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Exploring the Holocene Evolution of the South Texas Coastal Zone

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The South Texas Coastal Zone, consisting of Padre Island and the adjacent South Texas sand sheet, represents one of the largest undeveloped coastal landscapes in the world. The central segment of the island is sub-aerially connected to the mainland via an expansive sand flat that is occasionally flooded by wind-driven tides. If Padre Island and the South Texas sand sheet are genetically linked, this region could represent one of the largest coastal transgressive dune fields in the world. Thus, the sand sheet would presumably contain a rich chronology of Holocene evolution directly related to climate and sediment supply during and after the formation of Padre Island. This research considers the South Texas Coastal Zone as a unified sedimentary compartment, and discusses patterns present in morphometric and geophysical data suggesting these two large systems are intrinsically linked. Statistical analysis of aerial LiDAR and electromagnetic induction (EMI) surveys reveal discrete assemblages of landforms and sub-surface framework geology co-located on seaward and landward sides of Laguna Madre (the bay that divides Padre Island and the sand sheet). The co-located assemblages suggest multiple phases of aeolian activity where vegetation assemblages and sediment availability control the activation of contemporary dune systems on the back barrier and sand sheet. We propose that the sand sheet was active during arid periods. Conversely, large areas of the landscape were stabilized by colonizing vegetation when humidity was greater. In addition to changing climate conditions, the location and evolution of the sand sheet is believed to be controlled (in part) by a network of previously inferred paleo-channels. The topographic low landward of the central portion of the island occurs in the same region as the paleo-channels and may represent a relict Quaternary fluvial-deltaic system.