Evaluation of Ecosystem Services in Altay Region of Xinjiang

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Abstract. The Altay region of Xinjiang is rich in natural resources. It is a gathering place for energy resources in the northern part of Xinjiang and even in Xinjiang. Due to human activities and natural disasters, the ecology of the Altay region has been destroyed to some extent. For the ecological sustainable development of the Altay region, maintaining the ecological environment stability of the Altay region, assessing the value of ecosystem services in the Altay region, understanding the changes in the value of ecosystem services in the Altay region at this stage, and providing scientific and sustainable management and efficient management of environmental resources basis.

1. Introduction
The Altay region of Xinjiang is rich in natural resources, and water resources, land resources, forest resources, grassland resources and mineral resources all play an important role in Xinjiang [1]. In recent years, the industrial development in the Altay region has been rapid, and ecological problems such as air pollution, grassland degradation and desertification have been prominent in this area. At the same time, the unreasonable development of tourism projects has caused the environmental carrying capacity to be overloaded, resulting in serious damage to the ecosystem. The relationship between social economy and ecological environment is very close, and the destruction of ecological environment restricts the development of local economy. Based on the above questions, we evaluate the value of ecosystem services in the Altay region and understand the changes in the value of ecosystem services in the Altay region at this stage. To maintain the ecological environment stability of the Altay region and provide a scientific basis for the sustainable use and efficient management of environmental resources.

2. Overview of the study area
The Altay region is located in the northern part of the Xinjiang Uygur Autonomous Region and has a beautiful scenery. The administrative branch belongs to the Ili Kazakh Autonomous Prefecture. It is located at the northernmost part of Xinjiang and borders with Russia, Mongolia, Kazakhstan and other...
countries. The total area is 117,000 km², accounting for about the total land area of Xinjiang. 7% of the population, about 602,300, accounting for only 1.3% of the total. In addition, the area has diverse natural scenery, beautiful scenery and extremely rich tourism resources. Its existence has a profound impact on the natural environment and even human activities [6-7]. The district is one of the three largest pastoral areas in the country and has abundant grassland resources. It is an important animal husbandry base in Xinjiang. The abundant water resources are also the lifeblood of the neighboring Karamay, East Junggar oil fields and even the economic development of Urumqi. Rich resources to promote economic development have far-reaching significance for stabilizing the border and have a special strategic position [8].

3. Data acquisition and research methods

3.1. Data source
This study takes Costanza [9] as a reference for some of the results of global ecosystem service value assessment, establishes a relationship model to determine the annual rate of change, and calculates the unit area value of ecosystem services in 2000, 2005 and 2010. Based on the service value table of China's terrestrial ecosystems established by Xie Gaodi [10-11], the ArcGIS10.0 platform is used to extract the land cover remote sensing maps of the Altay region, and the area data of different land use types in the study area are obtained. The total value of ecosystem services in the Altay region in 2000, 2005 and 2010.

3.2. Research methods

3.2.1. Annual average rate of change. Based on the articles published in Global Change in 2014, such as Costanza, based on the unit value of the ecosystem services value of the global ecosystem in 1997 and 2011, a relationship equation was established to calculate the annual rate of change:

\[ A (1+x)^n=B \]  \hspace{1cm} (1)

\[ x=B/A^n-1 \]  \hspace{1cm} (2)

Where A is the base year, B is the target year, X is the annual average rate of change, and the number of years between the target year and the base year is n. Taking the unit value of 2007 as the base year and the unit value of 2011 as the target year, the rate of change X is obtained.

3.2.2. Calculation of the area value of ecosystem services in each year. According to formula (1), the target year is set to 2000, 2005, and 2010, and the service value per unit area of ecosystem service value in each year is calculated.

