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Ecological risk resonance of urbanization and its effect on geohazard disaster in Freetown, Sierra Leone

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As the highest rates of rapid urbanization-associated forest degradation occurring since 2005, Africa is particularly vulnerable to the ecology at preset. On August 14, 2017, a compound geological disaster ruined thousands of fatalities and hundreds of houses destroyed in Freetown, Sierra Leone. Land use changes associated with urbanization may increase ecological risk and subsequent geohazard risk. Land use change (LUC) is considered as the main factor that contributes to geohazard initiation. Thus, we took Freetown as a case study to quantitatively assess the magnitude of the increase in ecological risk associated with LUC. In this study, a series of indices were used to describe land use and ecological risk, including dynamic index, trend and state index, and ecological risk index. Results of this study showed that Freetown had experienced a rapid urbanization process, together with an unbalanced increase in urban land and complex conversion of bare and grass land, from 2007 to 2017. Significantly degenerated forest was converted into urban land, bare land, and grassland, while the ecological risk level increased from low to high. The area affected by the geohazard showed a larger increase in ecological risk than that of the surrounding mountainous area which indicated the attenuation of vegetation to disasters. Results of this study can surely provide scientific suggestion for how to make a balance between urban development and ecological protection for rational urban planning. Ecological protection is required to incorporate into development planning for the disaster resilience and sustainable development of Freetown, as well as other rapidly urbanizing cities in mountainous areas.