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Pictorial Account and Landscape Evolution of the Crevasses near Fort St. Philip, Louisiana

Mississippi River Geomorphology and Potamology Report No. 2

Freshwater diversions, sediment diversions, and artificial crevasse cuts are potentially viable engineering techniques for marsh management and ecosystem restoration in the lower Mississippi River region. To help understand, plan, and improve future diversion projects, it is beneficial to quantify the short- and long-term effects of existing natural crevasses to determine the evolution of ecosystem response.

Background

Crevasses (large breaches/breaks in levees) provide sediment-laden river water, which is a major historic contributor to Mississippi River delta formation. In modern times, channel training, flood damage reduction, and other man-made projects eliminated many of the river crevasses and their water sources for nutrients and sediments.

However, there are no man-made levees on the eastern bank of the Mississippi River from the Head of Passes to approximately river mile 43, allowing natural crevasses to form just south of Fort St. Philip in the 1970s. Fort St. Philip is approximately 10 river miles north of Venice, Louisiana, and approximately 20 river miles above the Head of Passes.

This report, authored by personnel from the U.S. Army Corps of Engineers, the U.S. Geological Survey, and Five Rivers Services, used remote sensing techniques and landscape-level assessments to quantify the short- and long-term impacts of the natural crevasses near Fort St. Philip over a 52-year period (1956-2008). The study also compared the magnitude and sequencing of these impacts to reference areas also on the river's eastern bank.

The study used aerial photography, satellite imagery, digital imagery, and existing and newly generated land and water classification data. These data were used to determine the time period of crevasse channel formation, provide a pictorial account of the evolution of the crevasses and impacted wetlands, evaluate land-water ratios and landscape change, perform comparisons to the reference areas, and develop descriptive figures and summary statistics.

Techniques

High-resolution photos and digital imagery were acquired for 1956, 1970, 1978, 1989, 1998, and 2008. All images were rectified using the 2008 digital imagery as the control. The land change trends were calculated using a combination of data sets and methods developed for previous coastal land change assessments and data sets created for this study. Extensive measures were taken to ensure the compatibility between data sets. Existing and newly generated land and water classification data provided both visual and computational aids to assess wetland area and change.

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Results and Findings

Currently, there is widespread belief that the introduction of river water to wetland areas will result in immediate land growth. However, this study indicates that crevasse formation may lead to at least short-term land loss. Report Figures 3-10 provide pictorial evidence that the Fort St. Philip crevasses were probably initiated by the 1973 Mississippi River flood and also show other notable landscape feature changes (formation of multiple crevasse channels, access canal construction, development of impoundment features, conversion of land to water, wetland restoration projects, etc.).

Figure 11 shows that the 1956 study area landscape consisted of 5,012 acres of marsh and 2,379 acres of water. Report figures document land loss in 1970 and continuing through 1998 (1970 = 4,377 land acres; 1978 = 2,760 land acres; 1988 = 2,444 land acres; 1998 = 1,780 land acres). The only net land gains were experienced in the 1998-2008 period (2,102 land acres; a 322-acre increase). These land gains appear to be impacts from the crevasses and/or from management/restoration projects emplaced in several areas of the study region.

Of the 58% of land loss that occurred between 1956 and 2008, 13% occurred between 1956 and 1970, and 32% occurred between 1970 and 1978. Episodic events during these periods included Hurricanes Betsy (1965) and Camille (1969), and the major Mississippi River flood of 1973 (+7.7-ft river stage at the Empire gage). The 1978-1988 loss rates were similar to those experienced prior to 1970, while the 1988-1998 rates were higher, possibly as a result of additional floods in 1991, 1995, and 1997.

Initially, the river water diverted through the crevasse channels physically removed significant marsh areas within the study area. These initial direct impacts were succeeded by several decades of larger regional loss patterns driven by subsidence and other episodic events (e.g., hurricanes and floods, access canals, etc.), and recent localized land gains. The evolution of the Fort St. Philip study area landscape differed significantly from reference area landscapes, which either lost wetland area more gradually and/or consistently over the 1956-2008 time period or experienced similar losses during the 1956-1978 period, but were subsequently more positively impacted by restoration activities during intermediate assessment periods.

The report provides very informative visuals of the study area's landscape evolution, statistical data in tables, and full details of the study effort. The report can be accessed at http://acwc.sdp.sirsi.net/client/search/asset/1033480 .

Summary of Significant Findings

- Crevasses/diversions may increase land loss in the short term (first few decades)
- Land gains are potentially long-term benefits from crevasses/diversions that may be enhanced by additional delta management/restoration activities
- Crevassing was a land loss accelerant in the study area for the majority of the analysis period
- Hurricanes, subsidence, and the construction of access canals may also have been direct impacts that helped drive regional land loss

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