

RESTORE

THE MISSISSIPPI RIVER DELTA

Impacts of Changing Climate Projections on Restoration of the Mississippi River Delta

G. Paul Kemp¹, Angelina Freeman², John W. Day, Jr.,
Louisiana State University

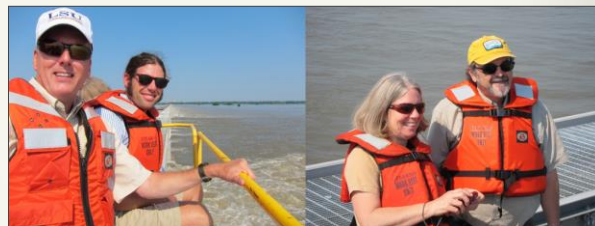
- (1) 1. formerly National Audubon Society
(2) 2. formerly Environmental Defense Fund

Deltas in Times of Climate Change II, Rotterdam, The Netherlands
September 24, 2014



Science and Engineering Special Team

- Recruit Leading Natural and Social Scientists and Engineers to Advise NGOs (National Audubon, National Wildlife, Environmental Defense Fund)
- Two-Year Multi-Disciplinary Caucus with No Predetermined Outcome
- Agreed on 10 fundamental issues/questions
- Convened three times a year and produced policy-relevant syntheses for different audiences
 - Long report
 - Short report
 - 2-Pagers
 - Conference
 - Media
 - Journal Articles
 - Book



**CHAIR: John Day, Ph.D.**

Distinguished Professor Emeritus,
Department of Oceanography and
Coastal Sciences at Louisiana State
University,

**Conner Bailey, Ph.D.**

Professor of Rural Sociology at Auburn
University,

**David Batker, M.S.**

Chief Economist and Executive Director
for Earth Economics.

**Samuel Bentley, Ph.D.**

Associate Professor and the Billy & Ann
Harrison Chair of Sedimentology at
Louisiana State University,

**Jaye Cable, Ph.D.**

Chair for Curriculum for the Environment
and Ecology and a Professor in the
Department of Marine Sciences at

**James Cowan Jr., Ph.D.**

Professor in Louisiana State
University's Department of
Oceanography and Coastal Sciences.

**Linda Deegan, Ph.D.**

Senior Scientist for The Ecosystems
Center at Woods Hole Marine
Biological Laboratory.

**Angelina Freeman, Ph.D.**

Coastal Scientist, Louisiana Coastal
Protection and Restoration Authority,
former Director of Mississippi River
Delta Science and Engineering
Projects for Environmental Defense
Fund.

**Luviu Giosan, Ph.D.**

Associate Scientist at Woods Hole
Oceanographic Institute.

**Robert Gramling, Ph.D.**

Professor of Sociology and Director,
Center for Socioeconomic research at
Louisiana State University, Lafayette,

RESTORE THE MISSISSIPPI RIVER DELTA North Carolina, Chapel Hill.

**Mary Kelly**

Founder of Parula, LLC, an
independent environmental
consultancy

**G. Paul Kemp, Ph.D.**

Independent consultant,
**Commissioner, Southeast
Louisiana Flood Protection
Authority**, former Vice-President,
National Audubon Society. Adjunct
Professor, Louisiana State University

**Shirley Laska, Ph.D.**

Professor Emerita of Sociology at the
University of New Orleans.

**Sarah Mack, Ph.D.**

Founder and CEO of Tierra
Resources.

**James Morris, Ph.D.**

Director of the Belle Baruch Institute
for Marine and Coastal Sciences and
a Distinguished Professor of Marine
Studies at the University of South
Carolina,

**William Nuttle, Ph.D.**

Independent consultant with
experience in developing an
integrated approach to scientific
ecosystems management

**Andy Nyman, Ph.D.**

Professor with Louisiana State
University Agricultural Center and
Louisiana State University.

**David Rogers, Ph.D., P.E.**

Associate Professor and Karl F.
Hasselmann Chair in Geological
Engineering at the Missouri University
of Science & Technology

**Gary Shaffer, Ph.D.**

Professor at Southeastern Louisiana
University and Chief Scientists for
Wetland Resources, LLC.

