ECONOMIC VALUATION OF BIODIVERSITY

—— A Case Study on Changbaishan Mountain Biosphere Reserve in Notheast China

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——长白山自然保护区案例研究

薛达元 著

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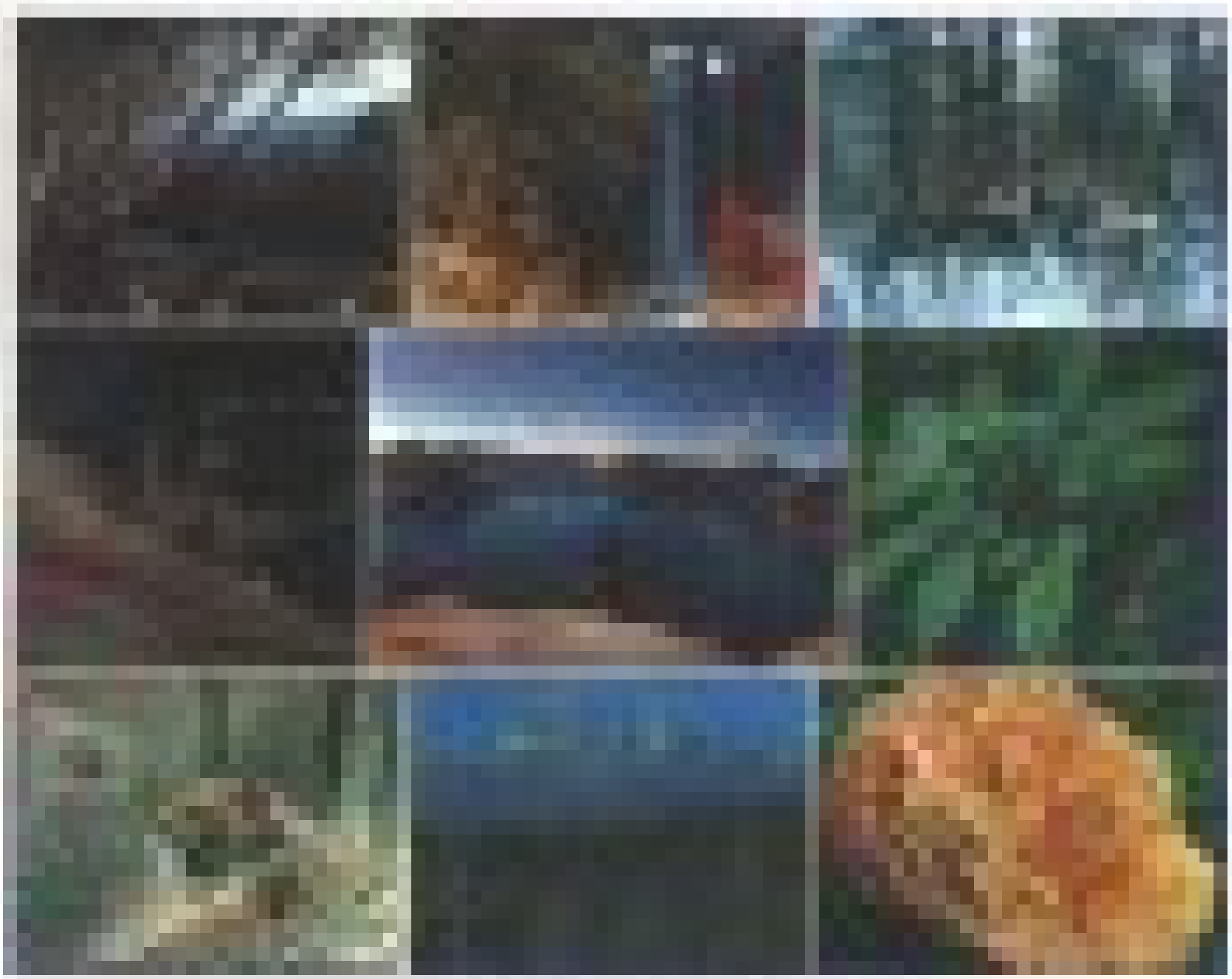

