



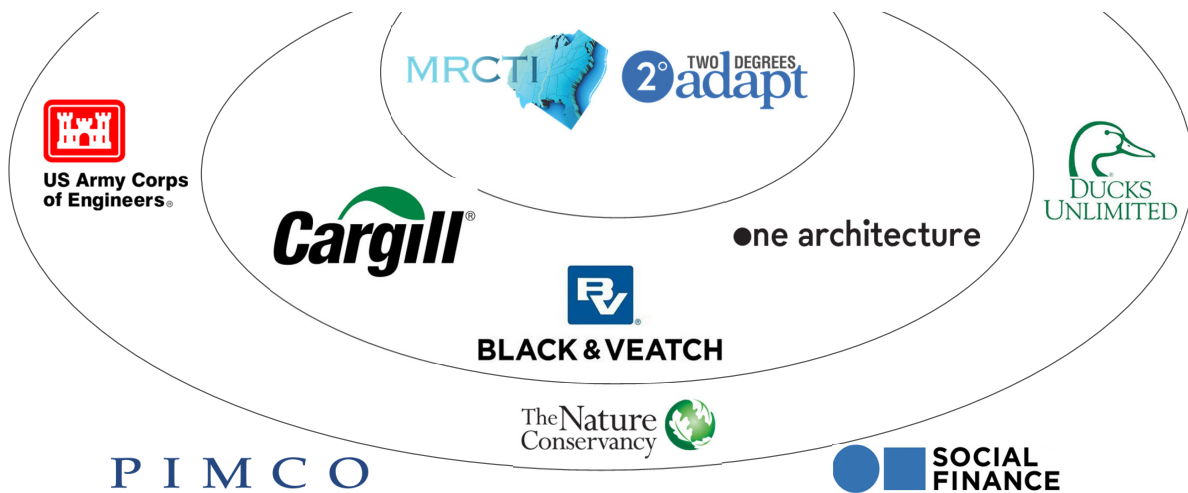
Mississippi River

Flooding Economic Impact & Nature-Based Adaptation Solutions

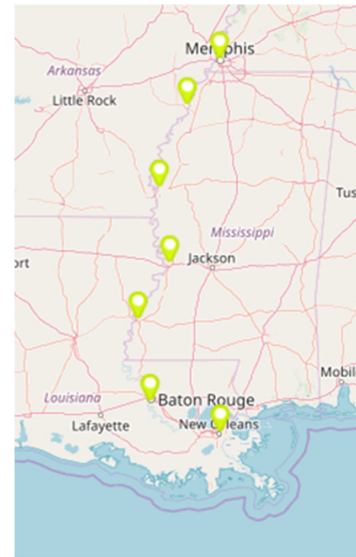
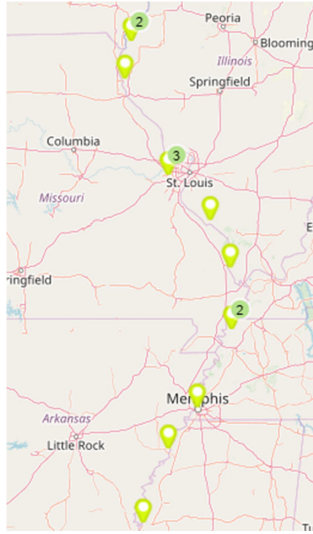
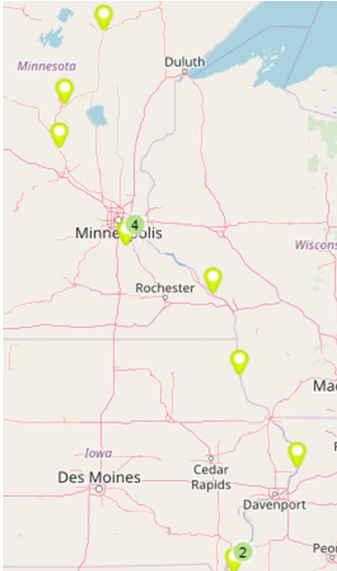
EPA Hypoxia Task Force, December 14, 2021



Our Cohort



What will a 1% flood look like in the future climate?

