On the eastern side of the estuarine zone is a narrow strip of islands that act as a dam between the estuaries and ocean (figures 1-2 and 1-11). They are called barrier islands because they are separated from the mainland by major water bodies.

This extensive strip of sand islands was produced by the interaction between high-energy ocean storms and the low-sloping coastal plain. As you saw in figure 1-11, the sand dam is broken by a series of small openings commonly called inlets or outlets. However, barrier islands are like icebergs, with only a small portion rising above the sea surface and the greatest portion hidden below sea level. The barrier island is perched on the top of a foundation called the shore face, which slopes steeply to between twenty-five to seventy feet below sea level. The ocean bottom then flattens onto the inner continental shelf (figure 1-13), the underwater or drowned portion of the coastal plain. The ocean side of a barrier island functions as an important energy-absorbing surface for wave, tidal, and current energy along the ocean margin.

On the Outer Banks, barrier islands can be divided into two basic types. A simple overwash barrier island occurs in a section of the coast where there is little sand available to form the island (figure 1-13A). These islands are sediment starved and have relatively low elevations and narrow widths. Complex barrier islands are sediment rich with abundant sand available to form a wide and high island with tiers of beach ridges and dunes stretching back from the ocean front (figure 1-13B). Natural barrier island processes will affect simple overwash islands differently than wide complex barrier islands, as indicated in the aerial photographs of Pea Island (figure 1-14) and the effects of Hurricane Isabel on Hatteras Island (figure 1-15).

Storms are important in maintaining the barrier islands. Ocean waves erode beaches and produce overwash that builds barrier island height and width. The upper panel in figure 1-14 shows a major overwash in which the energy of Hurricane Isabel transported large quantities of sand from the ocean side across the island all the way to the sound side. This event demonstrates the natural process of island building, in which overwash adds height to the island and builds the sound-side shore that becomes the new back-barrier marsh ecosystem. In addition, storms open inlets in weak portions of the barrier and build flood-tide deltas into the estuary with the eroded sands from the barrier. This adds width to the back side of the barrier upon which the barrier can migrate through time (figure 1-15). Over a long period of time, as the ocean shoreline continues to erode and recede, the overwash and inlet processes cause the island to gradually roll over itself, slowly moving toward the mainland.

A high and wide barrier island contains large volumes of sand in the form of beach ridges and back-barrier dune fields that prevent inlets from forming and overwash events from flowing over the island. Examples include Kitty Hawk Woods (figure 1-16), Nags Head Woods, Jockey’s Ridge, and Buxton Woods. Small-scale overwash occurs only locally along the active beach zone.