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图书在版编目(CIP)数据

生物多样性经济价值评估:长白山自然保护区案例研究/薛达元著 . -北京:中国环境科学出版社,1997.11
ISBN 7-80135-403-6

Ⅰ.生… Ⅱ.薛… Ⅲ.自然保护区-生物多样性-经济评价-长白山 Ⅳ.S759.992

中国版本图书馆 CIP 数据核字(97)第 22413 号

内 容 简 介

本书在综述大量国内外文献的基础上,系统地分析了生物多样性价值的分类体系和相关的评估方法。根据自然保护区的特点,建立了系统评估自然保护区生物多样性经济价值的方法体系。以长白山自然保护区为案例,具体评估、量化了该保护区生物多样性的直接实物产品价值、直接非实物服务价值、间接生态功能价值以及非使用类价值(包括存在价值、遗产价值和选择价值)。还对全国森林类自然保护区保护效益进行了推导。

本书是有关环境经济学理论、方法和应用实践的研究专著,可供从事生物多样性、自然保护区和环境经济学研究领域的科研教学人员、管理决策人员以及基层自然保护区职工参考。

中国环境科学出版社出版发行
(100036 北京海淀区普惠南里 14 号)
化学工业出版社印刷厂印刷
各地新华书店经售
*
1997 年 11 月第 一 版 开本 787×1092 1/16
1997 年 11 月第一次印刷 印张 11 1/2
印数 1—2 000 字数 280 千字
ISBN 7-80135-403-6/X·1240
定价:19.50 元

摘　要

生物多样性保护和持续利用已成为全球环境保护的热点问题，而生物多样性经济价值评估则是该热点需首先解决的一个基础理论问题，受到国内外的普遍关注。联合国环境规划署要求《生物多样性公约》缔约国广泛进行国情研究，重点评估生物多样性的经济价值。《中国21世纪议程》和中共中央、国务院1992年转发的中办7号文件都提出要进行自然资源的经济价值核算。为此，国内外，尤其是国外的很多学者已进行了许多探索研究。但是，由于自然资源，特别是生物资源的不确定因素太多，生物多样性价值评估的研究进展不大，至今尚无成熟的方法体系，而且国内在非使用价值评估等方面的研究还是空白。因此，生物多样性经济价值评估成为国内外环境经济学研究的难点，不管是对环境经济学的理论发展，还是对国家生物资源管理的决策应用，它都是迫切需要解决的难题，需要很多人的不懈探索。作者正是基于这样一种背景和实际需求，试图通过一个自然保护区的试点研究，对生物多样性经济价值进行系统评估，为解决此项难点进行一次研究探索。

本研究首先分析和探讨了生物多样性经济价值的类型和评估方法。依多数人观点，将生物多样性价值分为使用价值和非使用价值，前者包括直接实物价值、直接非实物服务价值和生态功能的间接价值，后者包括存在价值和遗产价值。而选择价值介于使用价值和非使用价值之间，鉴于其量化方法同于非使用价值，本研究将其归入非使用类价值一道估算。理论上保护区的总经济价值等于各类型价值相加之和。在评估方法方面，根据市场的存在与否及其性质，进行了方法的归纳，并提出系统评估自然保护区生物多样性价值的方法体系，即：对于有市场存在的物品和服务，采用市场价值法、费用支出法、机会成本法等；对于不直接交易的环境偏好，通过观察市场行为而推测其偏好显示或基于替代市场进行评估，使用旅行费用法（TCM）等；对于无市场的公共物品，采用条件价值评估法（CVM），即调查人们为确保自然保护区永续存在的支付意愿（WTP）。

