

Evaluation of Ecological Economic Functions of Jinan Liubu National Forest Park

济南柳埠国家森林公园生态经济价值评估

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Abstract

- ◆ Forest, as the main body of land ecosystem , plays an important role in global ecosystem.
- ◆ 森林作为陆地生态系统最主要的部分，在全球生态系统中扮演着重要的角色。

Abstract

- ◆ The research of evaluation of its ecological economic functions will benefit human beings' wellbeing and have significant influence on sustainable development.
- ◆ At present, many scientists from the area of ecology and economics focus on using different method to estimate the value.
- ◆ 森林生态经济价值评估是国内外研究热点之一，其研究对于增进人类福利和可持续发展具有重要意义。

Abstract

- ◆ This article uses several scientific methods to establish a entire system with more than 10 indexes to estimate the value of these services.
- ◆ To measure them, we start from the combination of ecological and economic analysis means.
- ◆ 本文结合国内外最新研究资料建立了一套科学的评估体系，从交叉学科角度综合运用生态学和经济学方法，全面评价了生态经济服务价值

Abstract

- ◆ We take into account both tradition ones like the sale value of woods , and ecological ones like the service values of eco-tourism, water storage and air quality purifying.
- ◆ 评估体系中既包括传统的林木产品价值，又涵盖了生态旅游价值、涵养水源、净化大气等生态服务价值。

Abstract

- ◆ In our conclusion, the total value of Jinan Liubu national forest park is 514 million RMB per year.
- ◆ As the largest proportion, the value of eco-tourism hold nearly 57% of the whole, which lead it to the most important part.
- ◆ 结果表明，济南市柳埠国家森林公园的生态经济总价值为5.14亿/年，其中生态旅游价值占近57%是最为重要的价值。

Abstract

- ◆ This result indicates that ecological functions, such as water storage, eco-tourism and erosion control, of the forest exceeds the traditional value (i.e. natural resources) in a large extent.
- ◆ 这一结果体现了生态服务功能带来的价值远远超过传统我们认为的自然资源价值。

Abstract

- ◆ Therefore, the utilization of forest should be based on the conception of sustainable development, and consider different aspects together to fully enjoy the profound value for every individual's welfare.
- ◆ 因而对于森林公园的开发利用要从可持续发展角度出发，结合科学发展观合理开发规划，以充分发挥森林公园的生态服务价值进而改善人民福利。

A Brief Introduction of the Park

- ◆ Liubu Forest Park is located in Jinan, Shandong Province and it is the largest forest park in Shandong with total area of 2467.5 ha.
- ◆ Altitude:400-900 m
- ◆ Average Temperature:25.3 °C (centigrade)
- ◆ 1992年由林业部批准为国家级森林公园，名列全国第二十五位，目前是山东省内最大的国家级森林公园。面积为2467.5公顷。
- ◆ 海拔400-900米 年平均温度25.3摄氏度

System of Indexes

Total Value 总价值	Natural Resource 自然资源价值	Timber: Market Exchange Value 木材: 市场交易价值
		Other products: Fruits... Market Exchange Value 林副产品——水果: 市场交易价值
	Ecological Service 生态服务价值	Eco-tourism : WTP& Benefit transfer 生态旅游: 支付意愿法和效益转移法
		Water storage : Cost of Substitute Projects 涵养水源: 替代工程法
		Carbon fixation and O ₂ release: Cost of planting 固氮释氧: 计算造林成本
		Purifying air : Cost of cleaning 净化大气: 治理污染费用
		Erosion control : Based on others' researches 水土保持: 参照他人研究中的属性数值
		Adjust the climate: Shadow Price 调节气候: 影子价格
		Diversity of species :Based on others' researches 维持物种多样性: 参照他人研究中的属性数值

Details of Methods

- ◆ **Value of Wood: Quantity * Price**
- ◆ 木材价格：森林实物量 × 森林原木价格
- ◆ Formula:

$$V_F = \sum_{i=1}^n V_i = \sum_{i=1}^n (S_i \times P_i)$$

- ◆ S:Quantity of each kind P:Price of each kind
- ◆ Include: Conifer, Broadleaf, Spinney etc.

Details of Methods

- ◆ **Value of Other Productions: Quantity * Price**
- ◆ 水果价格：水果产量 × 当年水果价格
- ◆ Formula:

$$V_F = \sum_{i=1}^n V_i = \sum_{i=1}^n (S_i \times P_i)$$

- ◆ S:Quantity of each kind P:Price of each kind
- ◆ Include: different kinds of fruits

Details of Methods

- ◆ **Value of Eco-tourism: Benefit Transfer**
- ◆ 生态旅游价值：效益转移法估计支付意愿
- ◆ Formula:

$$\begin{aligned} WTP_1 &= \alpha_i x + \varepsilon_i \\ &= \alpha_0 + \alpha_1 Age + \alpha_2 Gender + \alpha_3 Edu \\ &\quad + \alpha_4 Income + \alpha_5 SD + \varepsilon_i \end{aligned}$$

