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Barrier island migration over bedrock and implications for climate change adaptation.

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A 90-km-long, semi-continuous line of sand and gravel beaches and associated aeolian deposits on the exposed coast of the Outer Hebrides of Scotland is identified as a barrier island system. Individual islands comprise sand beaches and dunes (machair) backed by tidal basins or remnants of a back-barrier lagoon. The barrier islands are separated from each other by tidal inlets or stream outlets. This system rests on a planar bedrock surface(a strandflat) on which topographical irregularities strongly influence both plan- and profile morphology of the barrier island system. The result is a highly variable island chain with marked differences between adjacent islands. In depressions on the bedrock surface, a shoreface is present whereas on elevated sections the beachface rests directly on bedrock. Topographic highs influence the planform morphology by providing fixed points for development of headland-embayment cells, tombolos and salients. The system evolves by barrier migration in which the sediment volume is preserved but is redistributed onshore and alongshore, creating spatially variable evolutionary patterns in response to underlying topographic variability; the past and future evolution of the system under relative sea level rise is strongly influenced by the bedrock surface morphology. Human activities are threatened by ongoing migration but the adaptation strategies being proposed threaten the future sustainability of the island system