

## Ecological compensation standard for the Hani Rice Terrace System: An eco-functional-oriented improvement

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Agricultural land does not only provide food and fiber, which is important for food security for human beings, but also provides various non-market commodities for export or public use. However, there are also numerous negative impacts of paddy production on the environment. Thus, to encourage farmers to engage in ecological or organic agriculture to provide more ecosystem services, it is necessary to pay farmers for their losses when they alter their cultivation practices. However, most current standards of ecological compensation for paddy cultivation are calculated by separate factors, such as the cost of ecosystem conservation, value of ecosystem services, or willingness to accept eco-compensation. As such, a standard is difficult to achieve for all the stakeholders and there is a lack of operability due to neglected factors. Thus, this study was conducted in the Hani Terrace, which was designated as a Globally Important Agricultural Heritage Systems (GIAHS) in 2010 and World Heritage in 2013, and we calculated the standard of paddy eco-compensation based on the subjective decision-making characteristics of individuals and paddy ecosystem characteristics. This study is based on the opportunity cost that ecosystem services supply with a goal of determining the supply curve for ecosystem services. First, through observation and sample testing, we compared the differences in the value of ecosystem services supplied by two production modes: conventional mono-cropping (use of chemical fertilizers and pesticides) and fish cultivation in rice fields (using half amount of fertilizers and no pesticides). Second, from the perspective of the microeconomic decision-making of individual farmers, we investigated the space distribution of opportunity costs for supplying paddy ecosystem services. Third, from the perspective of the macroeconomic behaviors of farmers, we investigated the relationship between the compensation standard and the eco-environment benefits willingly provided by the farmers. Finally, we combined farmer willingness and the opportunity cost of ecosystem services, and the capacity of the majority to build an ecological-restoration oriented eco-compensation standard for the paddy system. The results indicated that the proportion of farmers converting their mode of production increased with the increase in the compensation payment. When the compensation payment amounted to 3,000 yuan hm<sup>-2</sup>, the conversion ratio of cultivation practices reached 35.74%, the added value of ecosystem services was  $80.77 \times 104$  yuan·hm<sup>-2</sup>·a<sup>-1</sup>, and the required compensation funds was  $91.04 \times 104$  yuan a<sup>-1</sup>. When the compensation payment was as high as 9,000 yuan hm<sup>-2</sup>, almost all farmers (97.12%) were willing to convert their mode of production; the added value of ecosystem services was  $219.49 \times 104$  yuan·hm<sup>-2</sup>·a<sup>-1</sup> and the required compensation funds were  $273.13 \times 104$  yuan a<sup>-1</sup>.