Impact of Sea-Level Rise on Florida Key Deer Population Abundance

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Sea-level rise (SLR) due to global climate change is expected to occur and impact the low-elevation Lower Florida Keys (LFK). The Florida Key deer (Odocoileus virginianus clavium; hereafter Key deer) is an endangered white-tailed deer subspecies endemic to the LFK and one of several local endemics likely to be negatively impacted by SLR due to loss of habitat. Adding complexity to the issue, the Key deer has experienced recent population declines due to an outbreak of New World screwworm (Cochliomyia hominivorax) and the destruction caused by Hurricane Irma. We created a compartment model using available data of extant Key deer demographic, habitat and environmental data. This allowed us to broadly determine potential impacts on the Key deer population in the face of hypothesized SLR scenarios (amount of habitat lost to inundation at different levels of SLR) at different time scales (2040, 2070, 2100). In order to comprehensively model potential scenarios and account for recent population fluctuations, we used high (pre-population decline) and low (30% population decline) starting population abundances, various intrinsic growth rates (stable, declining, or increasing), and different rates of environmental catastrophes (e.g., hurricanes and diseases). Best case starting variables that included high starting population, high intrinsic growth rate, and low probability of catastrophe resulted in population declines over all hypothesized levels of SLR (2040: 17–24% decline, 2070: 25–64% decline, 2100: 39–91% decline). Various combinations of reduced starting population abundances reduced intrinsic growth rate and increased probability of catastrophes had relatively little impact on population abundance declines (often within 5–15% of best case) under all SLR scenarios. However, an increase in hurricane abundance did result in decreases in population abundance in the near- and long-term under low SLR scenarios (20–40% lower than best case scenario). Impacts increased dramatically when SLR was removed from model simulations; indicating inundation of habitat was the primary driver of population change. Our model indicates that widespread loss of habitat will cause decreases in population abundance in the near-term and these decreases will continue in the long-term due to SLR. This is likely to be exacerbated by an increase in hurricane intensity or frequency over the same time period.