使用市场价值法等对长白山自然保护区的直接实物价值进行了评估。根据市场调查、专家咨询和统计资料查询，对保护区每年产出的动植物资源直接产品其数量和价值进行了评估，得出1996年该保护区直接实物产品市场总价值为8419.57万元，其中木材价值709.61万元，动植物药材价值678.31万元，林副产品（果品、野菜、食用菌、蜂产品等）价值6193.1万元，其他产品（野味、毛皮等）838.55万元。

采用费用支出法、市场价值法、旅行费用法（TCM）及条件价值法（CVM）对长白山自然保护区生物多样性直接非实物价值进行了评估，主要包括科研价值、文化教育价值和旅游价值。科研价值包括基础研究价值、开发研究价值和国际研究价值，主要以科研投资量估算；文化教育价值主要指学生实习基地价值、研究生论文基点价值以及出版物、影视产品的发行价值，亦以投资成本估算；旅游价值包括国内旅游价值和国外旅游价值，前者估算为游客的旅行费用支出、消费者剩余、时间价值和其他花费几项之和，后者仅以旅行费用支出及有关花费计算，将消费者剩余和时间价值忽略不计。计算消费者剩余使用了国

外流行的 TCM 技术，通过全国地理小区划分和游客的现场抽样调查，计算游客出发地小区的旅游率，建立旅游率与其人口、收入、旅行费用及旅行时间等因变量之间的回归模型和"供给-需求曲线"，以实际旅行费用为影子价格，利用不同地理小区间旅行费用的不断增加，求出全体游客的消费者剩余。计算结果表明，1996 年长白山保护区生物多样性直接非实物服务价值为 47674.7 万元，其中科研价值 3550.0 万元，文化教育价值 2194.3 万元，国内旅游价值 12508.0 万元，国外旅游价值 29422.4 万元。

使用市场价值法、影子工程法、机会成本法和替代花费等对长白山自然保护区森林生态系统的功能价值进行了评估。即：根据净生长率标准和标准序列立木林价，估算了保护区活立木生产量及其价值；根据径流量和单位库容建设成本估算出保护区涵养的水量及其价值；以无林条件下土壤侵蚀的总量及其土地废弃的机会价值和其中 N、P、K 养分流失的价值替代森林保护土壤的价值；以碳税法和造林成本法估算森林固定 CO_2、减缓温室效应的价值；还计算了林分持留养分的价值、森林吸收 SO_2 的价值以及森林防治病、虫、鼠害方面的效益。评价结果表明，保护区总的生态功能价值为 176465.94 万元，其中：活立木生产量价值 10777.43 万元，涵养水源价值 69741.2 万元，保护土壤价值 2307.02 万元，固碳价值 87716.6 万元，林分持留养分价值 4338.88 万元，降解 SO_2 和防治病虫害价值 1584.73 万元。

本研究着重研究了长白山自然保护区生物多样性非使用类价值的评估，尤其是存在价值的评估。根据 CVM 技术原理，使用设计的 WTP 调查表，对国内外 1097 位专家和公众进行了问卷式邮件调查，询问答卷人是否愿意为长白山自然保护区的永续存在而支付货币，并表明支付量。调查表总反馈率为 58.8%，其中境内主体样本的反馈率达 64.56%。使用 FoxPro 2.5 b for Windows 软件对反馈信息建立数据库，其统计结果表明，境内样本中愿意支付率达 74.02%，WTP 中位值为 33.30 元。研究还针对答卷人反馈的各种社会经济因素对支付意愿率及其 WTP 值的影响设计了一系列的相关分析试验，并采用列联表分析和 x^2 检验法进行显著检验，得出对长白山了解程度和偏爱程度等数项因素与支付意愿呈显著相关。研究结果还对长白山保护区非使用类价值的组成进行了划分，得出存在价值占 60.7%，遗产价值占 26.15%，选择价值占 13.15%。最后以全国城镇职工为总人口样本对长白山保护区非使用价值进行推导，得出 1996 年该保护区非使用类价值总计为 496500 万元，其中：存在价值 301375 万元，遗产价值 129835 万元，选择价值 65290 万元。研究还分析了偏差因素，并对评估结果进行了分析和讨论。

