

# Phase 6-PQUAL Nitrogen Sensitivity

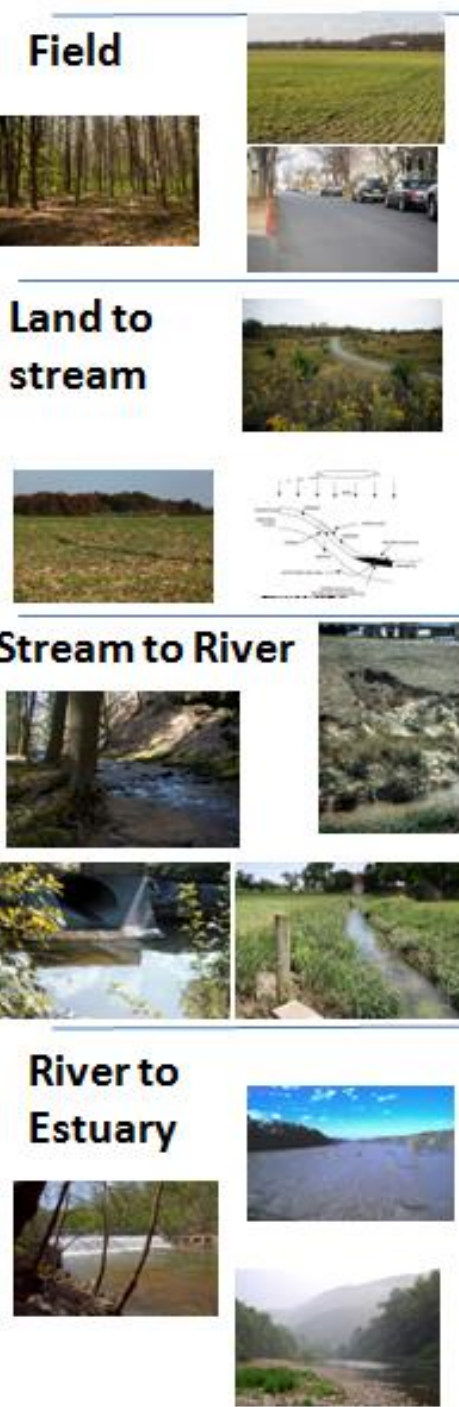
Modeling Quarterly Review Meeting  
April, 2015

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UMCES

# Objectives

- To review the previous nitrogen sensitivity analysis (2014)
- To present the new approach

*\* The input-output relationship or the effect of changes in nutrient inputs on nutrient export is referred to in this analysis as sensitivity.*



