

Gulf Hypoxia and Mississippi River Nutrient Management



Alan Lewitus Center for Sponsored Coastal Ocean Research NOAA/NOS/NCCOS



5th Annual NOAA/NGI Gulf Hypoxia Research Coordination Workshop 14 July 2014; Stennis Space Station, MS

Action Plan Coastal Goal

<u>"Reduce the 5-year running average of the hypoxic zone areal extent to</u> less than 5000 sq km (1928 sq mi) by the year 2015...

...(by reducing) the annual discharge of nitrogen into the Gulf. [2001 Action Plan]

...(by reducing) the annual discharge of nitrogen and phosphorus into the Gulf. [2008 Action Plan]



Long-Term Monitoring

Maximum annual areal extent of hypoxic zone – metric to assess progress toward Hypoxia Task Force Action Plan Goal



Setting Nutrient Reduction Targets

To inform 2008 Action Plan, EPA Science Advisory Board recommended 45% N reduction based on:

-- Scavia et al. 2004: ensemble of models (Scavia, Bierman, Justic) suggested a 40-45% reduction in N loading needed to meet Coastal Goal;

-- Scavia and Donnelly 2007: update model results using new USGS loading data



Reassessing Coastal Goal and Nutrient Reduction Targets

Hypoxia Task Force Goals Committee reassessing Goal and nutrient reduction targets using ensemble of models (Scavia, Turner, Forrest, Laurent & Fennel)





David Forrest, unpub

Predicted Area of Hypoxia Based on Nitrate Loading



Figure 1. May dissolved nitrite plus nitrate flux to the Gulf of Mexico and area of mid-summer bottom water hypoxia (dissolved oxygen concentrations of less than 2 miligrams per liter) in the northern Gulf of Mexico. Hypoxia area data from Nancy N. Rabalais, Louisiana Universities Marine Consortium. *No hypoxia area data for 1989.

≪USGS

2013 Preliminary Mississippi-Atchafalaya River Basin Flux Estimate

Annual Dissolved Nitrate plus Nitrite Flux



Data from Mike Woodside, USGS

Nutrient Reduction Initiatives

Hypoxia Task Force Federal Nutrient Reduction Initiatives



NRCS Mississippi River Healthy Watersheds Initiative (MRBI)

- Emphasizes producer partnership to implement comprehensive conservation systems in high priority watersheds
- NRCS dedicating \$80 million in financial assistance each fiscal year, plus associated technical assistance

Nutrient Reduction Initiatives

Hypoxia Task Force States' Nutrient Reduction Strategies

20% REDUCTION Milestone	M	Mississippi River Nitrogen				35% REDUCTION Milestone Phosphorus
		Source				Source
Baseline Load (1980–1996) Units = 1,000 metric tons (MT) per year Vegative value indicates increase in load	7.86 Valicultural	Wastewater	Miscellaneous	International In		Baseline Load (1980–1996) Units = 100 metric tons (MT) per year 24 22 12 58
Progress Since Baseline	1.5	-1.5	0	0		Progress Since Baseline 5 11 0 16
Recommended Strategy Reductions				Т		Recommended Strategy Reductions
Increasing Fertilizer Use Efficiencies on 13.2 Million Acres Recommended fertilizer rates Placement and timing of application Nitrification inhibitors	15 (13.2%)					Increasing Fertilizer Use Efficiencies on 1.9 Million Acres 1.8 Recommended fertilizer rates (3.1%) Placement and timing of application Reducing soil P levels Livestock feed management
Increase and Target Living Cover on 800,000 Acres Cover crops Perennial buffers Forage and biomass planting Perennial energy crops Conservation easements and land retirement	3.1 (2.7%)					Increase and Target Living Cover on 800,000 Acres 1.0 Cover crops (1.7%) Perennial buffers Forage and biomass planting Perennial energy crops Conservation easements and land retirement
Drainage Water Retention and Treatment for 1.1 Million Acres Constructed wetlands Controlled drainage	2.7 (2.4%)					Field Erosion Control on 7.2 Million Acres 0.5 © Conservation tillage and residue management (0.9%) © Terraces/grassed waterways Sediment control basins
Two stage ditches						Urban Stormwater + Other Sources (1.0%)
Wastewater Treatment		1.9			_	Wastewater Treatment 0.3 (0.5%)
Total Reductions	20.8	1.9	0	0	10tal 22.7	Total Reductions 3.3 + 0.3 + 0.6 + 16 = 20.2
Final Goal: 45% Reduction from Baseline Load = 51,000 Metric Tons Progress Since Baseline = 51,000 Metric Tons Additional 22.7 Additional 22.7 Milestone 22.7 Additional 22.7 Milestone 22.7 Additional 22.7 Additional 22.7 Additional 22.7 Additional 22.7 Additional 22.7 Additional 22.7 Additional 2.7 Ad						

Landscape Conservation Cooperatives



- (4) Eastern Tallgrass Prairie and Big Rivers LCC
- (13) Plains and Prairie Potholes LCC
- (16) Upper Midwest and Great Lakes LCC
- (9) Gulf Coastal Plains and Ozarks LCC
- (1) Appalachian LCC
- (8) Gulf Coast Prairie LCC

Mississippi River/Gulf Hypoxia Corridor Structured Decision Making (SDM) Workshop

12-14 August 2014, Memphis

Multi-LCC workshop to develop a plan for prioritizing agricultural conservation areas by mapping the most costeffective and receptive places for implementing practices with multiple benefits:

- Gulf water quality (reduced hypoxia)
- Local water quality
- Habitat conservation



Ecological Modeling

Ecological models developed to predict fisheries responses to hypoxia at population and ecosystem levels



Mississippi River Diversions

Diversion projects will alter the flow (both spatially and temporally) of sediments, nutrients and freshwater to coastal and marine systems



Influence on hypoxic zone?

From Howard Townsend, NOAA NMFS