最后，作者在得出长白山保护区生物多样性直接价值 5.61 亿元和总经济价值 72.91 亿元的基础上，对长白山自然保护区的保护投资与效益、自养开发与效益、保护机会成本与效益等作了分析，得出直接效益为政府保护投资的 263 倍，为木材生产机会成本的 6 倍；总效益为保护投资的 3400 多倍，为机会成本的 75 倍。此外，还以长白山自然保护区经济价值为基础，分别对全国 9 个森林类世界生物圈保护区、64 个森林类国家级自然保护区和全国 551 个森林类自然保护区的直接价值、间接价值和非使用价值进行了推导。

基于上述研究，作者认为：

1. 本研究是对自然保护区生物多样性各类价值进行系统评估的一次有效尝试，研究结果表明，生物多样性的各类价值，包括直接实物价值、直接非实物服务价值、生态功能的间接价值、选择价值、遗产价值和存在价值等都是客观存在的，并具有一定的数值。各类

型价值之间相互依存，并存在一定的重叠和交叉。由于评估方法不同和所选参数各异，各类型价值的可靠性也不一致，且相互差异悬殊，因此，各类型价值之间可比性不强，不宜将各类型价值简单相加为总经济价值。

2. 评价结果体现了保护区生物多样性的价值类型框架和价值量趋势。直接实物价值仅占总价值的 1.15%，说明长白山作为严格的科学保护区，资源的消耗使用受到限制；直接服务价值占总价值 6.54%，说明该保护区在科学、文化和旅游等方面的非消耗性使用价值是其直接效益的主要形式；生态功能价值占总价值 24.21%，说明其森林生态系统的功能健全，它是生态系统类自然保护区的主要特征；非使用类价值占总价值的 68.10%，说明长白山自然保护区在全国具有重要地位，是全国乃至世界的自然遗产，存在意义很大。存在价值数值最大表明它是自然保护区价值的最重要形式。

3. 长白山保护区各类型价值不是固定值，将呈不断上升趋势。由于价值量的估算主要基于 1996 年当年的产品市场价格、科研投资、旅行费用支出等，而这些价格和支出数额都呈逐年上升趋势。另一方面，随着国家经济好转和人们生活水平提高，对保护区科研、文化教育和旅游观光的需求也将增加，表现出价格与需求呈一致变化的趋势。此种趋势符合西方经济学的弹性理论，弹性理论认为价格和需求具有一定弹性，环境舒适类物品尤其如此。因为自然环境的供应是有限的，一旦破坏，不再存在。但随生活质量提高，人们对环境舒适的需求量总是上升的，这必然刺激价格上升。因此，保护区总经济价值将呈不断上升趋势。

4. CVM 对评价保护区非使用价值不失为一种有效的方法，目前也是唯一的方法，虽然评估不可能十分精确，但仍然可以得到一种价值趋势。鉴于 CVM 的不确定因素较多，偏差较大，在应用此方法时要特别谨慎。通过长白山实例研究，得到以下几点体会：

(1) 支付意愿主要与人们的自然保护意识相关，也与支付能力较少相关；

(2) 支付意愿主要与保护区知名度大小有关，与答卷人所在地理区域关系不大；

(3) 支付意愿与人们对被评估物品的了解程度密切相关；

(4) 存在价值的大小与推导的总人口样本大小关系极大；

(5) 存在价值不是一个固定值，它随 WTP 改变而呈动态变化。

5. 总旅游价值应包括旅行费用支出、消费者剩余、时间价值和其他有关花费，这样才能体现消费者的自愿支付总值。仅仅计算消费者剩余显然不足以包括全部游憩价值，因为全部游憩价值应包含消费者支出，消费者支出代表了生产者支出和生产者剩余。

