The Ethical Dilemma of Managing the Mississippi River

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As our world continues to change around us, the problems engineers face become increasingly more complicated and interconnected. Every new problem that arises brings with it certain ethical, social, and economic considerations. The rapidly changing climate is causing massive issues in communities across the United States, but most visibly across the Mississippi River Delta. As communities, farmers, and the federal government struggle to contain the mighty Mississippi-Missouri River system, ethical dilemmas around the levee system plague the discussion, and put engineers in the middle of the debate about how construction project issues should be mitigated.

Settlers began building levees along the Mississippi River in 1718 but were largely unsuccessful as the river continued to flood. The federal government mandated levees be built by farmers on their land, causing misaligned levees and caused larger downstream flooding. In 1879, the Mississippi River Commission was created as the first federal organization to attempt to standardize the Mississippi-Missouri River levee system. Their efforts to redesign the levees worked until the largest flood on record occurred in 1927. After the disastrous flood in 1927 in which 16.6 million acres of land flooded, the federal government decided to proceed with the “levee only” policy, instead of the other suggestions which included cutting off bends in the river and the diversion of tributaries and creating artificial reservoirs and outlets (Rogers). The last two options were deemed too costly. The new plan for managing the Mississippi-Missouri River floodplain was called “The Jadwin Plan” and was crafted by the Army Corps of Engineers. It called for a massive undertaking of updating all of the existing levees to higher standards and for creating floodways along the most distressed parts of the river basin, to include the Birds Point-New Madrid Floodway, the Morganza Floodway, the West Atchafalaya Floodway, and the Bonnet Carre Floodway (Rogers). The levees held until the flood of 1973 which caused damages estimated at 183,756,000 and set a record for days out of bank at 62 (Rogers). It also shed light on one of the largest problems with levees alongside the river, the realization that the carrying capacity of the river had decreased, increasing the elevation of the flow of water, and requiring a raise of the levees (The Coupled Histories 2018).
The cost of raising the levee one foot, in the Vicksburg District, costs an estimated $2.8 million per mile of levee (Rogers). However, physics shows that levees cause increased water flow elevation. Therefore, as more levees are built, the water flow upstream rises, causing the levees to be built higher or risk being overtopped. This phenomenon of flooding, levees, more flooding and higher levees, is called a hydraulic spiral, and it is increasingly expensive (Hersher 2018). With 2,216 miles of the levee system, if only the bottom ¼ of the levee system had to be raised one foot, the very simplified, estimated cost would be $1,551,200,000. However, the cost associated with levee heightening is not its only concern. Although the Army Corps of Engineers maintains the levees beginning in Illinois, there are local communities that are building levees in the upper Missouri Rivers. These levees, which are built over the height mandated by the Corps of Engineers, saves that one community from flooding, but forces more flood waters onto other communities (Hersher 2018). In this way, levee construction along the Mississippi River is being exploited by higher income communities that have the public funds to create the levees, at the expense of lower income communities which do not have the funds (Hersher 2018). This begs the question of if local communities should be allowed to build any levees at all, or if all the levees should be maintained exclusively by the federal government. It also raises the question of if there should be levees built in the Upper Mississippi and Missouri Rivers, as flooding occurs in the Mississippi and Missouri River basins in part due to the construction of levees downstream.

On May 2nd, 2011 after 10pm, another ethical dilemma became obviously apparent. At that time the Mississippi River had reached record flood heights at 18.8 meters and was threatening the town of Cairo, Illinois (Sulzberger 2011). In order to save the town, the Army Corps of Engineers followed their federally authorized flood plan, breaching the levees in Missouri in order to flood the New Madrid Floodway, decreasing the height of flow upstream in Illinois. The flood water of the Mississippi inundated 130,000 of acres of farmland in Missouri. The land remained inundated for months during the peak growing season. The lost crop worth was estimated at $60.6 million (Wilcox 2011). It is important to note that this figure was estimated only on the 130,000 acres designated as within the New Madrid Floodway, and does not include costs from seepage and back sewage. It also does not include the cost of
removing debris from the fields that the river water brought. Further, it also does not include the $42.6 million that the U.S. government will pay the Missouri Farmers in crop loss payments, which brings the total cost of the breached levee at over $1 billion total cost for the federal government, in economic crop loss and crop loss payments (Wilcox 2011). Cairo, Illinois had an estimated 1,600 housing units with an estimated $16,682 median household income, according to the 2010 census. By breaching the levee, the federal government valued the history, livelihood, and homes of the people of that city as more than the crop loss of the Missouri farmers. It begs the question, how do we as engineers, quantify non-monetary items such as history, wildlife, and people, and how do we ensure that the decisions that are made are fair?

More than just houses at risk, the levee system on the Mississippi River irrevocably changed the structure and composition of the river. Natural floodplains and wetlands in the lower Mississippi River are full of biodiversity and naturally remove an average of 40% of Nitrogen and Phosphorous from the river (Piazza). Eutrophication of the Gulf of Mexico, caused in large part by agricultural runoff in the Mississippi, has led to a dead zone due to the lack of dissolved oxygen. Environmental groups are increasingly trying to purchase and restore land in the lower Mississippi, such as Mollicy Farms. After planting 3 million trees over 16,000 acres, reconnecting the Ouachita River, the historic bayous restored, the record flood stage in the Ouachita River lowered one foot, and 48.1 MT of nitrogen are now removed from the Mississippi River Basin each year (Piazza). A new ambitious project aims to restore thousands of acres of the Atchafalaya River Basin to its natural state and protect the hundreds of unique birds and wildlife found within the basin. Other projects aim to reverse the devastating loss of sedimentation along the coastline of the gulf and are attempting to divert sedimentation back into the delta.

The levees along the Missouri and Mississippi River will remain a fixture of engineering for the foreseeable future. And as climate change over the next 100 poses a threat of vastly accelerating flooding in the Mississippi Delta, these ethical dilemmas will become increasingly exacerbated (Van der Wiel 2018). However, it’s our job as engineers to ensure that civil projects do not favor one community over another, or one type of industry over another in an unfair advantage. More importantly, as biosystems
engineers, we are charged with the unique purpose of ensuring that construction projects take full accountability of the possible long-term effects, and the adverse effects that these projects have on wildlife in the area. It will be engineers’ duty to continue to influence public understanding as it relates to environmental issues and federal policy on how to determine the worth of priceless features.
Works Cited


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