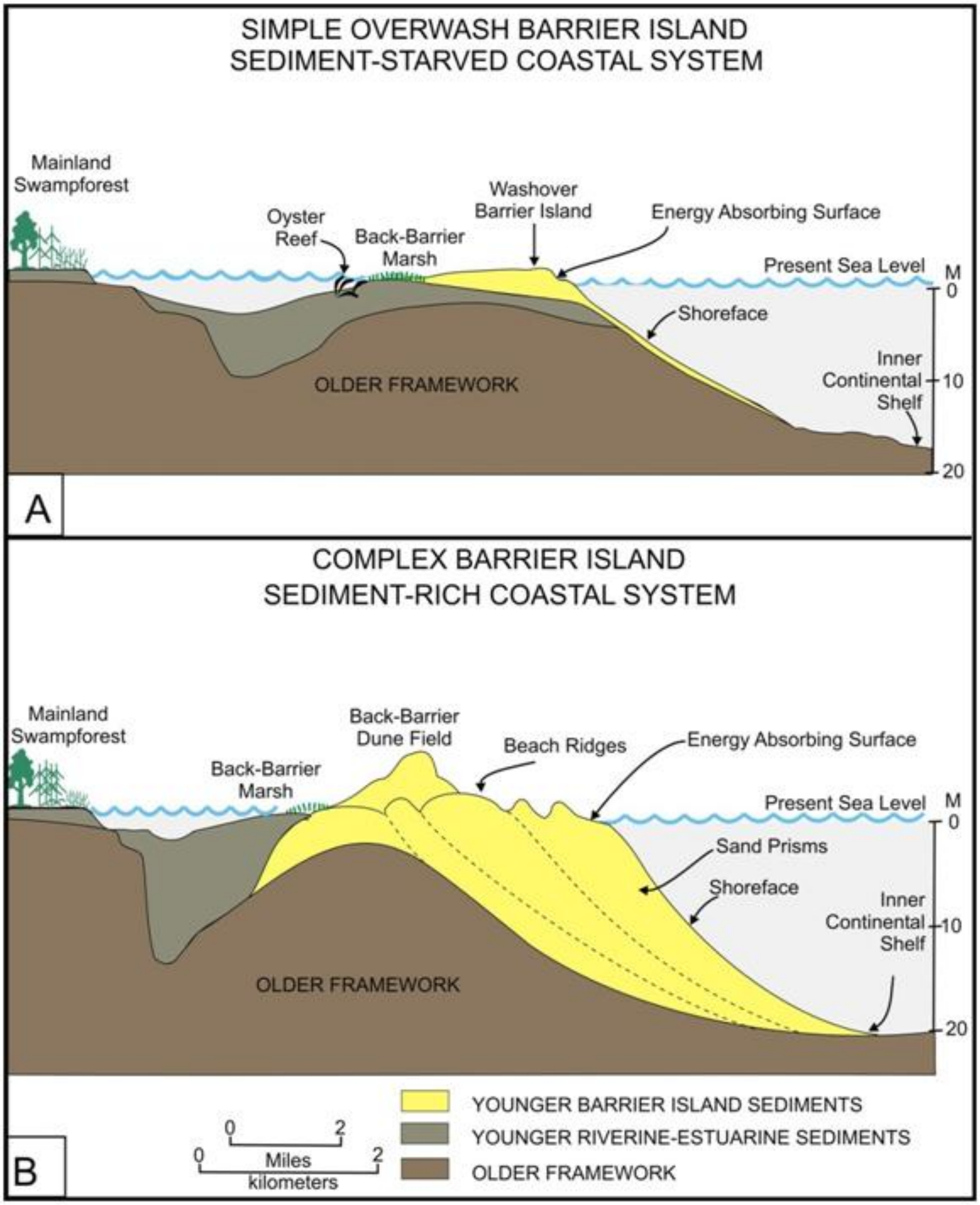

Figure 1-13. **Schematic cross-sectional diagrams show a simple overwash (Panel A) and complex barrier islands (Panel B) and the associated back-barrier estuarine shorelines. The older framework sediments on the Outer Banks are Pleistocene in age (> 10,000 years), while the younger sediments are all Holocene in age (< 10,000 years). Figure 4-5-1, p. 50 in Riggs and Ames (2003).**