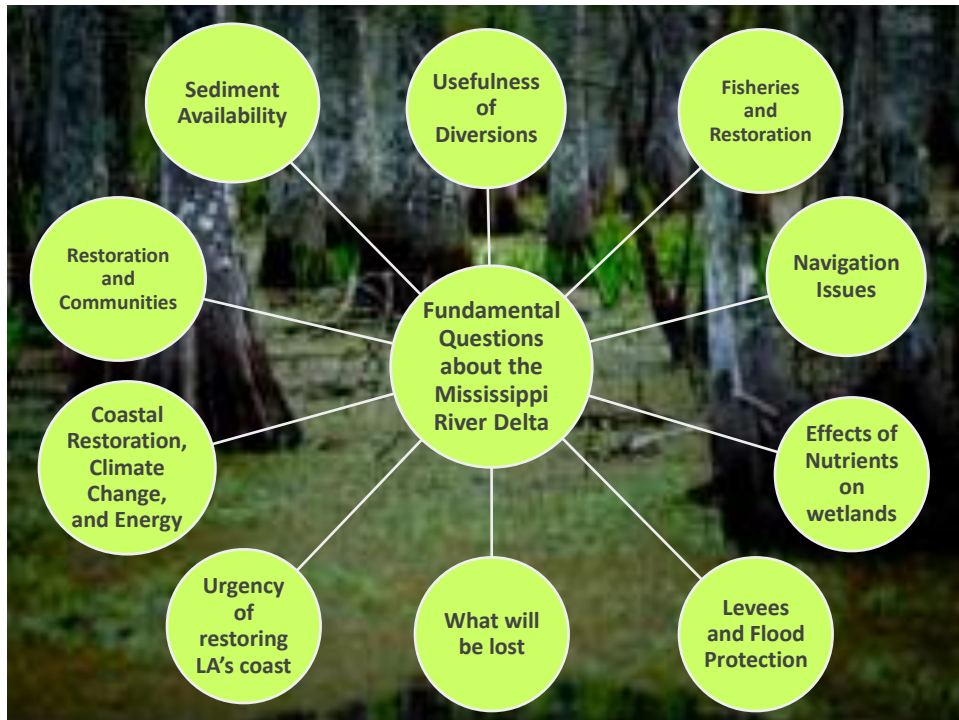
**Fred Sklar, Ph.D.**

Director of the South Florida Water
Management District

**Clinton S. Willson, Ph.D., P.E.**

Associate Professor of Civil and
Environmental Engineering at
Louisiana State University.