3.2.3. Calculation of total value of ecosystem services in Altay region. Calculate the total value of ecosystem services according to formula (3) by comparing the different terrestrial ecosystems in the Altay region with the corresponding ecosystem service value per unit area:

\[ S*P=T \]  \hspace{1cm} (3)

S is the area of different terrestrial ecosystems in the Altay region, P is the ecological service value per unit area of the ecosystem, and T is the total price of the final ecosystem services in the Altay region.
4. Results and analysis

4.1. Calculate the unit value of different years based on the unit value of Costanza

Costanza [9] and other articles published in Global Change in 2014 divide the global ecosystem into marine systems and terrestrial systems, which divide the terrestrial ecosystem into nine subsystems. The unit value of the value of various ecosystem services in the global ecosystem in 1997 and 2011 is calculated by formula (2), as shown in Table 1.

| Biome         | Unit: 2007$/ha/yr | Unit value | change | annual growth | annual average rate of change |
|---------------|-------------------|------------|--------|---------------|-------------------------------|
|               | 1997 | 2011  | 1997-2011 | 1997-2011 | 1997-2011                     |
| Ocean         | 798  | 1368  | 572       | 40.86     | 0.0394                        |
| Forest        | 1338 | 3800  | 2462      | 175.86    | 0.0774                        |
| Grass/ranch   | 321  | 4166  | 3845      | 274.64    | 0.2009                        |
| Wetlands      | 20404| 140174| 119770    | 8555.00   | 0.1476                        |
| Lake river    | 11727| 12512 | 785       | 56.07     | 0.0046                        |
| Farmland      | 126  | 5567  | 5441      | 388.64    | 0.3107                        |
| City          | 6661 | 6661  | 0         | 0         | 0                             |

In Table 1, the value of various services in the ecosystem showed an increasing value from 1997 to 2011, and the rate of change obtained was positive. In terrestrial ecosystems, the annual growth rate of wetland ecosystem services was the highest 8555 (2007$)/ha/yr). The largest annual rate of change is 31.07% of farmland, and the smallest is only 0.46% of lakes.

The reason for the increasing value of various services in the ecosystem from 1997 to 2011 was mainly due to the fact that in 1997 Costanza [12] and others estimated the ecological service value per unit area of each ecosystem. At that time, the estimates were only uncertain and estimated. The results represent only a minimum value, as scientific advances (1) further research and assessment of the broader ecosystem services sector. Although in 1997 the calculation process sought to be comprehensive, but many service items were missed, and these services were not fully studied. When more data is obtained, the estimated value will increase. (2) Reflecting the dynamics of ecosystems closer to reality and their interdependence. In many cases, value is based on current people's willingness to pay for ecosystem services, and people's preferences may not fully reflect social justice, ecological sustainability, and other important goals. If we really live in an ecologically sustainable, socially just world, and everyone in the world has a good understanding of their links to ecosystem services, then market prices and willingness to pay can be generated and now different outcomes lead to an increase in the value of ecosystem services. (3) As ecosystem services will face greater pressure and become scarce in the future, human activities will affect the stability of ecosystems due to problems such as vegetation damage and environmental pollution, which is also the cause of increased value.

In this study, the service value per unit area of terrestrial ecosystems was selected for research. According to the value of unit area and the annual average rate of change in 1997 and 2011 in Table 1, the unit area value in 2000, 2005 and 2010 was obtained by using formula (1) (Table 2).
Table 2. Table of service value per unit area in 2000, 2005 and 2010. Unit: 2007$/ha/yr

| Biomes          | 2000 year | 2005 year | 2010 year |
|-----------------|-----------|-----------|-----------|
| Forest          | 1673      | 2429      | 3527      |
| Grass/ranch     | 556       | 1389      | 3468      |
| wetlands        | 30838     | 61382     | 122178    |
| Lake river      | 11890     | 12166     | 12448     |
| farmland        | 284       | 1097      | 4245      |

As shown in Table 2, the unit value of each biome has increased in the past three years. In 2000, the value of each ecosystem unit was ranked from wet to small > wetland > lake > forest > pasture > farmland. The ranking in 2005 is the same as in 2000. It is worth noting that there have been changes in 2010, followed by wetlands > lakes > farmland > forests > pastures. It can be seen that in 2010, the service value per unit area of farmland ecosystems increased the fastest.

