

## Subsidence: An Important Factor

Subsidence is the sinking of the land surface caused by a number of factors, including compaction of young sediments, removal of mineral resources from beneath the surface, faulting and warping of the earth's crust, and artificial drainage of the land, which causes physical compaction and oxidation of organic matter (See BTNEP Video [Clip Four](#)). Louisiana's coastal zone is very flat, so even a slow rate of land subsidence can result in large-scale disappearance of marshlands if no additional sediment is provided. The lowering of land that occurs in Louisiana can be divided into two general categories: tectonic subsidence and compaction subsidence.

Tectonic subsidence refers to the large-scale downward geologic displacement caused by sedimentary loading and associated settlement process. This type of subsidence is directly linked to the Mississippi River system, which built the Louisiana deltaic plain during the last 7000 years. Beneath the present active delta as much as 1000 feet of sediments have accumulated, with land subsidence rates estimated at 5 to 10 feet per century. Away from the active delta the rate decreases.

The compaction aspect of subsidence is attributed to a variety of causes including overlying weight, subsurface withdrawal, and dewatering. Examples of overlying weight include physical features such as natural levees, man-made levees, buildings, spoil mounds, and even marsh buggy traffic. The net consequence of this overlying weight is the localized surface sinking as sediments are compressed.

Surface withdrawal of oil, gas, and groundwater also contributes to subsidence. The water table is at or near the surface on a wetland environment. When it is lowered because of drainage activities, the dewatered upper soils or sediments are subjected to oxidation, soil shrinkage and wind erosion. Although "natural" factors, such as marsh burning, have been cited as causing soils to dry out and subside, it is primarily human efforts related to urban expansion, agricultural drainage and reclamation, and flood control that have led to widespread localized surface subsidence.

There are two types of subsidence.

1. **Surface subsidence:** This type of subsidence, i.e., soils near the surface sinking, was not a problem in the not too distant past. Though subsidence has always occurred in the delta, each year's high water would overtop the low, natural levees and spread new soil across the river's floodplain. In most

places, the river added more soil than that which had subsided during the year. This resulted in net growth of the delta, so subsidence was not considered a villain, but just a natural process (See Activity: Subsidence Made Simple).

2. **Geologic subsidence:** This is subsidence caused by events deep in the earth. The delta consists of great quantities of sediment laid down over a great layer of salt (called the *Louann salt*) located some five miles below the surface. Huge chunks (fault blocks) of this salt (usually in the shape of polygons) subside, thus causing the surface to subside. Below a line running between New Orleans and the northwest side of Houma, the rate has been 3–4 in per century. This is a phenomenon that is out of human control.

Historically, annual floods over the banks of the Mississippi River provided the freshwater and sediment inputs needed to keep the marshes above water. Leveeing the river, which was necessary to protect our communities from the same flooding events, has eliminated these vital inputs. Subsidence drowns the marsh, causing chemical changes in wetland soils, which eventually kills marsh vegetation. Without the plant roots to hold together, the marsh soil breaks up and is carried away by wave action. Open water is the ultimate result. Barrier islands, which help protect the interior marsh from wave action and hurricanes, are also subject to subsidence and ultimately disappear without new sediment inputs. Subsidence is the most important and most pervasive factor leading to land loss.