

# Evaluation of Ecological and biocultural sacred places for the restoration of the Kumamoto earthquake area based on the Green Infrastructure and Eco-DRR (Ecosystem-based Disaster Risk Reduction)

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Japan is one of the most seismically active areas on Earth, accounting for about 20% of global quakes of magnitude 6.0 or greater. The magnitude-7.3 quake hit at a depth of 10km at 01:25 on Saturday 16 April 2016 (15:25 GMT on Friday) in Kumamoto Prefecture in Kyushu region, Japan, and a foreshock earthquake with a magnitude-6.2 at quake hit at a depth of 11km at 21:26 on 14 April in same area. This series of earthquakes was named The 2016 Kumamoto Earthquakes.

We are currently exploring solutions to minimize the impacts of natural disasters and landscape changes by focusing on green infrastructure and ecosystem-based disaster risk reduction in Minamiaso Village in Aso District, Kumamoto Prefecture. The characteristics of forests and green spaces depend on the natural diversity and historical importance of the surrounding area. It is important to understand the process of historical transition with regard to the occurrence of natural disasters in such areas.

In this study, we describe the effects of the location and design of sacred places, such as shrines, with consideration of security against natural disasters, and the ecological and biocultural characteristics of the selected site. Shrine forests are protected and managed in near-natural conditions for purposes of religious worship, and many are located in ecologically rich areas. It was found that shrines tend to be dispersed in certain areas. 68% of shrines have been built on slopes. To investigate the geographical features and their relationship with ecological resources, a continuous green space was generated by forming a buffer between the spaces of forests that include shrines and the surrounding green space. This analysis showed that the main building located on the downward slope shows either a high green preservation function (19.4% of cases) or a low one (38.9% of cases). It was conjectured that this difference derives from the relationship between the entrance path and the steep inclination.

On the other hand, the main building of a Shinto shrine shows an excellent green preservation function when located on a steep upward or downward slope (11.8% of cases). The forests associated with Shinto shrines function as sites of nature worship. Many shrine forests are located in areas considered safe from the effects of natural disasters, and placed under legislative protection by being designated as national or regional monuments of historical value. Shrines have a scattered distribution across the landscape, but are typically associated with specific geographical features such as small hills, springs, streams, and rivers, which are themselves objects of nature worship.

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