Strategies for Phosphorus Management on Cropland

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Phosphorus

* Essential nutrient for growth of crops.
* Often needs to be applied to land for optimal crop growth.
* Land application of P as animal manure, biosolids (sewage sludge), *and* mineral fertilizer can increase the risk of P pollution of freshwater.

Factors Contributing to Phosphorus Loss from ag land to surface water

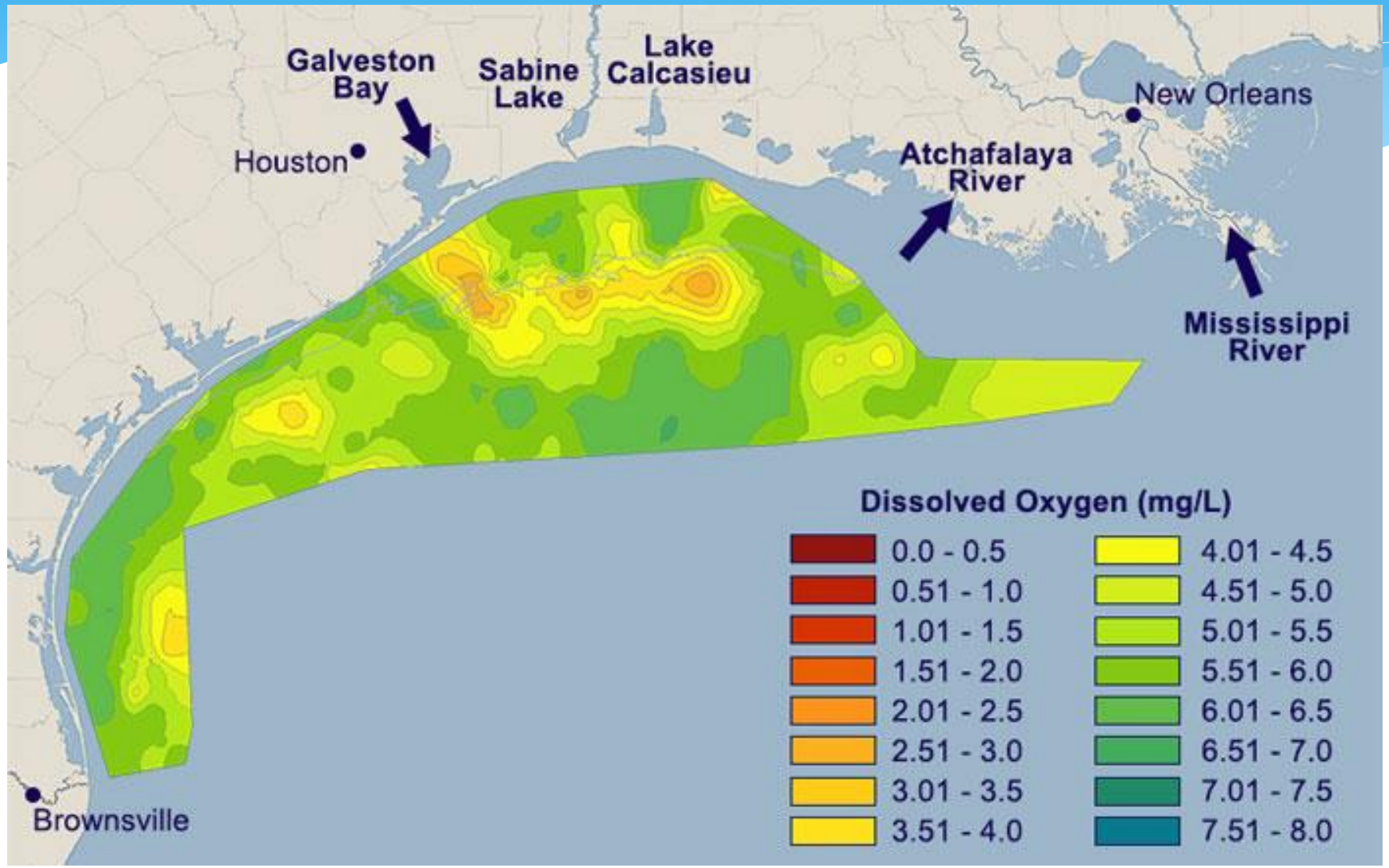
* **Commonly grouped as:**
  * Source (site and management) factors
    * STP levels.
    * Application Rate, Timing and Method,
    * Field Management and Operational Practices; and
  * Transport factors
    * Runoff volume,
    * Runoff from Rain and Snowmelt,
    * Distance from source to water bodies.

