Mammal conservation in a non-equilibrium world: conflicting results from land-bridge islands and the implications of Pleistocene extinctions

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In situ conservation strives to sustain a provincial biota in an area smaller than the province. Success requires that provincial species richness is currently below the evolutionary equilibrium determined by area, but most studies have implicitly assumed equilibrium conditions, possibly leading to a pessimistic outlook for conservation. Analyses of historical land-bridge islands predict many species extinctions from reserves, but these studies assume both the pre-fragmentation richness of islands and that their current, lower richness is due to fragmentation. I test these assumptions by comparing the island, provincial and interprovincial species-area relationships of terrestrial mammals from nine regions and recognizing that species-area relationships for these islands should rotate around a fixed point. Species extinctions from three archipelagos were greater than expected due to fragmentation alone and so over-estimate species losses from contemporary reserves. Patterns within six archipelagos suggest the current richness of some North American mammal provinces are below equilibrium, likely due to the extinction of mammals and glacial retreat during the late Pleistocene. Non-equilibrium conditions allow reserve richness to be maintained by compensating for decreased immigration rates (i.e. more isolation) by increasing reserve size. Previous studies that implicitly assume equilibrium conditions may have over-estimated the effect of fragmentation on species persistence. Inclusion of the point of rotation of land-bridge islands (SR, AR) in the classical species-area relationship $S=cA^z$, replaces the parameter c, giving $S = SR (Ai/AR)^z$. The degree to which increased reserve area can compensate for decreased immigration will depend on how close the point (SR, AR) is to the current provincial species-area relationship.