/5340814

Nandy, T., & Mandal, S. (2020). Unravelling the spatio-temporal variation of zooplankton community from the river Matla in the Sundarbans Estuarine System, India. *Oceanologia*, *62*(3), 326–346. doi:10.1016/j.oceano.2020.03.005

Nyumba, T. O., Sang, C. C., Olago, D. O., Marchant, R., Waruingi, L., Githiora, Y., Kago, F., Mwangi, M., Owira, G., Barasa, R., & Omangi, S. (2021). Assessing the ecological impacts of transportation infrastructure development: A reconnaissance study of the Standard Gauge Railway in Kenya. *PLoS One*, *16*(1), e0246248. doi:10.1371/journal.pone.0246248 PMID:33513202

Pu, N., Ren, J., Zhong, W., Zheng, N., Jiang, H., & Zhu, R. (2021, May). Green resource planning for large-scale hydropower generation in ecologically fragile plateau areas. [). IOP Publishing.]. *IOP Conference Series. Earth and Environmental Science*, *781*(3), 032037. doi:10.1088/1755-1315/781/3/032037

Rogayan, D. V. Jr, & Nebrida, E. E. D. (2019). Environmental awareness and practices of science students: Input for ecological management plan. *International Electronic Journal of Environmental Education*, *9*(2), 106–119.

Shafiei, A., & Maleksaeidi, H. (2020). Pro-environmental behavior of university students: Application of protection motivation theory. *Global Ecology and Conservation*, *22*, e00908. doi:10.1016/j.gecco.2020.e00908

Xu, J., Liang, X., & Chen, H. (2020). Landscape sustainability evaluation of ecologically fragile areas based on Boltzmann entropy. *ISPRS International Journal of Geo-Information*, *9*(2), 77. doi:10.3390/ijgi9020077

Zeng, J., Jiang, M., & Yuan, M. (2020). Environmental risk perception, risk culture, and pro-environmental behavior. *International Journal of Environmental Research and Public Health*, *17*(5), 1750. doi:10.3390/ijerph17051750 PMID:32156077

Zhang, Y., Xiao, X., Cao, R., Zheng, C., Guo, Y., Gong, W., & Wei, Z. (2020). How important is community participation to eco-environmental conservation in protected areas? From the perspective of predicting locals' pro-environmental behaviours. *The Science of the Total Environment*, *739*, 139889. doi:10.1016/j.scitotenv.2020.139889 PMID:32534312

Xiaoxia Ye is a professor of Chongqing Vocational Institute of Engineering.

Jinguo Zhang is a professor of Chongqing Normal University.

Mark Shelbourn is a professor at the University of Salford, Salford, M7 9NU, UK.