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ORIGINAL PAPER

Spatial distribution, connectivity, and the influence of scale: habitat availability for the endangered Mona Island rock iguana

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Abstract The Caribbean region is one of the five leading biodiversity hotspots in the world. Analysis of the spatial structure of critical habitats and how it affects endemic species in this region is essential baseline information for biodiversity monitoring and management. We quantified and evaluated the spatial structure and connectivity of depression forests on Mona Island and their potential impact on Mona Island rock iguana habitat, as a framework to assess spatial distribution, connectivity, and the issue of scale in small and widely dispersed habitats. Using IKONOS imagery, we mapped and delineated depression forests at four different scales (minimum mapping units: <100, 100, 500, and 1,000 m), and calculated landscape metrics describing their spatial structure, and connectivity, for each

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map resolution. Our approach resulted in a more detailed map than previously described maps, providing better information on habitat connectivity for iguanas. The comparison of the island landscape mapped at different scales provided evidence on how changing scales affect the output of spatial metrics and may have a significant impact when planning decisions and assigning conservation priorities. It also highlighted the importance of adequate ecological scales when addressing landscape management and conservation priorities. The analysis of landscapes at multiple scales provided a mechanism to evaluate the role of patch detection and its effect on the interpretation of connectivity and spatial structure of suitable areas for species with small and widely dispersed habitats. These methodologies can be applied other species, in different environments, with similar limitations related to connectivity and habitat availability.

Keywords Connectivity · *Cyclura cornuta stejnegeri* · Habitat spatial distribution · Landscape structure · Mona Island · Mona rock iguana · Scale

Introduction

The Caribbean region is one of five leading biodiversity hotspots in the world due to its large number of endemic species, high species to area ratios for plants and vertebrates, and high rate of habitat loss over particularly small areas (Myers et al. 2000). Mapping and analyzing the spatial structure of critical habitats for endemic species in these hotspots provides important baseline information about vegetation types and land cover for biodiversity monitoring and management (Bernknopf and Halsing 2001). Mapping and quantifying habitats in the Caribbean has relied on a variety of methods, principally based on geographic information systems (GIS) and remote sensing (RS) techniques and has been comprehensive for many sites (e.g., Laba et al. 1997; Ramos González 2001; Helmer et al. 2002; World Resources Institute and National Oceanic and Atmospheric Administration 2005; Quiñones et al. 2007). Nevertheless, the spatial resolution of most existing datasets (>15 m pixels) provides limited landscape-level capability for detecting and analyzing small and widely dispersed habitats, which may be especially important for some endemic species and biodiversity conservation in general. Recent advances in the development of imagery with high spatial resolution (e.g., IKONOS, Quickbird) provide excellent opportunities to gain more knowledge on the spatial distribution, connectivity and scale in these habitats.

Landscape-level studies are essential tools for species conservation and management, especially if they address habitat distribution and connectivity (Fielding and Haworth 1995; Henske et al. 2001; Zharikov et al. 2006; Pascual-Hortal and Saura 2007). GIS and RS techniques combined with landscape analysis offer effective approaches for habitat mapping, updating spatial databases, delineation of protection zones, landscape framework planning, and design of habitat corridors (Weiers et al. 2004). Because animal dispersal is highly dependent on the degree of landscape connectivity, there is increasing interest in considering habitat connectivity for landscape management and planning purposes (Pascual-Hortal and Saura 2006). In particular, timely research has been directed to endangered or threatened species which typically exhibit limited dispersal capabilities, low population numbers and dependency for special habitats for breeding or foraging purposes. *Cyclura* iguanas are the most endangered reptile taxon in the world (Alberts 2000, 2004). Their distribution is limited to the islands of the West Indies, with species or subspecies typically restricted to one or a few islands and cays. Due to its severely limited distribution