RESTORE THE MISSISSIPPI RIVER DELTA



Short Report on Web

Findings summarized in accessible short (30 pp) report and Web formats

www.restoremississippiriverdelta.org

Audience: Informed Public, Teachers, Students and Political Staff

RESTORE THE MISSISSIPPI RIVER DELTA

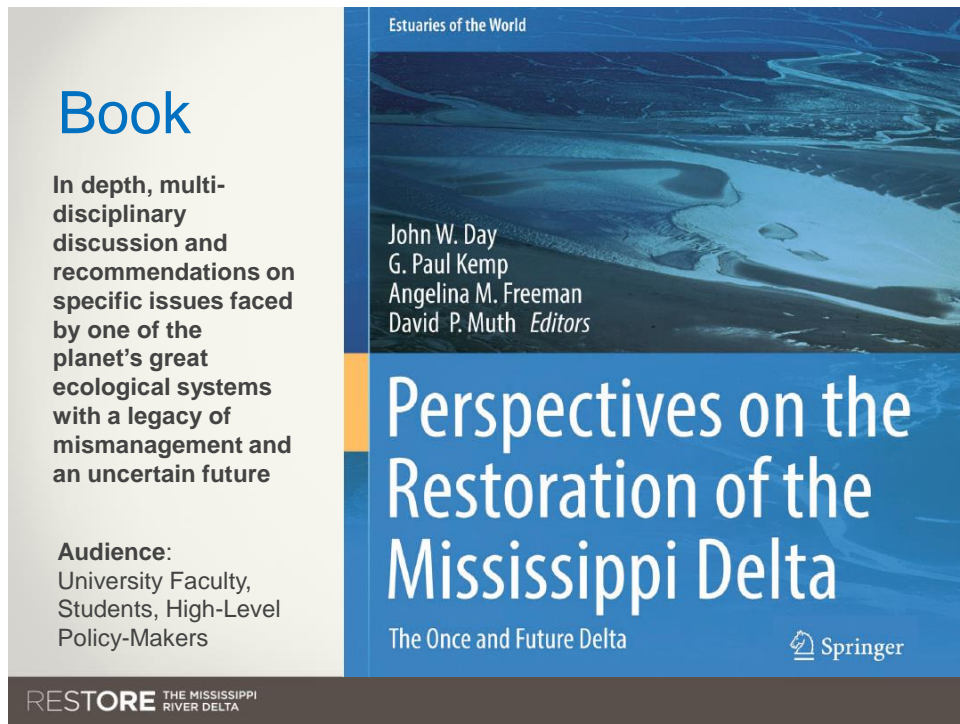


ANSWERING

10

FUNDAMENTAL QUESTIONS ABOUT THE MISSISSIPPI RIVER DELTA

A REPORT BY THE MISSISSIPPI RIVER DELTA SCIENCE AND ENGINEERING SPECIAL TEAM



If we know how delta will respond hydraulically to sea level rise and changes in flow regime, then we can “guide” it.... That’s “adaptation” not control

AR5 projects means and ranges for SLR that are 60% greater than 2007 AR4. Rahmstorf and others now suggest a reasonable planning number for 2100 should be > 1.2 m which is 20% higher than RCP8.5 AR5 forecast (Schaeffer et al. 2012)

	RCP	2100 CO ₂ Concentration (ppm)	Temperature increase (C)	Mean Sea Level Rise (m)				
			2081-2100	2046-2065	2100	2200	2300	2500
Low	2.6	421	1.0 [0.3 to 1.7]	0.24 [0.17 to 0.31]	0.43 [0.28 to .60]	0.35–0.72	0.41–0.85	0.50–1.02
Medium	4.5	538	1.8 [1.1 to 2.6]	0.26 [0.19 to 0.33]	0.52 [0.35 to .70]	0.26–1.09	0.27–1.51	0.18–2.32
High	6.0	670	2.2 [1.4 to 3.1]	0.25 [0.18 to 0.32]	0.54 [0.37 to .72]			
	8.5	936	3.7 [2.6 to 4.8]	0.29 [0.22 to 0.37]	0.73 [0.53 to .97]	0.67–1.92	0.92–3.59	1.51–6.63

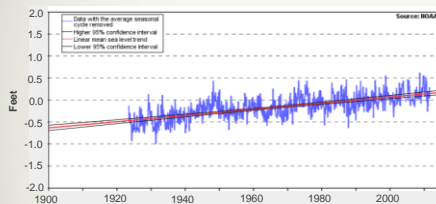
0.97 m is highest for 2100

Want to see high rates in action??

Sea-Level Rise

global rise = 2 mm/yr

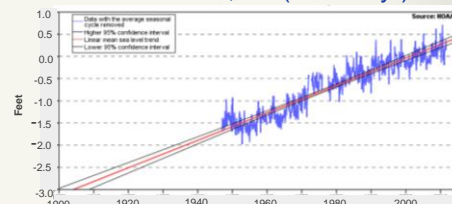
Pensacola, FL tracks Eustatic



Mean sea level trend is 2 mm/yr or extrapolated total of 0.17 m by 2100.