Hypoxia 101

* "Low oxygen"
* Primarily a problem for estuaries and coastal waters.
* Dissolved oxygen concentrations of less than 2-3 ppm.
* Caused by a variety of factors, including
  * Excess nutrients, primarily nitrogen and phosphorus, and
  * Waterbody stratification due to saline or temperature gradients.
* Nutrients can come from many sources, including any of the following:
  * Fertilizers from agriculture, golf courses, and suburban lawns,
  * Erosion of soil full of nutrients,
  * Discharges from sewage treatment plants,
  * Deposition of atmospheric nitrogen.

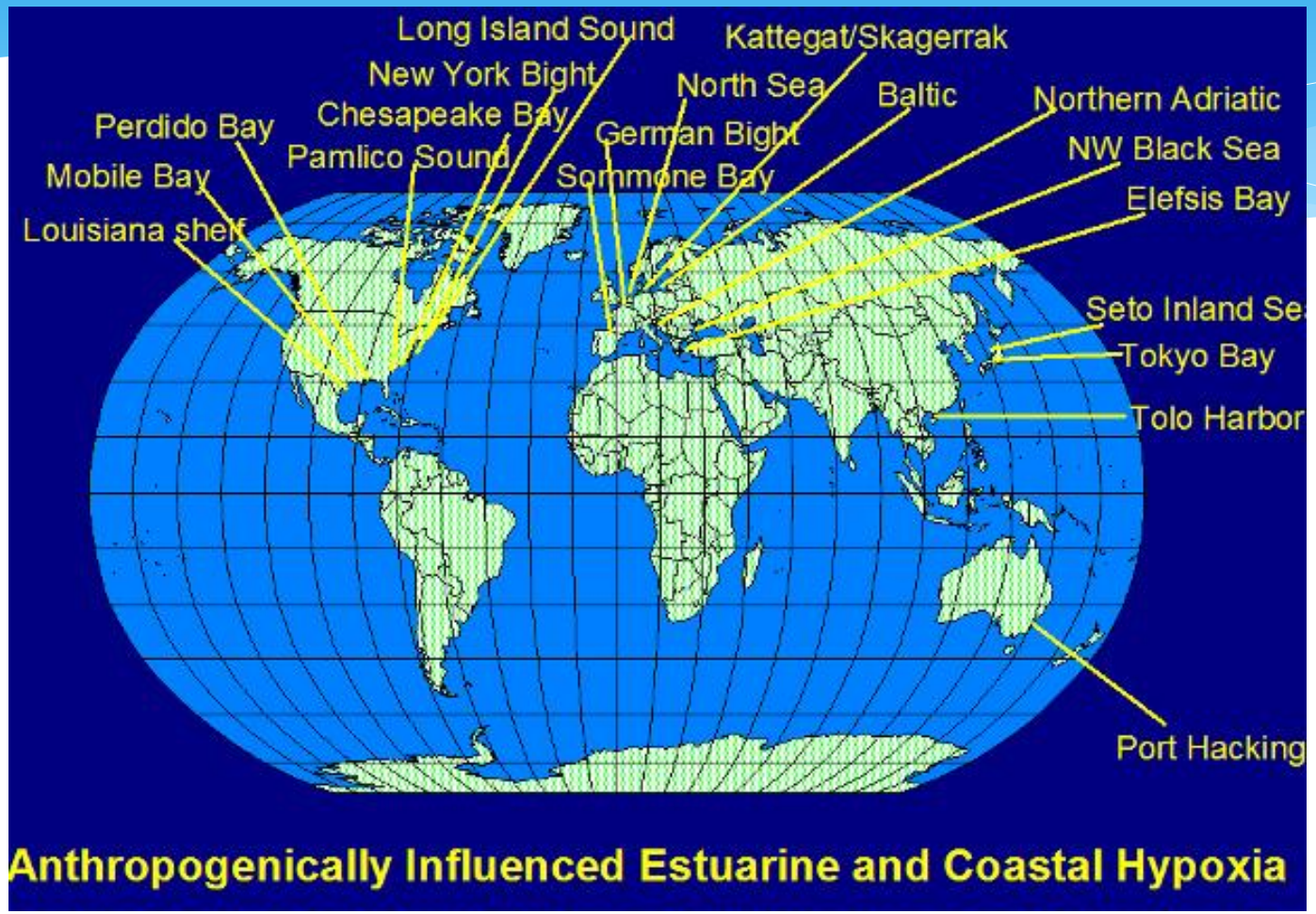
❖In 2013 - Hypoxia Zone in Northern Gulf of Mexico measured at 5,800 square miles.