4.2. Calculate the unit value of different years based on the unit area value of Xie Gaodi

Xie Gaodi et al. estimated the value of various ecosystem services in various ecosystems in the “Global Ecosystem Services Value and Natural Capital” published by Costanza et al., 1997, and at the same time, in the 200 ecologists in China. On the basis of the questionnaire survey, a table of service value per unit area of China's terrestrial ecosystem was established (Table 3).

Table 3. Table of ecological service value per unit area of different terrestrial ecosystems in China (2002)

| Service Value                      | Forest  | grassland | farmland | wetland  | water body | desert |
|------------------------------------|---------|-----------|----------|----------|------------|--------|
| Gas regulation                     | 3097.0  | 707.9     | 442.4    | 1592.7   | 0.0        | 0.0    |
| Climate regulation                 | 2389.1  | 796.4     | 787.5    | 15130.9  | 407.0      | 0.0    |
| Water conservation                 | 2831.5  | 707.9     | 530.9    | 13715.2  | 18033.2    | 26.5   |
| Soil formation and protection      | 3450.9  | 1725.5    | 1291.9   | 1513.1   | 8.8        | 17.7   |
| Waste treatment                    | 1159.2  | 1159.2    | 1451.2   | 16086.6  | 16086.6    | 8.8    |
| Biodiversity conservation          | 2884.6  | 964.5     | 628.2    | 2212.2   | 2203.3     | 300.8  |
| Food production                    | 88.5    | 265.5     | 884.9    | 265.5    | 88.5       | 8.8    |
| Raw material                       | 2300.6  | 44.2      | 88.5     | 61.9     | 8.8        | 0.0    |
| Entertainment culture              | 1132.6  | 35.4      | 8.8      | 4910.9   | 3840.2     | 8.8    |
| sum                                | 19334   | 6406.5    | 6114.3   | 55489    | 40676.4    | 371.4  |

In 2002, Xie Gaodi and others divided the ecological services into nine categories: gas regulation, climate regulation, water conservation, soil formation and protection, waste treatment, biodiversity conservation, food production, raw material production, and recreation. And the ecological service value per unit area of various ecosystems is obtained, and the service value per unit area of the ecosystem in 2002 is brought into the formula (1), and the service unit price in 2000, 2005 and 2010 is calculated separately. The service value per unit area is increasing year by year, as shown in Table 4.
Table 4. Service Value Table per Unit of Units in 2000, 2005 and 2010

| Biome              | annual average rate of change | unit value       |          |          |          |
|--------------------|-------------------------------|------------------|----------|----------|----------|
|                    |                               | 2000 year        | 2005 year | 2010 year |
| Forest             | 0.0774                        | 16655.89         | 24179.80 | 35102.45 |
| Grass/Rangelands   | 0.2009                        | 4442.29          | 11095.36 | 27712.49 |
| Wetlands           | 0.1476                        | 42133.33         | 83864.57 | 166928.78 |
| Lakes/Rivers       | 0.0046                        | 40304.74         | 41240.32 | 42197.61 |
| Desert             |                               | 371.40           | 371.40   | 371.40   |
| Cropland           | 0.3107                        | 3559.10          | 13767.55 | 53256.56 |

4.3. Analysis of the change in total value of ecosystem services in Altay region

The scientific and reasonable evaluation of the ecosystem service value of the Altay region is of great scientific significance for maintaining the stability of the ecosystem in the Altay region. The ArcGIS10.0 platform was used to extract the land cover remote sensing maps of the Altay region, and the data of different land use types in the study area were obtained.