6. 对科学研究和文化教育的价值评估尚没有成熟的方法，仅以投资成本替代其经济价值，可能忽略了科研与文化教育的效益，使价值评估偏低，有待于今后进一步研究。

7. 生态功能的间接价值其范围很广，本研究仅计算了主要几种功能价值，尚有遗传资源价值、调节气候价值、土壤有机质价值、动物栖息价值及野生动物生长量价值等，由于缺乏合适的方法而未作评估，实际上间接价值的潜力很大。

关键词：长白山，自然保护区，生物圈保护区，生物多样性，经济价值，价值评估，直接价值，间接价值，存在价值，遗产价值，选择价值，旅行费用法(TCM)，条件价值评估法(CVM)，支付意愿(WTP)，消费者剩余，生态功能价值，直接非实物服务价值。

Abstract

Conservation and sustainable utilization of biodiversity has become a hot issue in the protection of the global environment, however, how to value economically the biodiversity is a basic theoretical problem of the hot issue to be solved with the first priority, and has now attracted universal attention all over the world. The UNEP calls for all the parties of the Convention on Biological Diversity to conduct Country Studies with emphasis on economic valuation of the biodiversity. *China's Agenda 21* and the Document redistributed by the State Council in 1992 both demanded for checking the economic value of the natural resources. As a result, scholars both at home and abroad, especially those abroad, have carried out much probing research. Yet, it is due to the fact that there are too many uncertain factors concerning the natural resources, and the biological resources in particular, that not much headway has been achieved in the study on biodiversity valuation. There has not yet been any mature methodological system, and what is more, in China, it is still a blank as to how to assess the non-use value. Therefore, how to value the biodiversity has become a hard nut to crack for researchers the world over in the field of environmental economics. It is a difficult problem that urgently calls for solution, which will play a critical role in both development of the environmental economic theories and policy-making of the state for management of the biological resources. Based on such a background and practical needs, the author has been trying to make a systematic valuation of the biodiversity by means of a pilot research on a nature reserve, Changbai Mountai Biosphere Reserve, located in Northeast of China. This is a probing research oriented to break open such a hard nut.

In this research the effort is first given to analyzing and exploring types of the economic values of the biodiversity and their valuation methods. As most people hold, the value of the biodiversity can be divided into two, use values and non-use values. The former includes the direct extractive goods values,. direct non-extractive service values and indirect values of its ecological functions, while the latter encompasses the existence values and bequest values. Option values, however, lie in-between the use values and non-use values. In view of the fact that its quantification method is the same as that for the non-use values, it is included into the non-use values for assessment. Theoretically, the total economic value of a nature reserve should be equal to the sum of the various types values. As for the methodology for valuation, in the research, existing methods have been summed up on the basis whether the market exists or not and what its nature is, and hence, a method system has been brought forth to systematically valuate the biodiversity of the nature reserve. Namely, for marketable goods and services, the market valuation method, cost payment method or option cost method is recommended; for indirectly tradable environmental preferences, by observing their marketing per-

formance to infer exhibition of the preferences or to value on the basis of substitute marketing, the travel cost method (TCM) is suggested; and for public goods that enjoy no market, the contingent valuation method (CVM) is offered, i.e. to make a survey on people s willingness to pay to ensure the perpetual existence of the nature reserve.

The market valuation method is used to value the direct extractive goods values of the Changbai Mountain Biosphere Reserve (CMBR). Based on market investigations, consultations with experts and statistical data, assessment has been carried out of the quantity and values of the direct goods turned out from the animal and plant resources in the reserve. In 1996, CMBR marketed a total value of 84,195,700 yuan (RMB) of direct extractive goods, of which 7,096,100 yuan is of timber, 6,783,100 yuan of animal, plant and medicinal material, 61,931,000 yuan of forest byproducts (fruit, wild vegetable, edible fungi, bee products, etc.) and 8,385,500 yuan of other products (game, fur, etc.).

