

give passage to its waters, rushes with a steep fall through the arch. During the ascent of the tide, a body of fresh water, flowing down in an opposite direction from the higher country, is arrested in its course for several hours; and thus a large lake of brackish water is accumulated, which, when the sea ebbs, is let loose, as on the removal of an artificial sluice or dam. By the force of this retiring water, the alluvial sediment both of the river and of the sea is swept away, and transported to such a distance from the mouth of the estuary, that a small part only can return with the next tide.

It sometimes happens, that during a violent storm a large bar of sand is suddenly made to shift its position, so as to prevent the free influx of the tides, or efflux of river water. Thus about the year 1500 the sands at Bayonne were suddenly thrown across the mouth of the Adour. That river, flowing back upon itself, soon forced a passage to the northward along the sandy plain of Capbreton, till at last it reached the sea at Boucau, at the distance of *seven leagues* from the point where it had formerly entered. It was not till the year 1579 that the celebrated architect Louis de Foix undertook, at the desire of Henry III., to re-open the ancient channel, which he at last effected with great difficulty.\*

In the estuary of the Thames at London, and in the Gironde, the tide rises only for five hours and ebbs seven, and in all estuaries the water requires a longer time to run down than up; so that the preponderating force is always in the direction which tends to keep open a deep and broad passage. But for reasons already explained, there is naturally a tendency in all estuaries to silt up partially, since eddies, and backwaters, and points where opposing streams meet, are very numerous, and constantly change their position.

Many writers have declared that the gain on our eastern coast, since the earliest periods of history, has more than counterbalanced the loss; but they have been at no pains to calculate the amount of loss, and have often forgotten that, while the new acquisitions are manifest, there are rarely any natural monuments to attest the former existence of the land that has been carried away. They have also taken into their account those tracts artificially recovered, which are often of great agricultural importance, and may remain secure, perhaps, for thousands of years, but which are only a few feet above the mean level of the sea, and are therefore exposed to be overflowed again by a small proportion of the force required to move cliffs of considerable height on our shores. If it were true that the area of land annually abandoned by the sea in estuaries were equal to that invaded by it, there would still be *no compensation in kind*.

The tidal current which flows out from the north-west, and bears against the eastern coast of England, transports, as we have seen, materials of various kinds. Aided by the waves, it undermines and sweeps away the granite, gneiss, trap rocks, and sand-stone of Shetland, and removes the gravel and loam of the cliffs of Holderness,

\* Nouvelle Chronique de la Ville de Bayonne, pp. 113. 139. 1827.