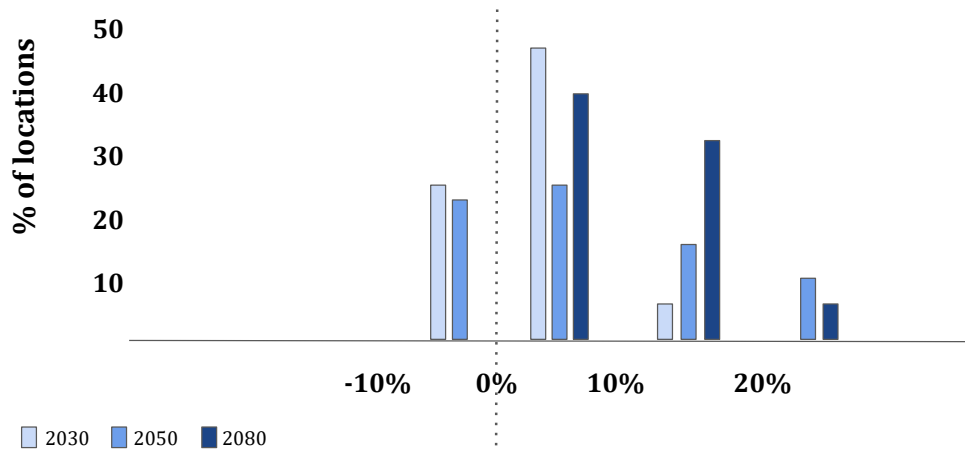


USGS and USACE gauges
Representing all 100 MRCTI communities

Hydrologic Analysis



Median change in 1% flood discharge (relative to 2005)

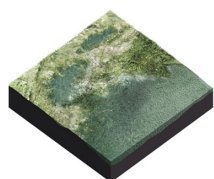


Several levees are at risk of overtopping

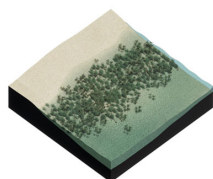


Location	Levee	Probability of Overtopping for 2030 1% Flood
Mississippi River at Grafton, IL	Consolidated North County Levee System	1.074
Mississippi River at Winona, MN	Winona City & Prairie Island	1.043
Mississippi River at Helena, AR	Mississippi and White Rivers Below Helena System	1.026
Mississippi River at Chester, IL	Bois Brule Levee & Drainage District System	1.010
Mississippi River at Greenville, MS	Greenville Harbor - West Bank	0.988
Mississippi River at Baton Rouge, LA	Mississippi River West Bank - Below Morganza	0.987
Mississippi River at Baton Rouge, LA	Mississippi River East Bank	0.983
Mississippi River at Greenville, MS	Greenville Harbor - East Bank	0.959
Mississippi River at Chester, IL	Saint Genevieve Levee System No. 2	0.938

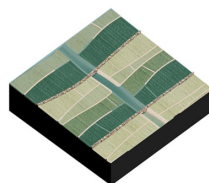
Solutions Analyzed



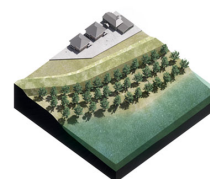
Wetland Restoration



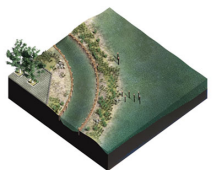
Submerged Vegetation



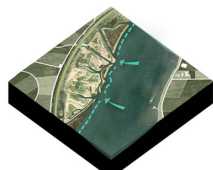
Regenerative Agriculture



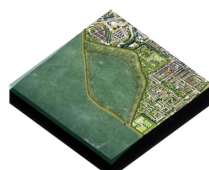
Reforestation



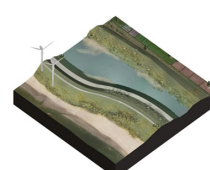
Secondary Channels*



Spillway Creation*



Controlled Overtopping*



Levee Armoring

* Collectively termed Floodplain Expansion strategies

Example of Shovel Ready Project: St Genevieve Restoration along Levee #3



Example of a Mega Project: Vicksburg- Eagle Lake Restoration



Return on Investment: 200 Acre Hypothetical Wetland Reforestation



- Key Assumption: City owns the land
- **If robust carbon and nutrient removal markets exist, even small NbS projects can yield attractive returns**

	Price Starting in 2021
Carbon	\$20/MT CO2e
Nitrate Removal	\$9.5/lb
Phosphate Removal	\$4.2/lb

20-year NPV	\$380,000
IRR	9%
Payback Period	13 years

Flood Damage Reduction Quantification



- To reduce the probability of overtopping by 10% for Levee #2 in St Genevieve in a 1% riverine flood in 2030
 - Nature-based solutions must offset 95,000 cfs of peak discharge
 - A set of wetlands with **60,000 acre-ft** of flood storage can do this for a duration of ~ **8 hours of peak discharge**
 - A reservoir with ~ **180,000 acre-ft** can store this peak discharge for **24 hours**
- “cutting the peak off a major flood is a local problem” flood expert at NOAA
- Smaller projects can still contribute significantly to
 - Lessen the impact of smaller riverine floods
 - Mitigate other types of floods e.g. flash floods
 - Co-benefits e.g. carbon sequestration, nutrient removal, recreational tourism