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Study on Ecological Impact Based on Multi-index Evaluation Model

Haoxiang Cheng, Xinyue Tu, Ruitong Xiao

College of Computer and Network Security (Oxford Brookes University), Chengdu University of Technology, Chengdu, Sichuan, 610059, China

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Abstract: China adheres to the concept that green waters and green mountains are golden mountains and silver mountains, respects harmony with nature, protects nature, gives priority to saving resources, protects the environment, and allows nature to recover itself. In this paper, the ecological impact assessment model of Saihanba is established, which starts with the hierarchical structure of multi-level indicators, while the impact of vegetation can be established through several low-level indexes, such as plant abundance, total plant number, plant cover area and so on. The comprehensive evaluation is carried out by using the combination of TOPISS model, fuzzy evaluation and DEA, and the evaluation indexes before and after the transformation of the model are calculated, and the analysis results are compared.

1. Introduction

Since 1962, 369 young people with an average age under 24 have come to this wasteland filled with yellow sand. Today, the forest coverage in Saihanba area has reached 80%. It supplies Beijing and Tianjin with 137 million cubic meters of clean water each year, sequesters 747,000 tons of carbon, and releases 545,000 tons of oxygen.

On the one hand, there is the historical mission that “civilization will develop followed with zoology thriving”. On the other hand, there are new issues encountered on the road of green development. Therefore, Saihanba people now have a higher goal, which is to restore the ecology. Since the 18th National Congress of the Communist Party of China, they have successively launched three major projects, namely, afforestation, natural improvement of artificial forests, and near naturalization cultivation of natural forests. They have tried to make artificial forests closer to natural ones.

2. Ecosystem evaluation model

The average of growing season precipitation in the Seyhanba area from 1965 to 2011 the average of growing season precipitation in the Seyhamba region from 1965 to 2011 was 377.6 mm, and the average of growing season precipitation to annual precipitation was 83.1% [1]. The growing season precipitation was generally low from the late 1960s to the late 1980s, fluctuating in the early 1970s, and fluctuating in the 1990s. The growing season precipitation was generally low from the late 1960s to the late 1980s, fluctuated considerably in the early 1970s, and increased and then decreased in the 1990s. Precipitation increased and then decreased in the 1990s, and continued to show a decreasing trend after 2000. The minimum value was -176.1 mm in 1971 and the maximum value was 164.1 mm in 1973. The minimum range is -176.1 mm in 1971 and the maximum value is 164.1 mm in 1973. The growing season usually starts in mid-May and lasts until mid-September, and precipitation during the growing season is the growing season precipitation is important for plant growth. The growing season precipitation is important for plant growth [2]

The minimum value of annual precipitation and growing season precipitation scale parameter is 2 years, and the maximum value is set to 32(25) years; the minimum value of monthly precipitation scale parameter is 2 months, and the maximum value is set to 512(29) months. The complex wavelet coefficients are output, and the wavelet coefficients are interpolated by the square of the mode part to form a wavelet coefficient mode square contour map (wavelet energy map).

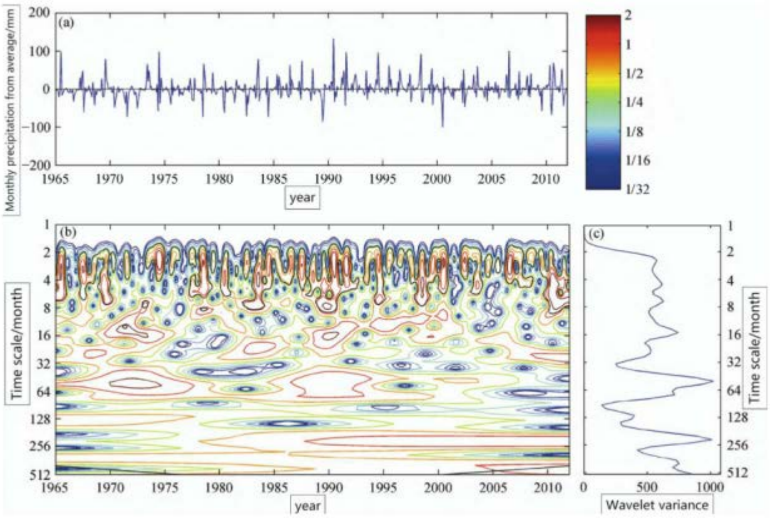

Figure 1: Monthly precipitation distance level series (a), wavelet transform mode squared contour map (b) and wavelet variance map (c) in the Sekhamba area from 1965 to 2011