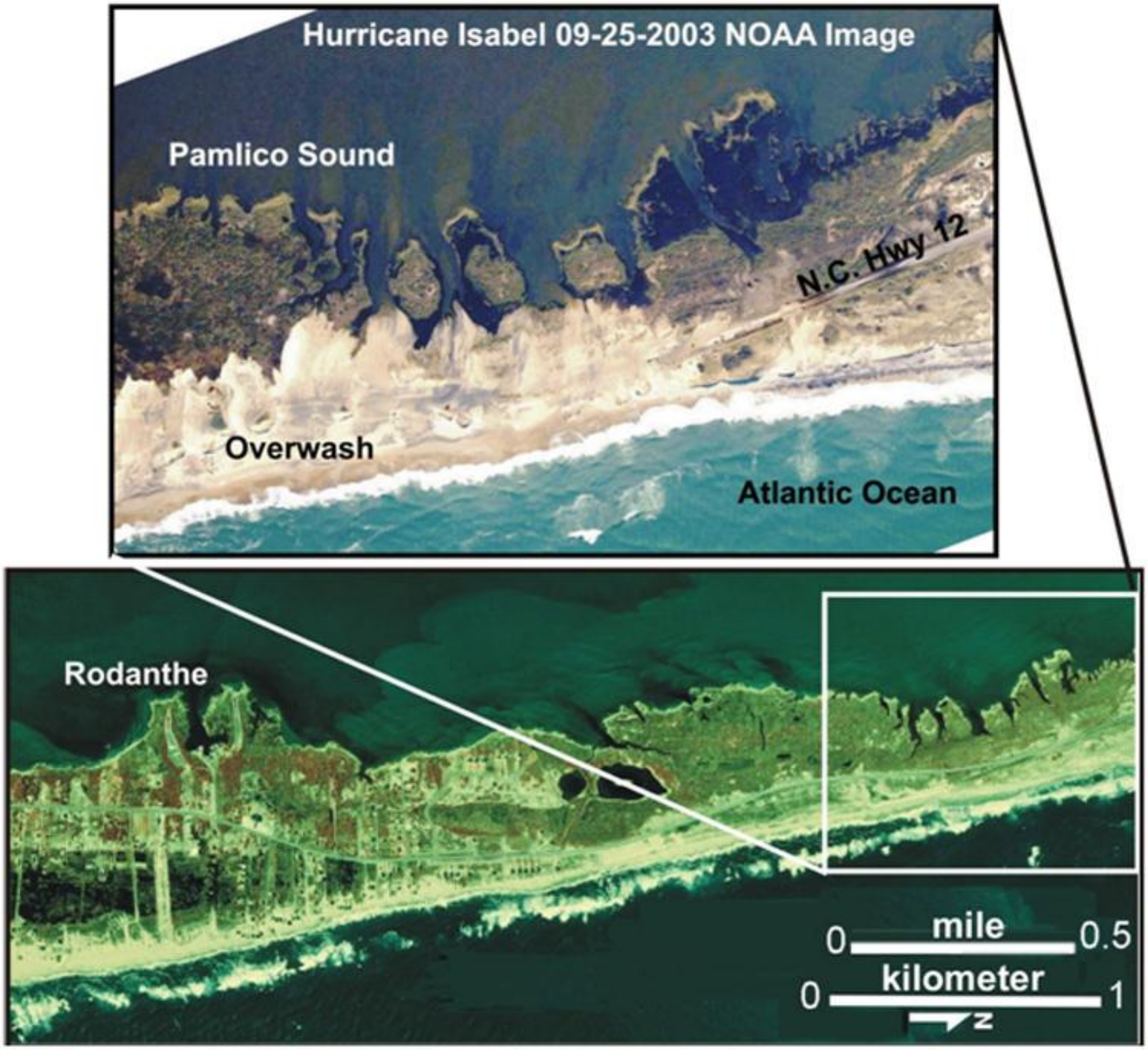

Figure 1-14. Pea Island aerial photographs show a segment of simple overwash barrier island just north of Rodanthe. The bottom panel is a 1998 aerial photograph of Pea Island with a box indicating the area in the NOAA 2003 post-Hurricane Isabel aerial photograph in the upper panel. Hurricane Isabel caused extensive overwash that buried N.C. Hwy. 12. The overwash sands add critical elevation to the barrier and width if the overwash sands are carried across the island to the estuarine side. Many houses in north Rodanthe were either destroyed or severely damaged in this storm.

