"from the BLIGHTY MISSISSIPPI to the MIGHTY MISSISSIPPI"

Derek Hoeferlin, Lilia Irene Compadre, Allison Mendez,
Jonathan Stitelman
Washington University in St. Louis

"from the BLIGHY MISSISSIPPI to the MIGHTY MISSISSIPPI" retrofits the Mississippi watershed's existing under-maintained infrastructures, de-urbanized cities and polluted ecologies into a networked eco-industry that reconsiders cause and effect relationships, from source to mouth.

No longer a natural river system, the Mississippi watershed is a controlled conduit. There have been benefits with river control, but also adverse environmental and economic byproducts. Two of these main negative impacts from development of the Mississippi watershed ultimately manifest in south Louisiana as wetland loss and in the Gulf as a hypoxic dead zone. These are caused by excess nutrients (primarily from upper Midwest agricultural practices); suppressed sediments (primarily from Missouri river reservoir dams); and, expedited flows (from leveeing the rivers that force fresh water—and what is left of the sediment—to the salty waters of the Gulf of Mexico).

Accepting that the Mississippi watershed will not return to a network of natural rivers, this aggressive large-scale counter-proposal offers an alternate vision to other current economic ambitions—such as the exploitation of the Mississippi watershed as the next oil and gas boom utilizing fracking practices and new pipeline infrastructures from Canada.

Alternately, the Mississippi will be mighty once again through an intertwined cross-watershed toolkit of collecting sediment, filtering nutrients, farming algae, refining algae fuel and distributing sediment and fuel.

For example, the Upper Mississippi Basin portion of the toolkit proposes physical engagement with existing dams and their proximate underutilized hydrologic pools and varied land uses. Rather than allowing the excess nitrogen and phosphorus to create the algae bloom dead zone in the Gulf of Mexico on its own, a series of stations are placed at each of the locks and dams in the Upper Mississippi river (north of St. Louis, Missouri). These stations will filter the nutrients into algae biomass that then can be transported to de-industrialized sites along the Mississippi river (such as north St. Louis city) to be refined into bio-fuel or additives for local use.

This part of the massive new eco-industry can withstand climate extremes such as floods and droughts; and, adapt to existing infrastructure networks. In the long-term, the algae fuel will be an alternate source of energy for the Mississippi watershed as oil and gas from the Gulf of Mexico become depleted and the negative impacts of shale fracking or additional pipelines are ultimately comprehended.

Simultaneously, the proposal sequesters the sediment that is being trapped by the dams along the Missouri river and transports the sediment to be utilized as a needed resource for the current and planned wetland restoration projects of the Louisiana delta. The continued coastal wetland loss certainly is an issue of national security for the future commerce of the entire Mississippi watershed; for the local safety of New Orleans in the face of climate change, sea level rise and tropical storm surges; and, for the fishing industry of the Gulf.

Two long-term interventions far "upstream" in the Mississippi watershed will generate a new watershed-based economy that has local benefits throughout the watershed; and, will help remediate two of the main threats to the Gulf Coast: that of wetland loss and the dead zone.

SEDIMENT + VOLUME

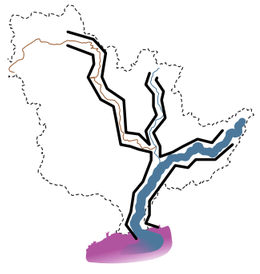
WETLAND LOSS

MISSISSIPPI WATERSHED: SEDIMENT + VOLUME

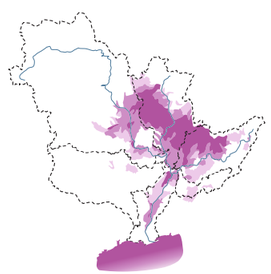
The Mississippi watershed stretches east to west from Appalachia to the continental divide; north to south from Canada to the Gulf of Mexico. It drains portions of 31 states and 2 Canadian provinces, is the largest watershed in North America and the fourth largest in the world, and, covers 40% of the United States' continental landmass. It encompasses differentiated sub-watersheds and several important urbanized areas including Baton Rouge, Chicago, Cincinnati, Columbus, Denver, Kansas City, New Orleans, Memphis, Minneapolis/St. Paul, Oklahoma City, Omaha, Pittsburgh and St. Louis. The Mississippi watershed is the main stem, but includes important economic and environmental tributaries—the Missouri and the Ohio Rivers. The Missouri River supplies the watershed's majority of sediment while the Ohio River and lower portion of the Mississippi River supply the majority of water volume.

