Variations in the Conservation Effectiveness of National Nature Reserves across China from the Perspective of Ecosystem Services

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Abstract

The establishment of nature reserves (NRs) played a vital role in the protection of specific species and ecosystem services (ESs). Most previous studies have examined the effectiveness of protection from the perspective of ESs in a single type of nature reserve. In contrast, few studies have evaluated the protective efficacy of NRs at a national scale and compared the differences in performance among different types of NRs. Therefore, it remains unclear whether all types of NRs are effective in conserving ESs and how their protective effectiveness varies. In this study, we estimated and compared the variations in ESs by measuring ecosystem service values (ESV) across 411 national NRs in China, both considering nine typical types of NRs and their functional zones: core, buffer, and experimental zones. The results showed that: The ESV of NRs followed a non-linear trend, initially decreasing and subsequently increasing. Notably, the ESV per unit displayed a distinct spatial gradient, with higher values decreasing first and then increasing. The ESV per unit presented a spatial pattern with high values in the east and lower values in the west. Compared with forest ecosystem NRs, ocean coastal, inland wetland, and wildlife NRs demonstrated superior efficacy in safeguarding ESs. Furthermore, the decline in ESV within the core, buffer, and experimental zones of NRs has been notably mitigated, with a marked improvement observed after 2010. Our findings also highlight a strong synergistic relationship among different ecosystem services within these NRs. By quantifying the protective effectiveness of various NRs, this study provides a scientific basis for optimizing future formulations targeted at protection and the sustainable management of ecosystem services in China's NRs.

Keywords: conservation effectiveness, nature reserves and functional zones, ecosystem services, trade-offs and synergies, China