Relative Sea-Level Rise (RSLR)

global rise + local sinking
Grand Isle, LA (10 mm/yr)



Mean sea level trend at Grand Isle is 10 mm/yr for extrapolated total of 0.9 m by 2100

At Grand Isle, the eustatic signal accounts for only 20 % of observed RSLR

The Delta on the Shelf Edge is Unstable

Sinking and Slumping at 2 m per century without Considering Sea Level Rise

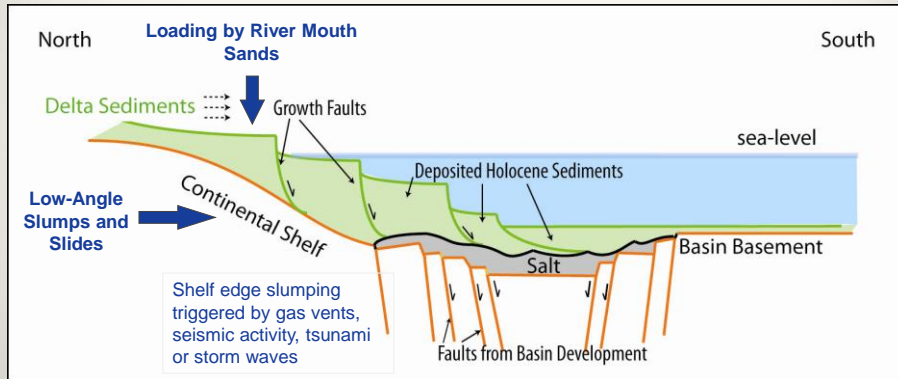
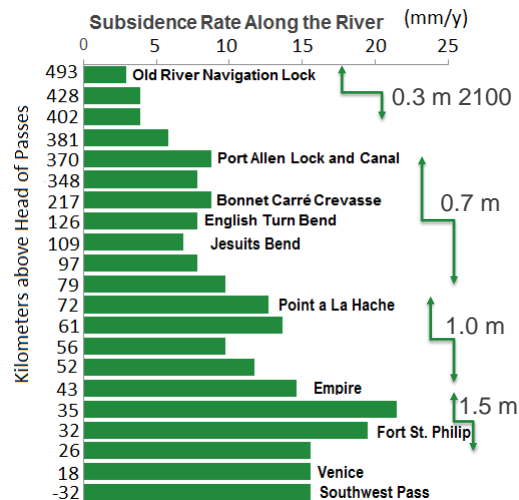
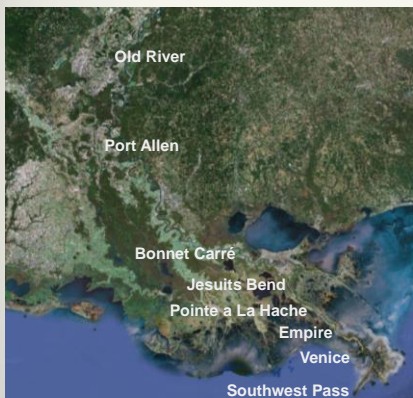


Figure from: Reed and Yuill, 1999

RESTORE THE MISSISSIPPI RIVER DELTA

The Land is Sinking

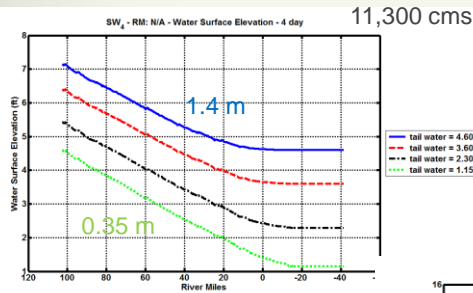
At the Bird's Foot: 1.3 – 1.7 cm/yr or 1.0 -1.5 m by 2100