Table 5. Statistical Table of Grade II Areas of Land Cover in Altay in 2000, 2005 and 2010

| Type              | 2000 Area | 2005 Area | 2010 Area |
|-------------------|-----------|-----------|-----------|
| forest            | 2604254   | 2647986   | 2674699   |
| Grassland         | 7077585   | 7989194   | 7934356   |
| Water body        | 169031    | 173445    | 184286    |
| Desert/sand       | 8034      | 4804      | 4200      |
| Dry land (farmland)| 317548   | 411109    | 454725    |

It can be seen from the above table that the area of different land types in the Altay region has increased from 2000 to 2010. Comparing the service unit prices of the ecosystems of Costanza and Xie Gaodi with the total ecosystem service value of the ecosystem types in different years of the Altay region, a comparative analysis of the three years of Altay in 2000, 2005 and 2010. Changes in the value of regional ecosystem services. (Figure 1, Figure 2)

![Figure 1. Altay ecological service total value change chart](image1.png)

![Figure 2. Altay's ecological services total value change chart](image2.png)
Figure 1 shows the total price of ecosystem services in the Altay region from 2000 to 2010, based on the service value per unit area of ecosystems in 2000, 2005 and 2010, calculated from the Costanza unit value. From 2000 to 2010, the total value of ecosystem services in the Altay region showed a steady and continuous growth, with the order being 2010>2005>2000. In 2005, it increased by 849.98 billion yuan over 2000. In 2010, it increased by 206.03 billion yuan compared with 2005, a large increase.

Figure 2 calculates the total price of ecosystem services in the Altay region for three years based on the service value per unit area of ecosystems in Xie Gaodi in 2000, 2005 and 2010. The results also show that the total value of ecosystem services in the Altay region has been growing steadily and continuously from 2000 to 2010. In 2005, it increased by 85.511 billion yuan compared with 2000, and in 2010 it increased by 185.531 billion yuan compared with 2005.

The analysis results show that the total value of ecosystem services in the Altay region in 2000, 2005 and 2010 in the three different unit area values of Costanza and Xie Gaodi is increasing, indicating that the value of ecosystem services in the Altay region is also improving, the ecological environment in the Altay region is getting better.

To further verify the accuracy of the results, we will multiply the area of the three-year ecosystem known by Altay by the value of the service value per unit area of the Costanza study in 2011, and calculate the area only if the unit value does not become The change in the total service value of ecosystem services in the Altay region during the growth period is shown in Figure 3.

Under the condition that the service value per unit area remains unchanged and the area increases, the total value of ecosystem services in the Altay region also shows an increasing trend. In 2005, it increased by 29.810 billion yuan compared with 2000, and 2010 increased by 23.776 billion yuan compared with 2005, indicating that the increase in the area of various ecosystems is an important reason for the growth of the total service value of the ecosystem in Altay.

Through comparative analysis, Figure 1 and Figure 2 show that the total service value of the ecosystem in the Altay region is increasing year by year with both unit value and area increasing. Figure 3 shows that in the case of constant unit value, it is only the Altay region. The different types of ecosystems have increased in area, and the total service value of ecosystems in the region is also increasing. The results show that the ecological environment in the region is developing in a good trend.

5. Conclusion
Based on the above analysis of the total service value of the ecosystem in Altay, the following conclusions are drawn:

(1) The ecosystem services in the Altay region of Xinjiang are valuable, and the total value of ecosystem services in the region has increased year by year from 2000 to 2010. Based on the unit product
value of Costanza and Xie Gaodi, the total service value of ecosystems in 2000, 2005 and 2010 was calculated. The average annual growth rate from 2000 to 2010 was 15.13% and 15.43%. When the unit value is unchanged and the area changes, the total service value of the three-year ecosystem is calculated to be 395.507 billion yuan, 425.316 billion yuan, 449.912 billion yuan, and the average annual growth rate from 2000 to 2010 is 1.28%.

(2) The reasons for the change in the total service value of ecosystems in the region. First, the service value per unit area of each ecosystem is increasing year by year. Second, the area of each ecosystem is also increasing. Secondly, through analysis, the increase in area is the main reason for the increase in the total value of ecosystem services.

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