By using the expense payment method, market valuation method, TCM and CVM, the direct non-extractive goods values of the biodiversity in CMBR is reckoned, covering mainly the scientific research values, culture and education values and tourist values. The first include the basic research values, development research values and international research values which are assessed on the basis of the investment in the researches; the second refer to the values of using it as a base for students to do fieldwork, the values of using it as a basic point for post-graduates to do their dissertations, and the values of publishing CMBR related publications and video products, of which the assessment is also based on the investment cost; and the last ones involve both domestic tourist values and international tourist values, the former is considered as the sum of the tourists' travel cost, consumer surplus, time value and other expenses, whereas for the latter only the travel cost and related expenses are counted, and the consumer surplus and time value are neglected. To calculate the consumer surplus, the TCM technique, popular in some western countries, is used. By dividing the country into small geographic sub-regions and carrying out on-site sampling investigations, calculating the visiting rates to CMBR of the tourists from the starting sub-regions, establishing a regression model between the visiting rates and the variables such as the populations, incomes, travel costs, travel durations of the sub-regions, and a supply-demand curve, using the actual travel cost as shadow price and making use of the increasing cost to travel between different geographic sub-regions, the consumer surplus of all the tourists can thus be figured out. The results show that in 1996, the direct non-extractive service values of the biodiversity in CMBR reached 476,747,000 yuan, of which 35,500,000 yuan is of scientific research values, 21,943,000 yuan of culture and education values, 125,080,000 yuan of domestic tourist values and 294,224,000 yuan of international tourist values.

In this research, the market valuation method, shadow engineering method, opportunity cost method, and substitute expense method are used to value the functions of the forest ecological system of CMBR, namely, based on the standard net growth rate and standard array stumpage, to calculate the output and value of the standing trees in the nature reserve;

based on the volume of run-offs and the construction cost per unit storage capacity, to reckon the volume and value of the water conserved by the nature reserve; to substitute the total volume of soil erosion under barren condition, the opportunity values of desertion of the land, and the values of N, P, K lost as nutrient elements for the value of the forest conserving the soil; to estimate the values of the forest fixing CO_2 and retarding greenhouse effect by using carbon taxation method and afforestation cost method; and also to calculate the values of the forest retaining nutrient elements, absorbing SO_2 and controlling the hazards of pests, insects and rodents. The valuation results reveal that the total ecological function value of the nature reserve is estimatedly 1,764,659,400 yuan, of which, 107,774,300 yuan is of the output of the standing trees, 697,412,000 yuan of water conservation, 23,070,200 yuan of soil conservation, 877,166,000 yuan of carbon fixation, 43,388,800 yuan of nutrient retention and 15,847,300 yuan of SO_2 degradation and control of pests.

This research focuses on the valuation of non-use values of the biodiversity in the reserve and its existence value in particular. In light of the principle of the CVM technology, a willingness to pay (WTP) questionnaire is designed and used for remote survey through mail service on 1097 specialists and common people. The subjects are asked to express their willingness to pay for the perpetual existence of CMBR by indicating the amount of payment. The feedback rate of the questionnaires is about 58.8% and that of the domestic subject copies reaches 64.5%. All the feedback information is processed with the software of FoxPro 2.5b for Windows into a database. The statistical results show that of the domestic subject copies, the willingness-to-pay rate reaches 74.02%, with WTP median value being 33.30 yuan. Based on the effect of the variety socio-economic factors on the WTP rate and the amount, a series of correlation analysis tests are designed, using association table analysis and x^2 test method to check significance. Results show that significant correlationship exists between the willingness to pay and the extent of awareness and preference to CMBR and other factors. The research has also sorted the components of the non-use values of CMBR and find the existence values account for 60.7%, bequest values for 26.15% and option values for 13.15%. In the end, with the country's urban employees as the sample of the whole population, the non-use values of the Changbaishan Nature Reserve in 1996 is deduced as 4,965,000,000 yuan, of which 3,013,750,000 yuan is existence values, 1,298,350,000 yuan bequest values and 652,900,000 yuan option values. Besides, deviation factors are analyzed and the valuation results have undergone analysis and discussion.