❖In 2002 the hypoxia measured its largest at 8400 square miles.



◆The Mississippi River basin drains approximately 41% of the land area of the conterminous United States, ranging as far west as Idaho, north to Canada, and east to Massachusetts.
◆The 2008 Action Plan required 9 states to develop nutrient reduction strategy plans (Indiana, Illinois, Iowa, Kentucky, Ohio, Louisiana, Wisconsin, Missouri, Mississippi,
♦Tennessee will be added this coming year.

World Wide Hypoxia Zones



Audience Question

When you think about “Strategies to manage Phosphorus loss” – what comes to mind?

Phosphorus Management begins with Planning

- **Nutrient Budget** for N&P for each field?
  - Realistic Yield Goals (Actual Documentation/County Averages)
  - Did you/CCA review reports for soils and manure?
- **Soil Testing** - Following UNL Procedures?
  - Sample Timing – before any P application?
  - Sampling Locations – Representative Samples, Old feedlots
  - Sampling Depths 0-8”; 0-2” for cont. no-tilled
  - Who is sampling?
- **Manure Samples for each type/source**?
  - Annual Sampling
  - Average of 5-years worth of sampling data
- **Rick Assessment** – Nebraska Phosphorus Index – esp. for fields receiving manure.
  - Completed? If yes, was it completed Correctly?

Table I. Typical nutrient content of manure. Because of variability between farms, individual manure analysis is preferable to the estimates below.

	% Dry Matter	Nitrogen		P_2O_5	K_2O
		Ammonium-N	Organic-N		
Slurry Manure		(lbs. of nutrient per 1,000 gallons of manure)			
Dairy	8	12	13	25	40
Beef	29	5	9	9	13
Swine (finisher, wet-dry feeder)	9	42	17	40	24
Swine (slurry storage, dry feeder)	6	28	11	34	24
Swine (flish building)	2	12	5	13	17
Layer	11	37	20	51	33
Dairy (lagoon sludge)*	10	4	17	20	16
Swine (lagoon sludge)	10	6	16	48	7
Solid Manure		(lbs. of nutrient per ton of manure)			
Beef (dirt lot)	67	2	22	23	30
Beef (paved lot)*	29	5	9	9	13
Swine (hoop barns)	57	4	13	20	
Dairy (scraped earthen lots)	46	3	14	11	16
Broiler (litter from house)	70	15	60	27	33
Layer	40	18	19	55	31
Turkey (grower house litter)	70			15	30
Liquid Effluent from lagoon or holding pond		(lbs. of nutrient per acre-inch)			
Beef (runoff holding pond)	0.25	71	8	47	
Swine (lagoon)	0.40	91	45	104	
Dairy (lagoon)	2	317	362	674	1082

Value based upon ASAE, 2005, D384.2; Manure Production and Characteristics with exception of those "*".

UNL Phosphorus Recommendations for Corn

* *For corn-bean rotations*, no additional phosphorus applications are recommended when soil tests for phosphorus are greater than 17-20 ppm (using Bray-1 soil test).
* Current research updates that figure and now recommends applying phosphorus when soil test P is 20-25 ppm *or less for continuous corn.*

Phosphorus Losses

* Influenced by Application
  * Rates (high vs moderate to low),
  * Timing (avoid potential runoff events) and
  * Method (Surface, broadcast vs Inject, incorporated)
* *Recent Applications* of Phosphorus are *most prone* to losses. (Vulnerability to a runoff event occurring shortly after surface application.)
  * Intense Rainfall
  * Irrigation
  * Snow Melt Days

Audience Question

* Which poses a greater risk for runoff –

  Fertilizer P (Commercial) or Organic P (Manure)?

  * Answer:

    Risk appears to be similar for either application. The potential runoff can be greater for manure application because manure is often applied to meet Crop N needs, so the amount of P applied generally exceeds the crop needs for P.

