

WIND-TIDAL FLATS AND WIND TIDES
OF THE SOUTH TEXAS COAST

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The following is a compilation of comments, explanations, and definitions from the literature concerning the "wind-tidal flats" and "wind tides" of the south Texas coast.

WIND-TIDAL FLATS

1). Wind-tidal flats are environments characterized generally by flat, barren, relatively featureless terrane less than 3 feet above mean sea level. Wind-tidal flats on the eastern side of Laguna Madre principally occur on sediments (sands) transported into Laguna Madre from Padre Island by wind and storm-surge tides. On the western side tidal flats occur along the mainland margin where southeasterly winds have deflated older eolian deposits, as well as Pleistocene barrier-strandplain and deltaic deposits. Wind-tidal flats containing extensive algal mats occur principally to the west of the Gulf Intracoastal Waterway. Wind-tidal flats are flooded rapidly, usually by northers or the prevailing southeasterly wind regime (Brown et al., 1977, p.63, much more extensive information available in this publication on wind-tidal flats, including figures, maps, etc.)

2). Wind-tidal flats: -1' to +2' MSL, exposed or submerged by wind or tide action, sand or mud substrate; bluegreen algal mats, bacteria, algae, protozoans in substrate, burrowing mollusks and crustaceans, hermit crabs, killifishes, shorebirds (General Land Office, 1975, map unit on Map 6B- Biological Resources Map; this map and several others within this publication have wind-tidal flat information and distribution along the Texas coast)

3). The following categorical information on wind-tidal flats is from the Division of Natural Resources University of Texas at Austin (1973):

Definition - Wind-tidal flats

These extensive flats occur primarily on the back sides of barrier islands south of St. Joseph Island and on the landward side of the Laguna Madre from mean sea level to about plus three feet. These areas are sandy, although they become muddy in depressed areas in the "land cut" portion of coast immediately south of Baffin Bay. Flats are flooded by wind-driven lagoon and bay water either during northers, or by persistent southeasterly spring and summer winds. Because of the intermittent tidal inundation and extreme temperatures resulting in the thin sheets of water, biologic activity is restricted primarily to felts or mats of

blue-green algae with diatoms, green algae, bacteria, protozoans and round worms.

If the sediment is stabilized sufficiently, if the rise and fall of tides are favorable, and if enough moisture is available from the nearby saltwater marsh as percolation or from rainfall or other sources, a considerable and characteristic floral assemblage develops composed largely of Myxophyceae as Lyngbya confervoides. Very few organisms are capable of adapting to this harsh environment, but L. confervoides often constitute eighty percent of the living community. Other blue-green algae of the genera Oscillatoria, Microcoleus, Schizothrix, Phormidium, and Anacystis, are present but not abundant. Unicellular green algae, flagellates, diatoms, pink and purple bacteria are occasionally found. The bacteria Desulfovibrio spp. and Beggiatoa spp. have also been observed in this blue-green algal biotope. Large amounts of carbon are fixed by the mat system constituting this biotope. It is probable that considerable nitrogen fixation occurs.

The biota play an important role in the maintenance of the mat. The grazing action of dense populations of water bugs and the carnivore action of Cyprinodon sp. on animal consumers of the blue-green mats are part of internal regulating machinery that permits the biotope to hold its organization. The algal mat may restrict oxygen movement in the sediment which then becomes anaerobic and black. In addition to the blue-green algal flat, assemblages characteristic of the sand flat biotope may be present.

Use Factors

The major factor in wind-tidal flat areas which is critical from a use standpoint is the frequent wind-tidal and hurricane flooding. Any activities should be designed to cope with this factor. These areas are analogous to "buffer zones" where hurricane surge tides expend some of their energy before rising over higher land areas.

Another factor of importance is the high concentration of halite (sodium chloride), gypsum, calcium sulfate, and hydrogen sulfide often present in wind - tidal flat sediments. These compounds are toxic to the growth of higher plants, and thus render the areas unsuitable for agricultural and similar uses.

The sandy sediments of wind-tidal flat areas are moderately permeable, and thus are potentially capable of transporting pollutants downward into local aquifers.

Beneficial Uses

As noted above, the extreme physical and chemical properties which exist preclude most human uses. However, uses such as well development and placement of platforms for hydrocarbon production purposes, as well as other properly engineered construction, are permissible, as long as improperly treated wastes are not discharged into adjoining bay-estuarine areas or directly onto the wind-tidal flat sediments.

Detrimental Uses

Construction of buildings and highways should be discouraged because of frequent tidal flooding and potential hurricane damage. Channeling and piling of spoil in these areas can cause impoundment of large volumes of runoff water following hurricane rains.

The disposal of improperly treated solid and liquid wastes is harmful in these areas because of the potential pollution of local aquifers and the bay-estuarine ecosystem.

4). Wind tidal flats are broad flats covered at irregular intervals by lagoon or bay waters under the influence of wind-generated tides (Hayes and Scott, 1964, p. 239)

5). In reference to the Land-Cut area of the Laguna Madre, Shepard and Wanless (1971, p. 245) state that the "...central section of Laguna Madre is ordinarily dry." They also note that these flats are "rarely flooded" (p.246).

6). Broad barren sand flats that are low lying and alternately flooded by ponded rainwater and inundated by wind-driven bay water are termed wind-tidal flats (Morton and McGowen, 1980, p.130, from Fisk, 1959).

7). Wind tidal flat - a broad, barren flat bordering a lagoon or bay and is inundated at irregular intervals by lagoonal or bay waters under the influence of wind generated tides (Hayes, 1965).

8). Another term occasionally used synonymously with wind-tidal flats is "sabkha". Tolbert (1985, p.2) explains that this term is derived from an Arabic word used to describe salt flats or salt marshes; in the literature, the term "sabkha" is used to describe an arid environment where topography is controlled by the water table, and where evaporation exceeds precipitation, causing ground water salinities to increase beyond that of seawater.

9). Wind-tidal flats are generally bay-margin environments periodically inundated by wind and stormtides (White and Galloway, 1977, p.14).

10). Wind-tidal flat - an extensive, nearly horizontal tract of land in a very low-lying coastal area that is flooded primarily by wind tides (Weise and White, 1980, p.89 & 90).

Extensive barren flats on the periphery of Laguna Madre that are subject to flooding by wind tides are called wind-tidal flats. In the Land-Cut Area of Laguna Madre, wind-tidal flats occupy the entire lagoon (Weise and White, 1980, p.57).

WIND TIDES

1). "Wind driven tides may flood as much as 200 sq.mi. of low-lying lagoonal margin" within the Kingsville Area (Brown et al, 1977, p.24).

"Wind-tidal flats are flooded rapidly, generally by northers or the prevailing southeasterly wind regime" (Brown et al., 1977, p.63).

Flooding from wind tides can be localized on the flats and is a "function of the duration, intensity, and direction of the wind" (Brown et al., 1977).

2). Strong winds, accompanied by spring tides and a barometric low can create tides 2-3' higher than those produced solely by astronomical conditions (McGowen et al., 1977).

3). Copeland and Thompson (1968, p. 199) note that wind-driven tides will cover "normally dry land" within the Laguna Madre.

4). Wind tide* - a rise in water level on the downwind side of a body of water, such as a lagoon, caused by the force of wind on the water surface (Weise and White, 1980, p.90);

More important than astronomical tides in the Padre Island area are wind tides; wind tides are produced when strong and steady winds elevate the water surface, flooding areas of low elevation (eg. wind-tidal flats) (Weise and White, 1980, p.38).

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