At last, based on the research finding that the total economic value of the biodiversity in CMBR, the author further analyzes the investment and benefits of the conservation, self-supporting development and its benefits, and opportunity cost and benefit of the protection of the reserve. The findings reveal that its direct benefits (561,000,000 yuan) will be 263 times as much as the protection investment by government and 6 times the opportunity cost for timber production; the total benefit (7,290,602,100) will be over 3,400 times as much as the investment and 75 times the opportunity cost. In addition, on the basis of the eco-

nomic values of CMBR, deduction is made of the direct values, indirect values and non-use values of the 9 forest-type MAB biosphere reserves in China, 64 forest-type national nature reserves and total 551 forest-type nature reserves throughout the country.

Based on the above-described research, the author holds that:

1. This research is an effective trial on how to do systematic assessment of the various values of the biodiversity in nature reserves. Its findings reveal that the various values of the biodiversity include direct extractive goods values, direct non-extractive service values, indirect values of its ecological functions, option values, bequest values and existence values all exist objectively with a certain numerical value; they depend on and, to a certain extent, overlap and interlace one another. The difference in valuation method and parameters adopted makes the reliability of the resultant values varied, sometimes sharply. Consequently, the comparability of the values of various types is very week, so it is not advisable simply to add up the values to get the total economic value.

2. The results of the valuation reflect the framework of the value types and the trend of magnitude of the values of the biodiversity in nature reserves. Its direct extractive goods values account for less than 1.15% of the total value only, indicating that as a rigorous science reserve, the CMBR restricts consumption of its resources; its direct service values for 6.54%, demonstrating that in the reserve, the non-consumptive use values in the field of science, culture and tourism are the major form of its direct benefits; its ecological function values for 24.21%, showing the sound and complete functions of the forest ecological system, which is the major feature of the category of ecosystem reserves; its non-use values for 68.10%, proving the important position of the CMBR in the country as the nation's and even the world's natural bequest and the significance of its existence. Its existence value has the largest numerical value, indicating that it is the most important form of the values of nature reserves.

3. The various values of the CMBR are not fixed ones, and instead show a steady rising trend, because the reckoning of the values is mainly based on market price of the products, investments in the scientific research, and travel cost in 1996, which, however, show a rising trend with the year. On the other hand, with the improvement of the nation's economy and the living standard of the people, the demand for scientific research, cultural education and tourist sightseeing in the nature reserves grows along a curve similar to that of the price. Such a trend consists with the elasticity theory of the western economics, which holds that both price and demand have certain elasticity, especially for environment amenity goods. Because the supply of the natural environment is limited, once destroyed, it will no longer exist. However, with the improvement of the living quality, people's demand for environment amenity is always rising, which, no doubt, will stimulate the price to go up. As a result, the total economic value of the nature reserves will show a steady rising trend.

4. The CVM can yet be regarded as an effective one to evaluate the non-use values of a nature reserve, and it is an only one at present. Although, the valuation can not be done

with great accuracy, it does show a kind of trend of values. In view of the fact that CVM has too many uncertain factors, and a rather large deviation, one should take special care when applying the method. Through the case-study of CMBR, the author has got the following understanding:

1) The willingness to pay is more closely related to people s awareness of natural conservation than to their ability to pay;

2) The willingness to pay is more closely related to the popularity of a nature reserve than to the geographic location of the subject people involved in the survey;

3) The willingness to pay is closely related to people's awareness of the evaluated objects;

4) The magnitude of existence values is significantly correlated with the size of the sample out of the whole population for deduction;

5) Existence values are not fixed and vary dynamically with WTP.

