

EGU2020-11273

<https://doi.org/10.5194/egusphere-egu2020-11273>

EGU General Assembly 2020

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Continued evolution of the Lower Mississippi: changes to fluvial islands over five decades (1965 to 2015)

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The lower Mississippi continues to adjust to upstream human impacts and channel engineering. Fluvial islands (vegetated sandy bars > 1 ha) are a key mode of riverine adjustment along the Lower Mississippi, and have substantially increased in number and size over the past five decades, from 112 in 1965 to 295 by 2015, which can largely be attributed to groyne construction. This study examines the morphologic evolution of fluvial islands from Cairo, IL to the downstream-most island at about Bonnet Carre Spillway (~5 km upstream of New Orleans). The analysis utilizes lidar DEMs, historic air photos, and adjacent hydrologic (stage) data. Additionally, changes to island vegetation were examined by comparison of the Normalized Difference Vegetation Index (NDVI) calculated from analysis of Landsat imagery for 1996 with 2014.

While each island is somewhat unique and influenced by local scale factors, there are clear geomorphic differences between new islands and older islands. New islands (did not exist in 1965) do not have appreciable natural levees and the island high point is at about flood stage. Older islands that are stable and larger have formed natural levees, which are higher than average flood stage and often higher than the adjacent floodplain surface. The downstream slope of new islands is an order of magnitude higher than old islands, averaging 0.0028 m/m and 0.0009 m/m, respectively. This is likely attributed to the downstream growth of islands, increasing in length and aggradation on the downstream flank. Additionally, between 1996 and 2014 island vegetation matured, with the area of moderate vegetation decreasing at the expense of an increase in denser vegetation. A comparison of the NDVI for the same islands in 1996 and 2014 between Vicksburg and Red River Landing reveals an increase in vegetation health and density. While the area of islands classified as sandy (NDVI 0.1-0.2) and scrubby (NDVI 0.2-0.3) vegetation did not substantially change between 1996 and 2014, the amount of dense vegetation (NDVI > 0.5) considerably increased (from 3.2 km² to 9.8 km²) as the amount of moderate vegetation (NDVI 0.3-0.5) decreased (15.1 km² to 8.4 km²). The increase in vegetation density can be attributed to the increased amount of time since island formation was initiated, and a maturation of the island surface with its geomorphic development.

The change to fluvial islands over the past five decades represents continued geomorphic evolution of the Lower Mississippi. This is of interest because, although it occurs during a period in which sediment supply has dramatically decreased, with the influence of channel engineering there remains sufficient coarse sediment to drive fluvial landform evolution along the Lower

Mississippi.