Details of Methods

公园游客支付意愿回归模型

<i>WTP</i>	系数	标准差	t统计量	sig.
<i>Gender</i>	12.460	19.916	0.626	0.535
<i>Edu</i>	-2.075	2.554	-0.813	0.421
<i>Age</i>	0.666	1.184	0.563	0.576
<i>Income</i>	0.035	0.005	6.714	0.000
<i>SD</i>	131.755	27.365	4.815	0.000

$$R^2 = 0.626, \bar{R}^2 = 0.583$$

市区游客支付意愿回归模型

<i>WTP</i>	系数	标准差	t统计量	sig.
<i>Gender</i>	27.792	17.018	1.632	0.110
<i>Edu</i>	-5.430	3.366	-1.613	0.114
<i>Age</i>	-1.019	0.701	-1.453	0.153
<i>Income</i>	0.034	0.005	7.466	0.000

$$R^2 = 0.585, \bar{R}^2 = 0.548$$

Details of Methods

- ◆ Mean Value transfer 直接均值转移

$$e_1 = \frac{|\overline{WTP_1} - \overline{WTP_2}|}{\overline{WTP_2}} \times 100\% = \frac{|147.00 - 166.00|}{166.00} \times 100\% = 11.45\%$$

- ◆ Estimated Function transfer 估计函数转移

$$e_2 = \frac{|\overline{\hat{WTP}_2} - \overline{WTP_2}|}{\overline{WTP_2}} \times 100\% = \frac{|176.485 - 166.00|}{166.00} \times 100\% = 6.32\%$$

- ◆ In conclusion, we obtain the value, although the econometric method is too basic.
- ◆ 最终，得到了其旅游价值，尽管计量方法过于简单。

Details of Methods

- ◆ Indirect Values
- ◆ Main Method: Measures From Ecology.
- ◆ Then use the data on next page to calculate economic value.
- ◆ 间接价值
- ◆ 主要利用生态学方法进行衡量
- ◆ 然后利用下页所列数据进行对应的经济价值估算

Public Data

Build reservoir 建水库	¥ 6.11/t	China Water Conservancy Annual 中国水利年鉴
Water Purifying 净化水源	¥ 2.09/t	Jinan Statistic Annual 济南市统计年鉴
C Fixation 固定二氧化碳	¥ 1200/t	Carbon tax ratio in Sweden 瑞典碳税率
Making O ₂ 释放氧气	¥ 1000/t	Government website of moh 卫生部网站
Cleaning SO ₂ 治理二氧化硫	¥ 1.2/t	Government Fines standard 政府罚款标准

Details of Methods

- ◆ Value of Water Storage 涵蓄水源
- ◆ Layer of Dead Foliage 落叶层
- ◆ Layer of Soil 土壤层
- ◆ Use series of measures of ecological properties to calculation final value.
- ◆ 利用一系列生态学指标计算最终价值

Details of Methods

表 14: 森林土壤层蓄水量

植被类型	面积 (hm^2)	土层 厚度 (m)	增加枯 水期水 量比 (t/hm^2)	土壤蓄 水量 (t/hm^2)	增加枯水 期总水量 (万t)	土壤总蓄 水量(t)
针叶林	579	0.4	412.80	1661.40	239011.20	961950.60
阔叶林	198	0.4	540.53	2113.60	107024.90	418492.80
针阔混交林	381	0.4	468.40	1906.60	178460.40	726414.60
灌木林	417	0.4	521.00	1977.80	217257.00	824742.60
乔灌混交林	275	0.4	556.40	2184.60	153010.00	600765.00
空地	617	0.4	120.40	1540.80	74286.80	950673.60

注：增加枯水期水量比、土壤蓄水量数据根据李红云等(2004)所测指标整理。

Details of Methods

- ◆ **Value of Air Purifying** 净化大气
- ◆ **SO₂** 二氧化硫治理
- ◆ **Dust** 粉尘治理
- ◆ **Value of Fixation CO₂ and Generating O₂** 固氮
释氧价值
- ◆ **Cost of planting Trees to Fix CO₂** 造林成本
- ◆ **Cost of planting Trees to generate O₂**

Details of Methods

- ◆ **Value of Erosion Control** 水土保持
- ◆ **Value of Species Diversity** 物种多样性
- ◆ Use data from other's similar researches and estimate by the scale of area.
- ◆ 使用他人研究成果中所计算的数值，按面积比例进行估计。

Details of Methods

- ◆ **Value of Adjusting the Climate** 调节气候价值
- ◆ Calculate the difference between local temperature and urban temperature multiply cost of using air-conditions to lower temperature.
- ◆ 计算当地气温和市内气温差距，乘以使用空调降温的费用

Final Results

Natural Resource 自然资源价值	Timber木材	21.44	4.17%
	Other products: Fruits 林副产品	37.56	7.30%
Ecological Service 生态服务价值	Eco-tourism 生态旅游	292	56.76%
	Water storage 涵养水源	41.89	8.14%
	Carbon fixation and O ₂ release 固氮释氧	13.66	2.66%
	Purify air 净化大气	5.50	1.07%
	Erosion control 水土保持	5.233	1.02%
	Adjust the climate 调节气候	8.883	1.73%
	Diversity of species 物种多样性	88.31	17.16%
	Total 总计	514.472	Million

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