Identifying Climate Change Refugia for Hawaii's Vulnerable Endemic Species with a Spatial-Temporal Model in GIS

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Hawaii is a biodiversity hotspot with high levels of endemism. Many endangered species are vulnerable to climate change. The project's purpose is to determine the habitats threatened by sea-level rise (SLR) and identify climate refugia, including habitat loss over time. A spatial GIS model was created with publicly available data, including the combined impact of high wave flooding, passive flooding, and coastal erosion due to SLR. Constraints such as elevation, development, and other unsuitable areas were modeled under four (4) scenarios based on IPCC projections. The model identified fifty-one (51) species whose habitat will be inundated by SLR within this century. Thirty-five (35) potential refugia (16,600 acres across 6 islands) were identified to provide pathways for the migration of these species. The results were aggregated to determine statewide critical habitat loss over time. Total habitat loss was plotted against the SLR scenarios of 0.5 feet, 1.1 feet, 2.0 feet, and 3.2 feet. Regression analysis determined 452 acres of Hawaii's critical habitat potentially lost by 2035. This project indicates that SLR will reduce Hawaii’s biodiversity levels and inundate the habitat of endemic species. The two main takeaways are: adequate refugia could be established for vulnerable endemic species and immediate action is needed to avoid mass extinction of these coastal species. This model can support biodiversity conservation efforts and prioritize protected area management.

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