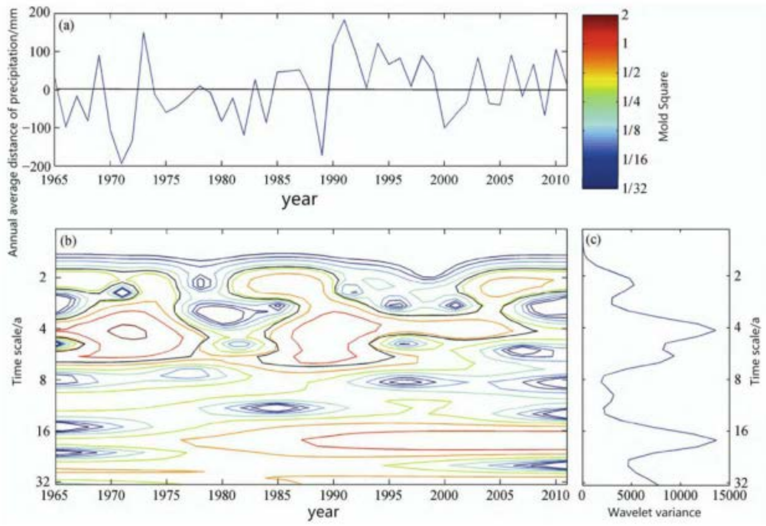

Figure 2: Annual precipitation distance level series (a), wavelet transform mode squared contour map (b) and wavelet variance map (c) for 1965-2011 in the Sekhamba area

3. Determination of evaluation value of each index

Where the development goals are clearly defined in the existing national, provincial and municipal forestry plans, the development goals shall be taken as the reference value; the reference value of economic and social indicators shall be determined according to the local average level. Finally, the comprehensive index method is used to calculate the evaluation value of each index. The inverse indicators of this paper include forest annual growth rate, annual average incidence of forest diseases and insect pests and forest fire index, and the other indicators are positive indicators. The calculation method is as follows:

Positive indicator evaluation value:

$$D_{k1} = P_k / S_k \tag{1}$$

Reverse indicator evaluation value:

$$D_{k1} = P_k / S_k \tag{2}$$

The calculation results of the evaluation values of each index are as follows.

(1) Proportion of ecological public welfare forest area D1

The area of Seyhanba forestry ecological public welfare forest is 38241.1 ha2, accounting for 45.7% of the woodland area (83677.8 hm), more than 30%, so the evaluation value is Di=Pi/Si=l.

(2) Biodiversity D2

The calculation formula is as follows: F= (Pi)/(1/n) where F indicates the biodiversity index [3-5], Pi indicates the area share of vegetation type i, and n indicates the number of vegetation types. The main vegetation types in the Seyhanba forest area were classified as grassland, shrubland, plantation forest, natural secondary forest and others. The area of grassland accounted for 26.90%, shrub forest accounted for 6.10%, plantation forest accounted for 34.20%, natural secondary forest accounted for 30.50%, and others accounted for 3.50%, so F=0.851. No reference value was selected for this index. D2 =0.851.

(3) Forest cover ratio D3

The forest coverage rate of Seyhanba Forestry Park is 75.5%. If the unestablished afforestation land and thinning forest in the forest area [6].

(4) Nature reserve area proportion D4

The area of the nature reserve in Seyhanba Forest is 20,029.8 hectares, accounting for 21.6% of the total area of the forest. o No reference value is selected for this indicator. Therefore, D4=0.216o

(5) Forest land utilization rate D5

The forestry land area of the forestry field is 83,677.8hm2, and the forest land area is 68,842.5hm2, and the forest land utilization rate is calculated to be 82.3%. The utilization rate of forested land in developed countries in the world is 90% (Wu, Gaojie, 2010) o Therefore, D5=P5/S5=84.0%.

(6) Storage volume per unit area of forested land D6

The forested land area is 86642.5hm2 and the storage volume is 8099222m^3 , so the calculated storage volume per unit area of forested land is 117.65m3/hm2 o Taking the world average forest storage volume per unit area of 100m3/hm2 as the reference value, D6=Pb/S6=l.

(7) Annual forest growth rate D7

The study shows that in order to ensure the sustainable use of forest resources, the annual forest consumption should be controlled within the annual growth volume, so it is appropriate to control the annual forest maturity ratio within 0.8 to prevent losses caused by forest fires and other unexpected disasters. The annual forest growth rate is calculated as 127464.9/489076.7=0.26(<0.8) Therefore, it can be considered that the index is in line with the sustainable status and D7=1.