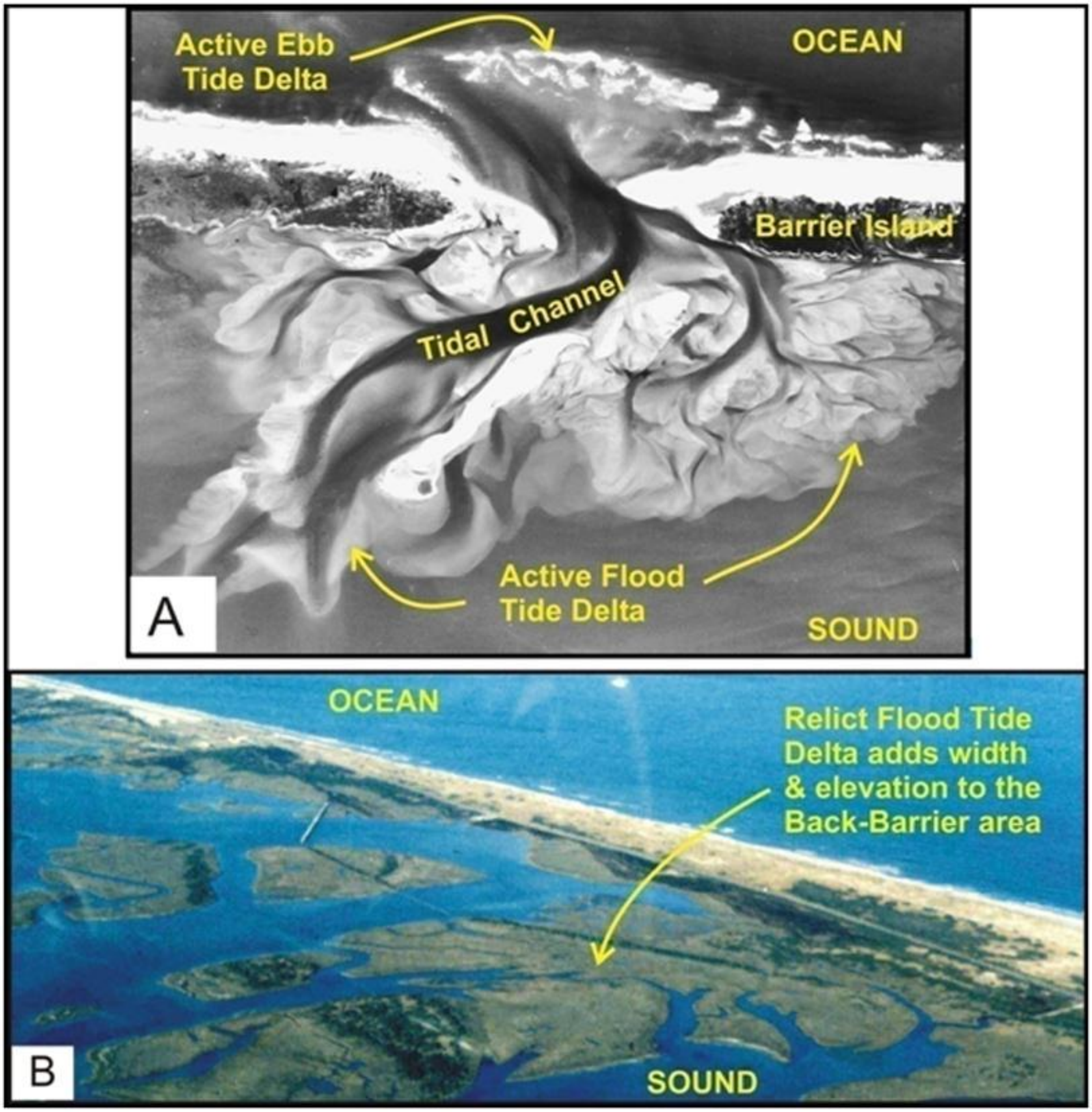

Figure 1-15. Panel A. The 1943 aerial photograph of Drum Inlet shows the separation of North and South Core Banks with extensive sand shoals associated with the tidal deltas. The ebb tide delta forms on the ocean side and the flood tide delta on the sound side of the barrier island. The deltas are formed by the deposition of sand sediment when the strong inlet tidal currents transporting the sand enter the adjacent ocean and estuarine water bodies. Panel B. This is a 1992 oblique aerial photograph of New Inlet flood-tide delta. The inlet closed in 1945 and all sand shoals have subsequently become vegetated by salt marshes. Notice the historic New Inlet Bridge that is still visible across the marsh.

