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Postprint: Landscape Value Assessment of Qinghai Red Beds and Coordinated Management Model for Landscape-Geological Disasters

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Abstract

Red bed landscapes are distinctive ornamental geomorphological landscapes composed of red beds and their weathered materials, widely distributed worldwide. China is rich in red bed landscape resources, yet concurrently experiences frequent geological hazards such as red bed landslides and collapses. Engineering management of disasters in scenic areas often neglects landscape value, resulting in habitat degradation and resource waste. Therefore, research on coordinated governance of red bed landscapes and geological disasters possesses practical significance. This study, based on the “Basic Research on Red Bed Catastrophe Prevention and Control” project, investigates development characteristics, value assessment, and integrated governance models for red bed landscapes and geological hazards in Qinghai Province. The research first reveals the development characteristics and patterns of red bed landscapes in Qinghai. Through selection of 62 red bed geological heritage sites, it analyzes the developmental patterns and spatial distribution characteristics of red bed landscapes and geological hazards from perspectives of stratigraphic geomorphology, lithology, and structure. A red bed landscape value assessment system is constructed, encompassing 4 criterion layers, 9 first-level indicators, and 24 second-level indicators. Comprehensive evaluations are conducted for three typical red bed landscapes: Xiaqiong Temple, Ashigong, and Kanbula. From four dimensions—esthetic, cultural, and social values, plus landscape quality—the study quantitatively analyzes the impact mechanism of geological hazards on red bed landscape value. Adopting the concept of turning harm into benefit through comprehensive governance, it innovates red bed hazard governance models by constructing a four-element synergistic governance mechanism of “geological genes-climatic habitats-red bed landscapes-red bed hazards”, and proposes five integrated governance models: cultural empowerment, artistic reinforcement, following intrinsic nature, adapting to local conditions, and systematic governance. Landscape-oriented governance is applied to two red bed hazards—the Xiaqiong Temple landslide and

Ashigong collapse—exploring the feasibility of integrated governance models that simultaneously enhance landscape value and leverage disaster prevention effectiveness. The established red bed landscape value assessment system provides quantitative reference for the development and utilization of red bed landscape value, while the integrated governance model offers guidance for research on red bed landscape protection and landscape-oriented management of geological hazards, holding significant importance for advancing the concept of integrated geological landscape-disaster governance.

Full Text

Preamble

Research on Coordinated Management of Geological Hazards and Red Beds Landscape Based on Landscape Value Evaluation in Qinghai Province

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Abstract

Red beds landscapes are distinctive scenic landforms composed of red-colored strata and their weathering products, widely distributed across the globe. China possesses abundant red beds landscape resources, yet these areas frequently experience geological hazards such as landslides and collapses. Conventional engineering mitigation measures in scenic regions often neglect landscape values, resulting in habitat degradation and resource waste. Consequently, research on the coordinated management of red beds landscapes and geological hazards holds significant practical importance. This study, supported by the “Basic Research on Red Beds Disaster Prevention and Control” project, systematically investigates the development characteristics, value evaluation, and integrated management models for red beds landscapes and associated geological hazards in Qinghai Province.

We reveal the development patterns of Qinghai's red beds landscapes through analysis of 62 geological heritage sites, examining stratigraphic and geomorphological characteristics, lithological structures, and spatial distribution patterns of both landscapes and hazards. We construct a comprehensive red beds landscape value evaluation system comprising four criterion layers, nine primary indicators, and twenty-four secondary indicators. This system is applied to conduct integrated evaluations of three typical red beds landscapes: Xiaqiong Temple, Ashigong, and Kanbula, quantitatively analyzing how geological hazards impact landscape values across four dimensions—esthetic, cultural, social value, and landscape quality.

Adopting a “turning harm into benefit” approach to comprehensive management, we innovate red beds hazard governance by establishing a four-element coordinated mechanism encompassing geological genes, climate habitat, red beds landscape, and red beds hazards. We propose five integrated management modes: cultural empowerment, artistic reinforcement, following intrinsic nature, adapting to local conditions, and systematic governance. The feasibility of these models is demonstrated through landscape-oriented remediation of the Xiaqiong Temple landslide and Ashigong collapse, showing how disaster prevention can enhance landscape value. The evaluation system provides quantitative reference for red beds landscape development, while the integrated management models offer valuable insights for landscape conservation and hazard remediation, significantly advancing the concept of integrated geological landscape-hazard management.

Keywords: Qinghai red beds; landscape integration; landscape value evaluation; geological hazards

Note: Figure translations are in progress. See original paper for figures.

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