Oceanography Congress 2017: Concept of ecosystem intrinsic value and application in marine environment - Luo Ping Zhang - Xiamen University

Abstract

So far, the foremost popular methods for ecosystem valuation are ecosystem service valuation (ESV), which is predicated on the utility of ecosystem to citizenry instead of on the target value of the ecosystem. After more than 10 years' application, it has been found that all losses of ESV were about 10% of the benefits of human activities. The ecosystem intrinsic value (EIV) is defined as an neutral value of ecosystem within the previous studies that arises from the presence, substance, energy, information, constructions, purposes and processes of ecosystem, but independent with man, man's will and favourites. The valuating method and movements for EIV were established by using the procedures of emergy analysis and eco-exergy analysis from the ecosystem properties, which represents the present value and the externally occupied capacity of ecosystem, respectively. The evaluating approach and procedures of EIV were applied into Xiamen Bay and Pearl River Estuary, China. The results displayed that the EIVs of both ecosystems were around USD 54 million km-2 that were irrespective with their socio-economical levels.

It demonstrates that the EIVs are the target value of the ecosystem and independent of human consciousness, will and preference. The total marine EIV in Xiamen Bay was nearly 30 times of ESV and eight .5 times of the GDP of Xiamen marine industry in 2010. EIV in unit area is more than 10 times of the average global ESV in estuaries, the highest marine ESV. It implies a possible undervaluation to ecosystem value by ESV concept and approach. Due to its under-valuating ecosystem, as a result, ESV may mislead decision-making process and leads to that ecological degradation continues to accelerate. All of these show that EIV is an objective value of ecosystem, a more rational value can just conserve ecosystem by using it and support decision-making towards sustainability. Ecosystem valuation can function a basis of scientific support for decision-making. So far, the foremost popular methods for ecosystem valuation are ecosystem service valuation (ESV), which is predicated on the utility of ecosystem to citizenry instead of on the objective value of the ecosystem. After more than 10 years' application, it has been found that all losses of ESV were about 10% of the benefits of human activities.

In this, the ecosystem intrinsic value (EIV) is defined. EIV is an objective value that occurs from the existence, structures, purposes and procedures of ecosystem, but independent with man, man's will and preferences. The valuating approach and methods used for EIV were developed by using energy approach and thus the methods of emergy analysis and eco-exergy analysis. The EIV calculated by emergy from the substance, energy and knowledge of ecosystem and by eco-exergy from the structure and performance of ecosystem represents the existent value and thus the externally working capacity of ecosystem, respectively. The method and approaches of EIV calculation were useful to Xiamen Bay, China. The results displayed that the marine EIV in Xiamen Bay was 209 billion RMB, with 116

billion RMB of emergy and 92.4 billion RMB of eco-exergy in 2010, nearly 30 times of ESV and 8.5 times of the GDP of Xiamen marine industry in 2010. The EIV in unit area of Xiamen Bay is more than 10 times higher than the average global ESV in estuaries. It implied a possible undervaluation to ecosystem value by ESV calculation, which can mislead decisions-making processes. Comprehensive recognition and systematic evaluation of ecosystem value are important for sustainable decision-making and nature preservation. The most general thought, ecosystem services value (ESV), however, is based on the utility of ecosystems to humans and thus would bias ecosystem value. Here we compared and discussed the concept of ecosystem intrinsic value (EIV), which emphasizes the objective value of ecosystems. A practical approach based on emergy and eco-exergy analysis was developed for evaluating EIV and was then applied in Pearl River Estuary (PRE), a large subtropical estuarine ecosystem in southern China. EIV of PRE was around USD 54 million km−2, which was on the edge of the Xiamen Bay ecosystem, additional subtropical inlet with separate social-economic levels of growth. The consistent values suggest that EIV is independent of human activities. Further, EIV was integrated into two analysis based decision-making processes. Results showed significant decrease of benefits in both decisions by using EIV. Especially, within the case of principal coastal functional zoning in Xiamen Bay, the results by EIV ruled out the function which was accepted by ESV. Together, our results demonstrated that EIV provides stricter and more objective evaluation of ecosystem value and thus is predicted to reinforce current decision-making processes towards more sustainable development and nature conservation. Ecosystem-Based Management (EBM) has expanded global popularity in recent years, but the lack of consensus on its definition has excluded the utilization of a universal operation framework. The large number and sort of principles that structure EBM, and therefore the diversity in perspectives among key management players, has impeded the sensible application of EBM. Agreement on a list of the essential ingredients of EBM is vital to successful application. A frequency analysis of EBM ideologies was directed to spot the Key Principles that presently define EBM, from an inventory of twenty-six principles extracted from a subset of the EBM theoretical/conceptual literature (covering a variety of published sources across disciplines and application types).

Fifteen Key Principles were recognized (in descending frequency of presence within the literature): Consider Ecosystem Networks, Suitable Spatial & Sequential Scales, Adaptive Management, Use of information domain , Combined Management, Investor Involvement, Account for Dynamic Nature of Ecosystems, Environmental Integrity & Biodiversity, Sustainability, Recognise Coupled Social-Ecological Systems, Decisions replicate Societal Choice, Distinct Boundaries, Interdisciplinarity, Suitable Monitoring, and Acknowledge Uncertainty. It also examines the development of EBM principles over time, leading to predictions on the directions EBM will take in the future. The frequency analysis methodology used here are often replicated to update the Key Principles of EBM within the future.

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