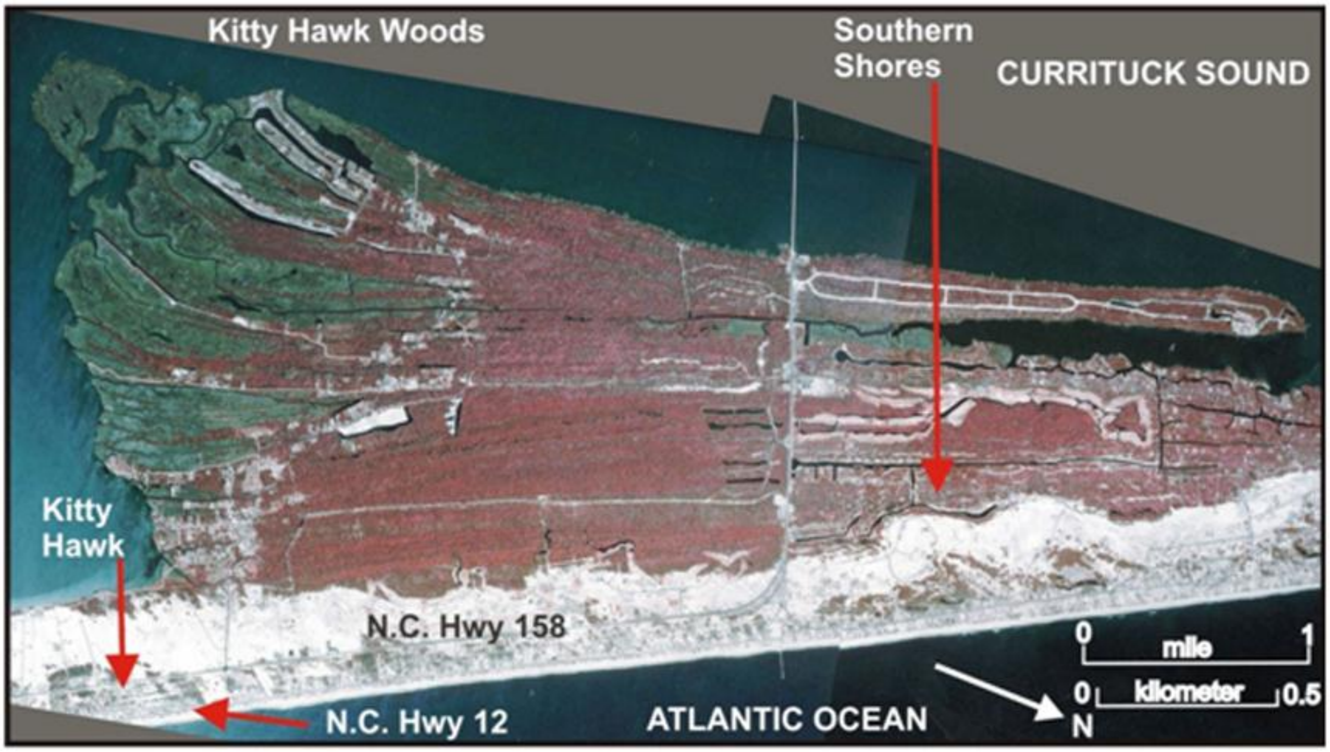

Figure 1-16. A 1982 infrared aerial photograph of Kitty Hawk shows the extensive sequence of beach ridges that constitute Kitty Hawk Woods. This is an example of a complex barrier island. The red color in this false color image taken in the winter, is photosynthesizing plants (e.g. pines, bay trees, live oaks etc.), whereas the gray-green color represents the marsh grasses. The white zone west of N.C. Hwy. 158 is a series of slightly developed back-barrier dunes, whereas the white zone east of N.C. Hwy. 158 is the highly developed active beach. Figure 4-5-3, Panel A, p. 52 in Riggs and Ames (2003).