4. Results

According to the results of forest resources inventory since the establishment of Seyhanba in 1962, the forest area and live wood accumulation in Seyhanba Forestry Park have been steadily increasing. The dynamic trends of forest resources in the successive inventories of Seyhanba are shown in Figure 2. From 1962 to 1982, the forestry area of the forestry plantation was on a large scale, and the forestry area was on a straight line, mainly pure larch forests. The main work in this stage is to carry out forest nurturing, improve forest quality and enhance ecological stability of

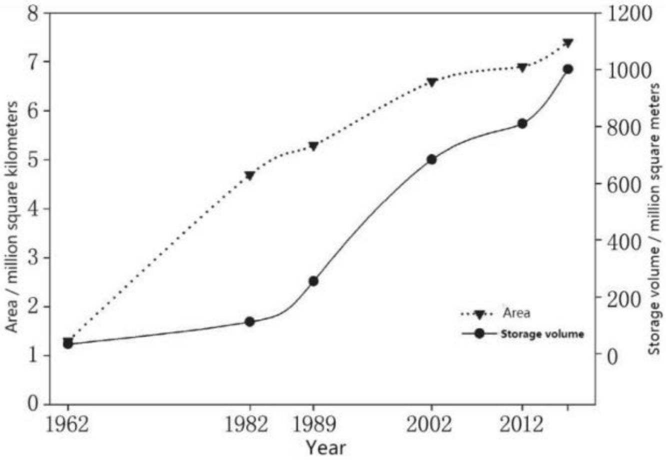

Figure 3: The dynamic changes of forest area and volume

The idea of forest management in Seyhanba has gradually shifted from timber use to ecological protection and landscape recreation; the disappearance of charcoal forests shows that, with the development of the times, the way of heating in Seyhanba and the surrounding areas has changed, and the era of relying on wood for heating and cooking has passed.

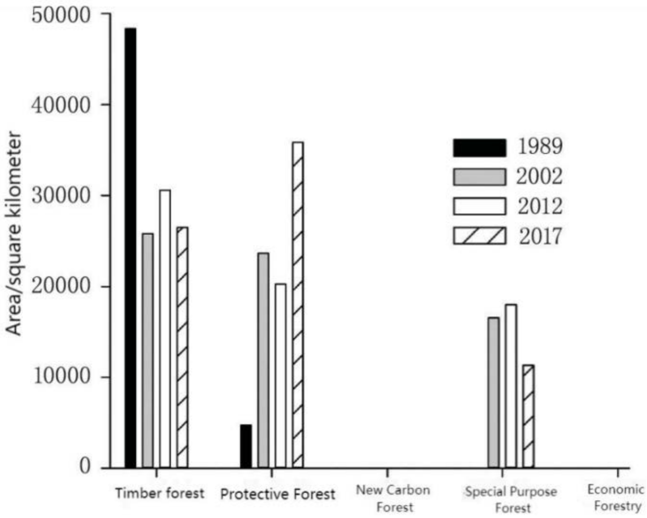

Figure 4: Area changes of forest types

5. Conclusion

China insists on respecting harmony with nature, protecting nature, giving priority to saving resources, protecting the environment, and allowing nature to recover itself. Therefore, this paper starts with the influence of vegetation, animal, climate and water resources, and establishes the hierarchical structure of multi-level index through the process of statistics, clustering and gridding. The impact of vegetation can be established through several low-level indicators such as plant abundance, total number of plants, plant cover area and so on. The evaluation indexes before and after the model transformation are calculated, and the analysis results are compared.

References

[1] Blake A J, Morgan K, Bendall M J, et al. FALLS BY ELDERLY PEOPLE AT HOME: PREVALENCE AND ASSOCIATED FACTORS [J]. Age and Ageing, 1988, 17(6): 365-372.

[2] Stalenhoef P A, Diederiks J P M, Knottnerus J A, et al. A risk model for the prediction of recurrent falls in community-dwelling elderly: A prospective cohort study [J]. Journal of Clinical Epidemiology, 2002, 55(11): 1088-1094.

[3] Kalula S Z. A WHO Global Report on fall among Older Persons Prevention of falls in older persons [J].

[4] Dargentmolina P, G Bréart. [Epidemiology of falls and fall-related injuries in the aged]. [J]. Revue Dépidémiologie Et De Santé Publique, 1995, 43(1): 72.

[5] Northridge M E, Nevitt M C, Kelsey J L, et al. Home hazards and falls in the elderly: the role of health and functional status [J]. American Journal of Public Health, 1995, 85(4):509-15.

[6] Steinmetz H M, Hobson S J G. Prevention of fall among the Community-Dwelling Elderly: [J]. Physical & Occupational Therapy in Geriatrics, 1995, 12(4): 17.