5. The total tourism values should include travel cost, consumer's surplus, time value and other relevant expenses. Only in such a case, can the total value of the consumer's willingness-to-pay be reflected. Obviously, merely counting the consumer surplus is far from covering the total recreation value, because it should include consumer's expenditure, which represent producer's cost and surplus.

6. Up to day, there has not been any mature method to assess the values of scientific research and cultural education. It is likely to neglect the benefits of scientific research and cultural education, merely by substituting the investment cost for its economic values, and hence, to underestimate its values. More efforts should be given to further research on this topic.

7. The indirect values of its ecological functions cover a much wider range. In this research, only a few function values are counted, with the genetic resource values, climate regulator values, soil organic matter values, animal habitat and animal values for their growing population, etc. are left untouched, because of the lack of applicable methods for their valuation. Therefore, actually the potential indirect values are enormous.

Key words: Changbai Mountain, nature reserve, biosphere reserve, biodiversity, economic value, valuation, direct value, indirect value, existence value, bequest value, option value, travel cost valuation method (TCM), contingent valuation method (CVM), willingness to pay (WTP), consumer surplus, ecological function value, direct non-extractive service value.

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第一章 绪 论

一、有关背景

1. 生物多样性概念

“生物多样性”是一个包括物种、基因和生态系统的概括性术语。McNeely 等将生物多样性简单地表述为“生物之间的多样化和变异性及物种生境的生态复杂性（McNeely 等，1990）。1992 年巴西联合国环境与发展大会通过的《生物多样性公约》将“生物多样性”定义为：“所有来源的形形色色生物体，这些来源除其他外包括陆地、海洋和其他水生生态系统及其所构成的生态综合体；这包括物种内部、物种之间和生态系统的多样性”。

上述定义表明“生物多样性”包括所有植物、动物和微生物的所有物种和生态系统，以及物种所在的生态系统中的生态过程。因此，生物多样性通常被认为有三个水平，即：遗传多样性、物种多样性和生态系统多样性。遗传多样性是指遗传信息的总和，包含在栖息于地球的植物、动物和微生物个体的基因内；物种多样性是指地球上生命有机体的多样化，虽然实际上已描述的仅 140 万种，但已被专家估计在 500 万至 5000 万种之间或更多；生态系统多样性与生物圈中的生境、生物群落和生态过程等的多样化有关。

生物多样性的三个层次之间是相互依赖、密不可分的，尤以生态系统多样性作为物种多样性和遗传多样性的基础与存在保证。生态系统具有极其多样化的类型。根据环境条件和生物区系，地球表面可分为陆地、淡水、海洋、岛屿等生态系统；陆地生态系统又可分为森林、草原、荒漠、冻原等生态系统；森林生态系统又可再分为热带雨林、热带季雨林、常绿阔叶林、落叶阔叶林、针叶林等生态系统；每一森林类型还可按地区、海拔高度、森林结构、群落类型、关键物种及生态特点等再度划分。生态系统内部始终进行着生物物种之间的能量流动以及生物群落与环境之间的物质循环，这是维持物种生存和进化的必要过程。保护生态系统的多样性则维持了系统中能量和物质运动的过程，保证了物种的正常发育与进化过程以及物种与其环境间的生态学过程，从而保护了物种在原生环境下的生存能力和种内的遗传变异度。由此可见，生态系统是由生物群落和生物群落环境这两个最基本的要素组成，而生物群落是生态系统的核心。由于生物群落是由若干生物物种所组成，因而，丰富多彩的生态系统是物种多样性和遗传多样性存在的保证。保护生物多样性的根本措施是建立各种自然保护区，就地保护多样化的生态系统及其生物资源。

2. 生物多样性就地保护

生物多样性保护途径主要有就地保护和移地保护。就地保护是生物多样性保护的根本途径，通过建立自然保护区，保护有代表性自然生态系统、珍稀濒危野生动植物物种的天然集中分布区、有特殊意义的自然遗迹等保护对象所在的陆地、陆地水体或者海域，确