Mechanisms for Phosphorus Loss

1. Soluble form dissolved in surface runoff (Dissolved P, DP)
2. Particulate form bound to eroded soil particles or organic matter (Particulate P, PP)

Manure Application Considerations

* Uniform Applications
  * Removal of wet manure in the fall may producer frozen manure when applied and can produce “lumps” in the field and can damage equipment. In addition to poor distribution.
* Rotate Fields for Manure Application
* No Double Dipping, i.e.
  * Avoid applying runoff water/effluent & manure solids to same field for fear of increasing STP levels to high risk.

Surface Application of Nutrients to Frozen and/or Snow-Covered Soils

For Fall and Winter Surface Application of Manure

Apply to High Risk Fields First

* P-Index Ratings 3.0 or greater
* Slopes >12%
* Ground cover <30%

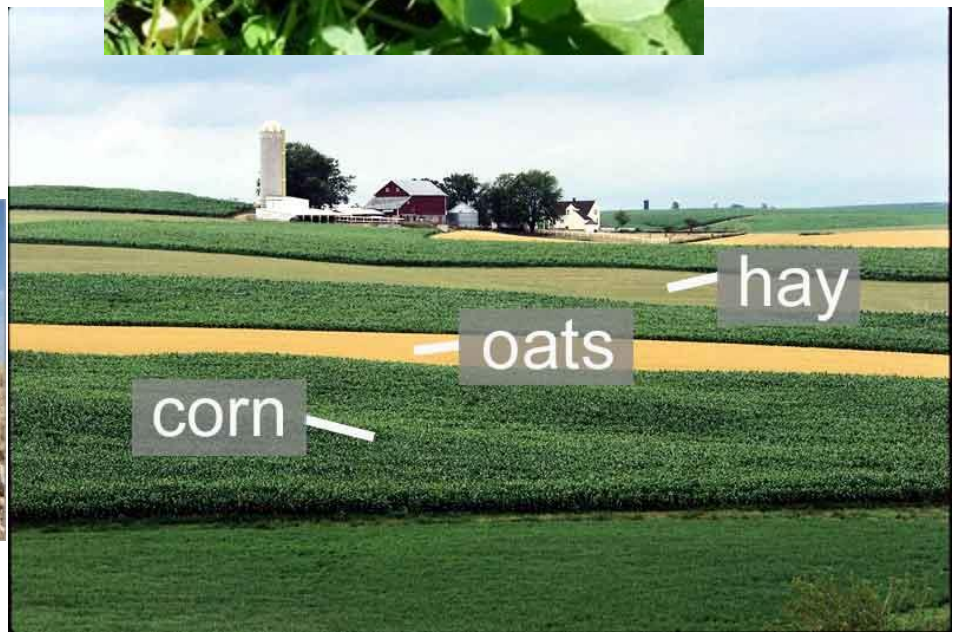
Apply to Low Risk Fields

* After the high risk fields have been manured
* Emergency Application Sites

Avoid surface manure application on ***high risk fields*** when fields are frozen and/or snow-covered

Operations or Management Practices that Reduce Runoff and Erosion

* Cover Crops
* Green Manures
* Crop Residues
* Strip Cropping



Conservation Practices that provide Runoff and Erosion Control Benefits

* Grade Stabilization Full Flow
* Level Terraces
* Pond & Grade Stabilization Retention
* Tile Inlet Terraces
* Water & Sediment Control Basins
* Grassed Waterways
* Grassed Waterways and Terrace
* Buffer Strips / Grassed Filter Strips

Livestock Operations with Large Volumes of Manure – Consider Alternatives

* Manure Composting
  * More uniform product
  * Less available N; P value won't change.
  * Lighter product & can be transported to fields further away
* Transfer manure - solids / compost to area farmers

Conservation Activity Plans (CAPs) for Nutrient MGT and Comprehensive Nutrient MGT

* NRCS offers financial assistance for the development of CAPs
  * CAP 102 – CNMPs
  * CAP 104 – Nutrient MGT

What Are CAPs?

* Simply “Planning”
* CAPs identify conservation practices needed to address specific natural resource concerns on their land.
* Completed by Certified TSP for CAP102/104.
* Upon a completion of CAPs, producers can apply for EQIP assistance on structures or implementation of management.

CAPs Payments Rates

No.	Description	Payment Rate Range*
102	CNMP	$5923.07—$9,272.28
104	Nutrient MGT	$1,665.53 - $2,397.89

The End

Thank you for your attention