WASTES AS RESOURCES: SUPPRESSED SEDIMENTS, EXPEDITED FLOWS, EXCESS NUTRIENTS

EXPEDITED FLOWS



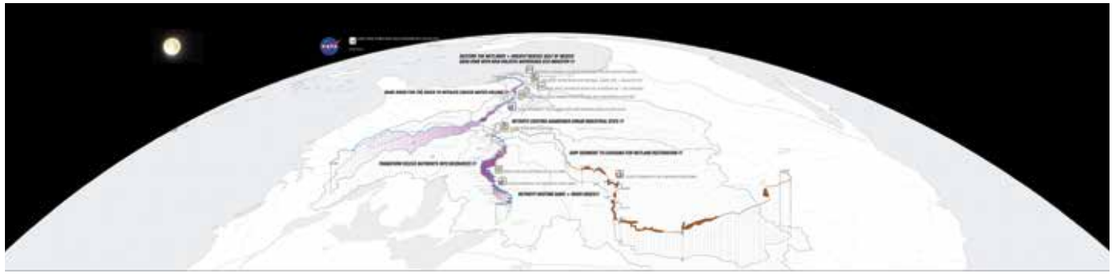
EXCESS NUTRIENTS



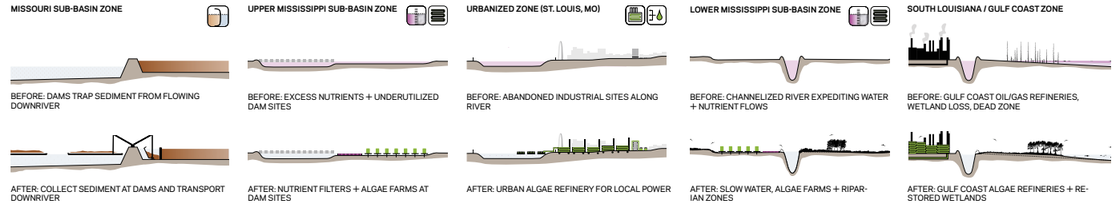
Two of the main negative environmental and economic impacts from development of the Mississippi watershed ultimately manifest in south Louisiana and the Gulf of Mexico: WETLAND LOSS and the DEAD ZONE.

WETLAND LOSS is caused primarily from **sediment suppression** and **expedited flows**. Due to the damming of the sediment rich Missouri River, a large portion of the sediment never makes its way to south Louisiana to help grow the land with flooding. The extreme leveeing of the Mississippi watershed also expedites the river flow, not allowing the river to flood to distribute the sediment. What little sediment resource is left is forced out to the Gulf of Mexico. Coastal Louisiana loses the equivalent of one football field of wetlands every 30 minutes.

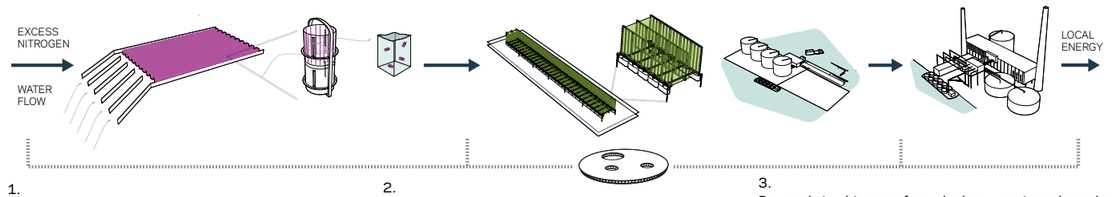
The **DEAD ZONE** primarily is caused by excess levels of nitrogen and phosphorus nutrients discharged into the Mississippi watershed via run-off. According to the USGS, 70% of the nitrogen and phosphorus is the result of large-scale agricultural processes in the Lower Mississippi, Upper Mississippi and Ohio sub-basins. 75% of all nitrogen and phosphorus discharged into the Mississippi watershed originates from only 9 of the 31 states drained by the watershed—Illinois, Iowa, Indiana, Missouri, Arkansas, Kentucky, Tennessee, Ohio and Mississippi. As these nutrients make their way unmitigated through the Mississippi watershed, they significantly contribute to the Dead Zone phenomena in the Gulf of Mexico off the coast of Louisiana. The dead zone is a hypoxic area caused by algae blooms that develop from the excess nutrients nitrogen and phosphorus. The algae blooms, coupled with the large amounts of fresh water at the surface of the Gulf, starve oxygen from reaching important marine life in the lower, heavier, saltier areas of the Gulf.



SUB-BASIN RETROFIT ZONES



FILTER, FARM, REFINE, DISTRIBUTE

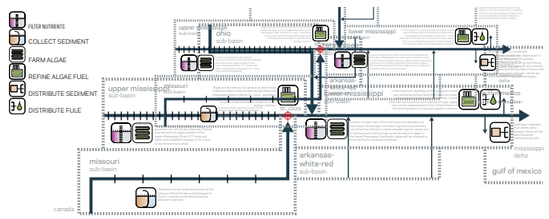


1.
Nutrient rich Mississippi water flows through a Nitrogen extraction filter. The filter consists of an underwater field of barrels containing colonies of bacteria that feed on Nitrogen, amplifying the natural nitrogen cycle in the river. The bacterial filter at Mississippi Dam 26 contains 41,000 bacterial colony barrels. Each barrel is capable of removing 17 lbs of Nitrogen from the Mississippi River every two weeks. The bacteria, which has concentrated Nitrogen, is used as plant food for the algae farm.

2.
Algae farms require a lot of space because algae occurs at low concentrations in water. The algae farm at Mississippi Dam 26 floats on pontoons over 450 acres of reclaimed water surface on a distributary of the Mississippi river. A single acre of algae can yield 2,000 to 10,000 gallons of biofuel. Algae is grown in photo-bioreactor units strung together into 300' bays. The bioreactor units can be easily detached from the bay and brought by boat to a processing facility where the algae is harvested and stored in silos. Algae biomass is transferred from storage silos onto barges doc

3.
Barges bring biomass from the harvest sites along the river to the retrofitted abandoned industrial site in North St. Louis. Refined algae biofuel will locally power St. Louis—in the short term as fuel additives; and, in the long term as a completely alternate fuel source.

NETWORKED ECO-INDUSTRY TOOLKIT



PROTOTYPE ALGAE FARM AT RETROFITTED DAM