

論文の内容の要旨

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論文題目： Trade-off mechanisms between forest ecosystem services and economic activities
based on quantitative value assessment

—A case study in Wuyishan City, China

(定量的価値評価に基づく森林生態系サービスと経済活動の均衡メカニズム研究

—中国ウイ山市を事例として)

Abstract

With a growing body of evidence confirming that ecosystem services support human well-being, trade-offs between ecosystem protection and economic decision-making have become popular topics. Currently, most countries and regions seek ecological and economic win-win situations instead of sacrificing ecology, as has been commonly done in the past. However, achieving a balance between the economy and ecology requires a robust quantitative assessment of various comprehensive indicators, such as ecological benefits, costs, and effects. Because of the difficulties of quantifying the economic contribution of ecosystems and their services, the trade-off mechanisms between ecology and the economy remain poorly understood. Uncertainty of these mechanisms causes unsatisfactory performance in ecological and economic decision-making and precludes the achievement of eco-protection despite the investment of sufficient funds. In this doctoral study, we propose an innovative Management-Stakeholder-Investment (MSI) framework for key issues that are often difficult to quantify in ecological and economic trade-offs.

We comprehensively verified the effectiveness and applicability of the MSI framework by considering a typical ecological and economic conflict in southern China: the conflict between local eco-protection and tea cultivation in the Wuyishan area. We applied the MSI framework to quantify the effect of local ecological policies, the conflicts and needs of stakeholders, and the total economic contribution of the local ecosystems. First, using a variety of methods to quantify public feedback, combined with changes in land-use patterns, we developed a Public Feedback Method (PFM), confirmed the effectiveness of local eco-protection policies, and

quantified the economic benefits of the policies, which were equivalent to \$140 million. Second, by developing Subjective-Objective Combination Assessment (SOCA) methods for conducting the willingness analysis of stakeholder wishes, we calculated a compensation range for tea farmers from \$443/ha to \$2114/ha per year in the tea-removing area for ecological afforestation. Third, we developed the Public Appraisal Method (PAM) to account for the value of ecosystem services. In the Wuyishan area, the value of 28 types of ecosystem services was calculated, and the total value of ecosystem services provided by the local forests was calculated as approximately \$25.7 billion/year.

The MSI framework provides practical guidance for the trade-off process and is of great significance for exploring multi-dimensional trade-off mechanisms. A typical conflict between economic activities and ecological protection in the Wuyishan area permitted the practical verification of the MSI framework. We solved key difficulties in the local trade-off process between ecological protection and economic activity. Under the guidance of the MSI framework, this doctoral study has developed PFM, SOCA, and PAM—three new methods for separately quantifying policy effectiveness, stakeholder needs, and ecological value—to characterize the trade-off mechanisms between ecosystem services and economic activities. This study is thus of great significance for understanding the future coupling relationship between ecosystems and human well-being.