Data from: West Bay Sediment Diversion ERDC Report: Brown et al., 2009

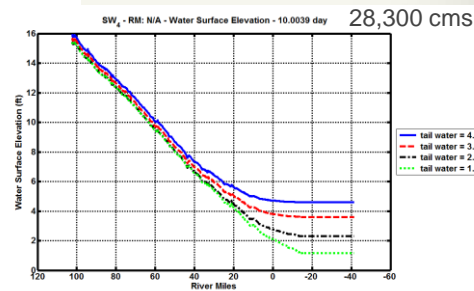
RESTORE THE MISSISSIPPI RIVER DELTA

Model Predicted Impact of RSLR on Lower Mississippi River Backwater Hydraulics



Results of 1D modeling
without overbank flooding
By Clint Willson

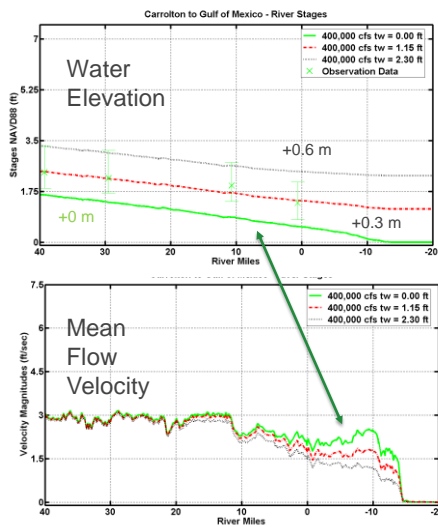
- Lower hydraulic gradient
- Higher water level (stage)
- Difference confined to lower 100 km for high Q
- RSLR effect extends far upstream during low Q



