



**RICHARD
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FACTS OF THE MATTER

Beaches change constantly as sand comes and goes

A beach seems constant from day to day, yet it is an ever-changing river of sand. On a geologic time scale the life of a beach is like a fruit fly in our human time scale.

Contrary to our daily perception of the beach as a static pile of sand, there is constant movement along shore, onshore and offshore and between foreshore and backshore.

The beach is a system in dynamic equilibrium between input and output. Input comes from streams that carry the weathered remains of rocks from highlands and waves that bring coral and shell fragments from offshore reefs.

Output happens as breaking waves move sand parallel to shore up and down the beach face in a zigzag pattern until it encounters a rip current that carries it out and deposits it beyond the breaker zone.

High tides and storm waves reach farther up the beach face and move larger sand grains, steepening the beach slope and moving sand offshore.

Waves in the breaker zone carry sand to the beach from offshore where it moves in the longshore current.

There is seasonal movement of sand onshore and offshore. Larger waves move sand off the beach and deposit it offshore. Smaller waves move the sand back onto the beach.

Onshore and offshore movements deposit broken fragments of offshore reef onshore, adding to the input budget of the beach.

In an ideal world where all of the factors that influence input and output of sand were constant, all beaches would remain in a constant state of dynamic equilibrium. In the real world there are too many variables such that no beach ever reaches a complete equilibrium, at least not for long.

Taken as an average over long time periods, input equals output, but in the short term either input or output might dominate, leading to the growth or decay of the beach. Over time we might see large gains or losses of sand as the equilibrium shifts from an input-dominant to output-dominant system.

Over millennia a graph of sand volume would look like a stock market chart with lots of irregular ups and downs, some large, some small, with some long-term spurts of alternating growth and decline. This is perfectly normal and reflects nothing more than natural variations in input and output, which are disturbing in the short term.

This is of little solace to property owners who find the shoreline encroaching on their house or hotel. In the past the reaction was to build groins or sea walls that change the dynamics of the beach over a short frontage. This always leads to unfavorable changes to someone else's property downstream.

Problems with beach erosion are aggravated by interventions that disrupt the input of sand. These include channeling of streams, landscaping and construction that limit erosion in the highlands, destruction and death of reefs, and dredging of harbors.

Several projects have replenished Kuhio Beach in four decades of personal memory by bringing in sand from elsewhere. As much as 100,000 cubic yards has disappeared since 1951. Some of this is now being put back into the system by the current offshore dredging, which represents a more sustainable approach to beach management.

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Sand reclamation, like that being done now in Waikiki with sand pumped in from offshore, is a better alternative than many other attempts to deal with the ebb and flow of the quantity of sand that rings our shorelines.