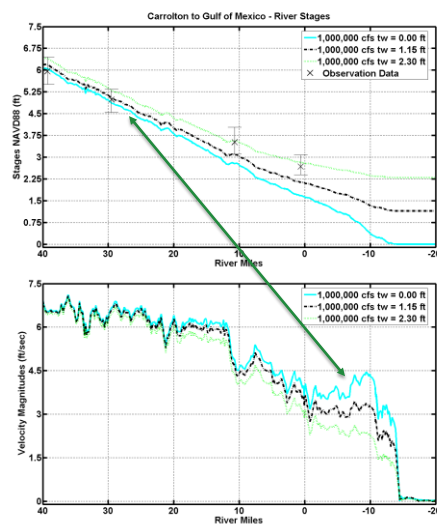
RESTORE THE MISSISSIPPI RIVER DELTA

Take a Closer Look at Model Results from the Last 100 Kilometers

11,300 cms



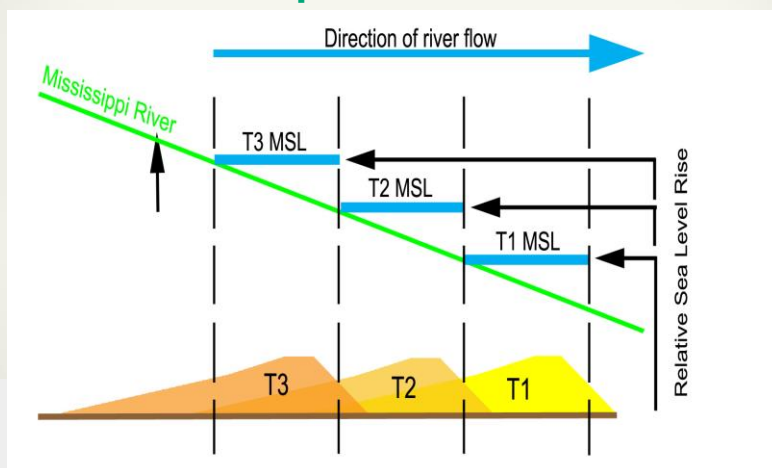
28,300 cms

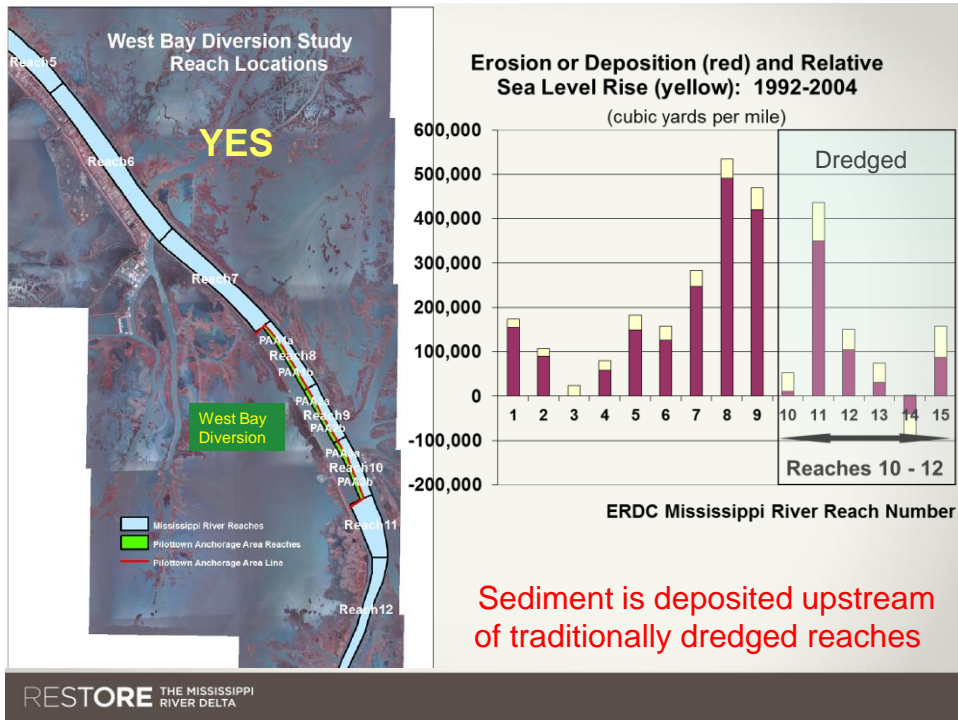


RESTORE THE MISSISSIPPI RIVER DELTA



If upstream channel shift is prevented, will RSLR shift river sediment deposition upstream??

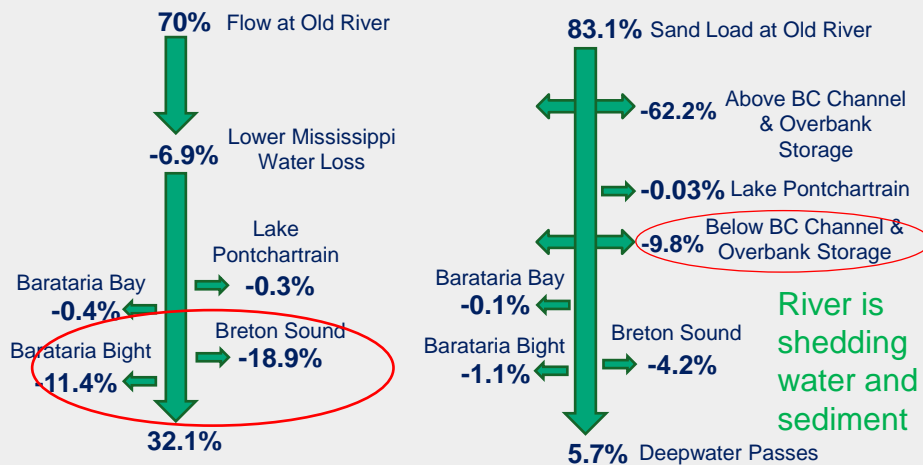




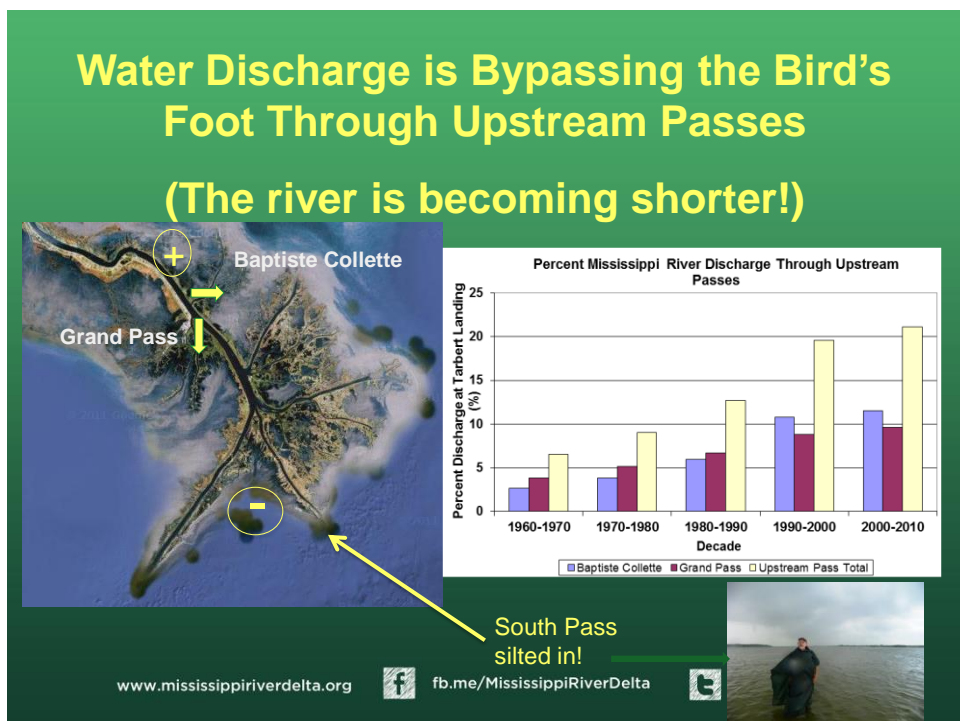
Mississippi River Water and Suspended Sand Budget 2008-2010

Water Discharge

Sand Discharge

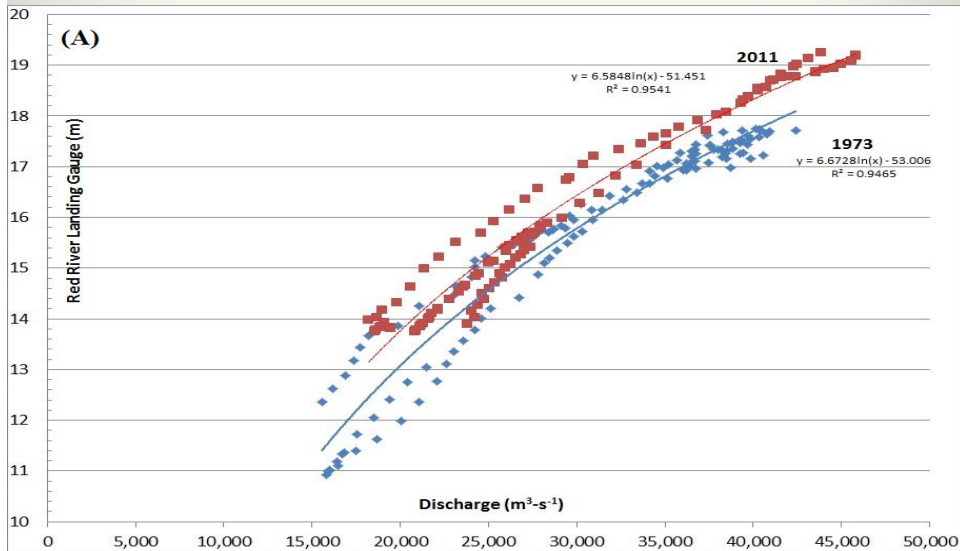


Allison et al. 2012, A water and sediment budget for the lower Mississippi–Atchafalava River in flood years 2008–2010. Journal of Hydrology



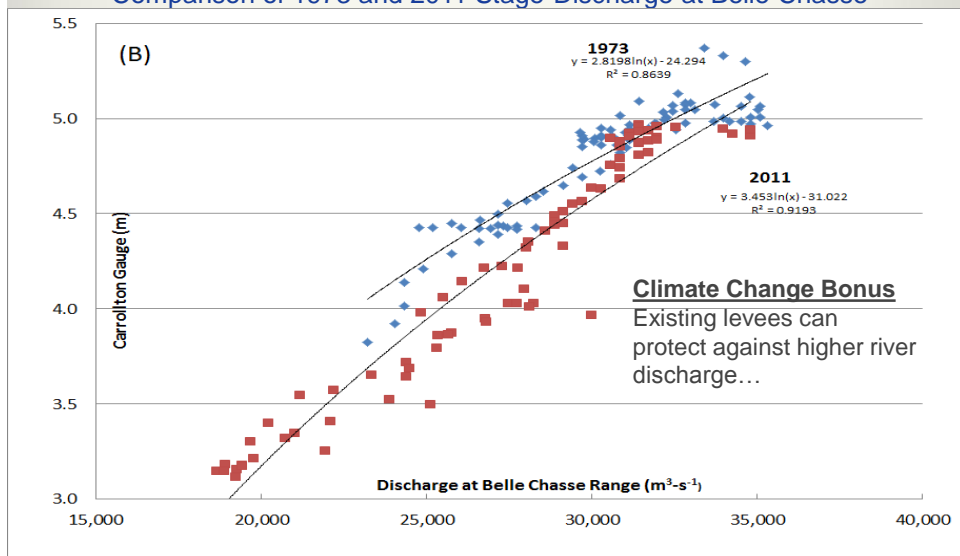
Flood Flowlines are Rising Upstream

Comparison of 1973 and 2011 Stage-Discharge at Red River Landing upstream of Baton Rouge

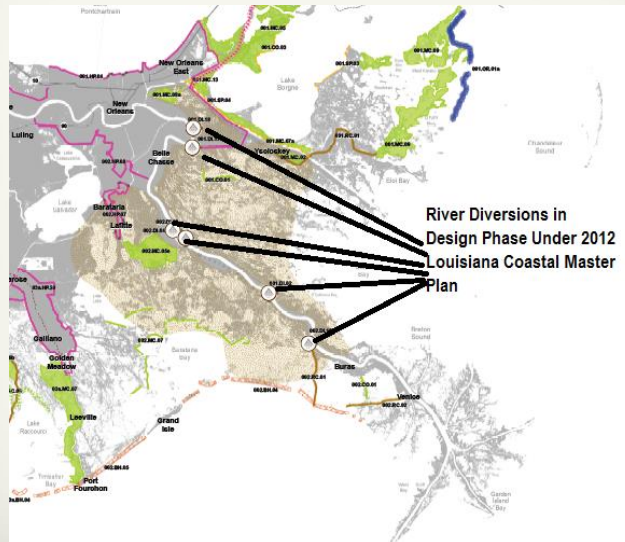


BUT Falling Downstream of New Orleans

Comparison of 1973 and 2011 Stage-Discharge at Belle Chasse



Proposed Diversions will take advantage of deltaic retreat from shelf edge



RESTORE THE MISSISSIPPI RIVER DELTA

A New Crevasse – Mardi Gras Pass – East Bank Downstream of Levee – February 2012



Creation and Maintenance of New Outlets Upstream of Birds Foot Hydraulically Favored as RSLR Grows

RESTORE THE MISSISSIPPI RIVER DELTA

RESTORE

THE MISSISSIPPI RIVER DELTA



RESTORE

THE MISSISSIPPI RIVER DELTA



Other contributors to SEST

Kenneth J. Bagstad, Ph.D., Economist,
Geosciences & Environmental Change Center,
US Geological Survey

S. Ahmet Binselam, Ph.D., Numerical
Modeling, Structure Hazards Response, FM
Global, Norwood, Massachusetts

Richard E. Condrey, Ph.D., Professor
Emeritus, Louisiana State University,
Department of Oceanography & Coastal
Sciences

Robert Costanza, Ph.D., Professor of Public
Policy, Crawford School of Public Policy,
Australian National University, Canberra

Isabelle de la Torre, Earth Economics,
Tacoma, Washington

D. Elaine Evers, Retired, Louisiana State
University, Department of Oceanography &
Coastal Sciences

Paul E. Hoffman, Ph.D., Department of
History, Louisiana State University

Matthew Moerschbaecher, Louisiana State
University, Department of Oceanography &
Coastal Science

David P. Muth, Natural History, Director,
Mississippi River Restoration Campaign,
National Wildlife Federation, New Orleans,
Louisiana

Paula Swedeen, Pacific Forest Trust,
Olympia, Washington

Karen A. Westphal, Master Naturalist,
Mississippi River Restoration Campaign,
National Audubon Society, Baton Rouge,
Louisiana

RESTORE THE MISSISSIPPI
RIVER DELTA