# Phase 6

## *Nutrients*

Estimate Spatial Average EOS  
Based on land use and inputs

Estimate watershed delivery  
variance based on landscape  
parameters

Estimate small stream effects

Directly Simulated in HSPF

Phase 6 Load =

Average + Sensitivity \*  $\Delta$  Inputs  
Load

BMPs

Watershed Delivery Variance  
Centered on 1

Stream Delivery

River Delivery

# Previous Nitrogen Sensitivity Analysis Using P532-AGCHEM

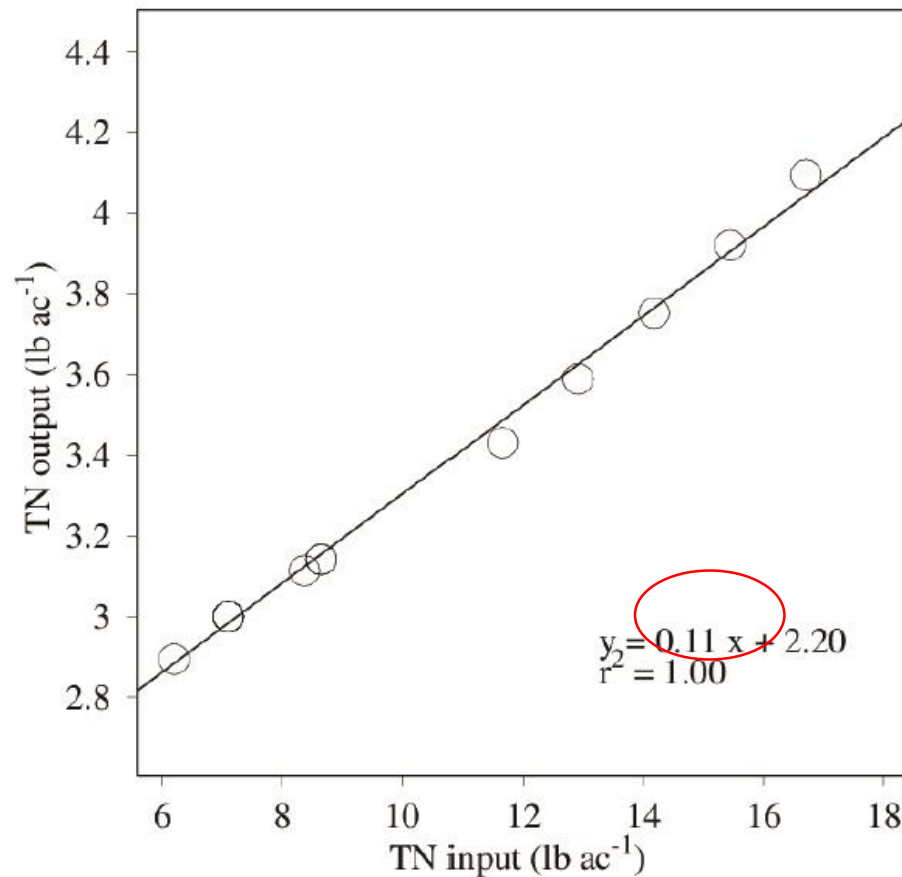
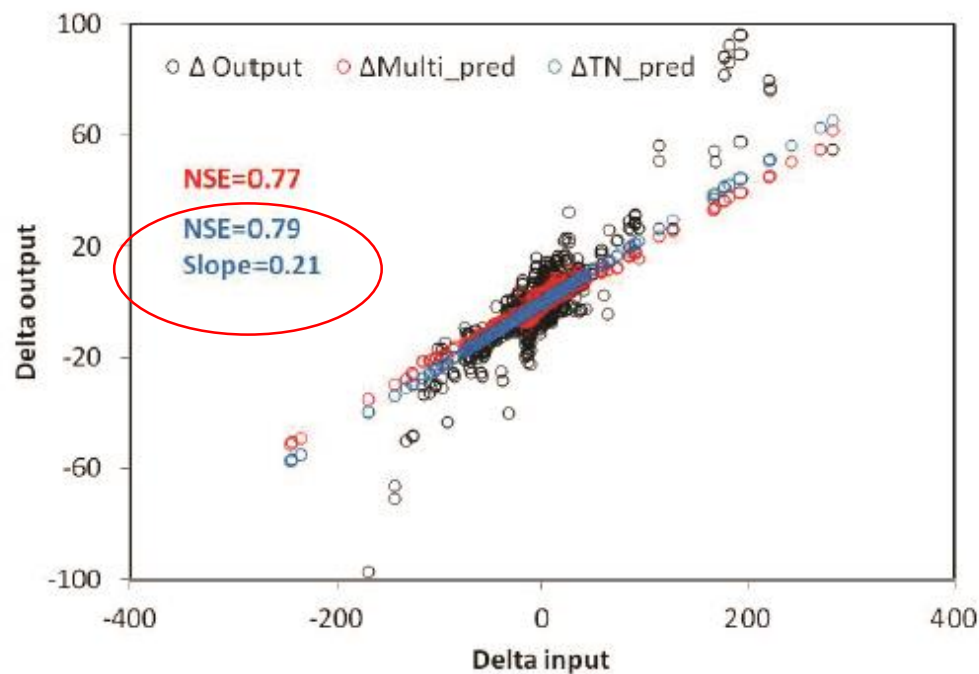


Figure 3. 1. Example of regression function between total nitrogen atmospheric deposition (TN input) and output on forest land use of the land segment A24023, Washington County, MD. Atmospheric deposition is the only type of input on forest.

(Tian, 2013)

# Previous Nitrogen Sensitivity Analysis Using P532-AGCHEM

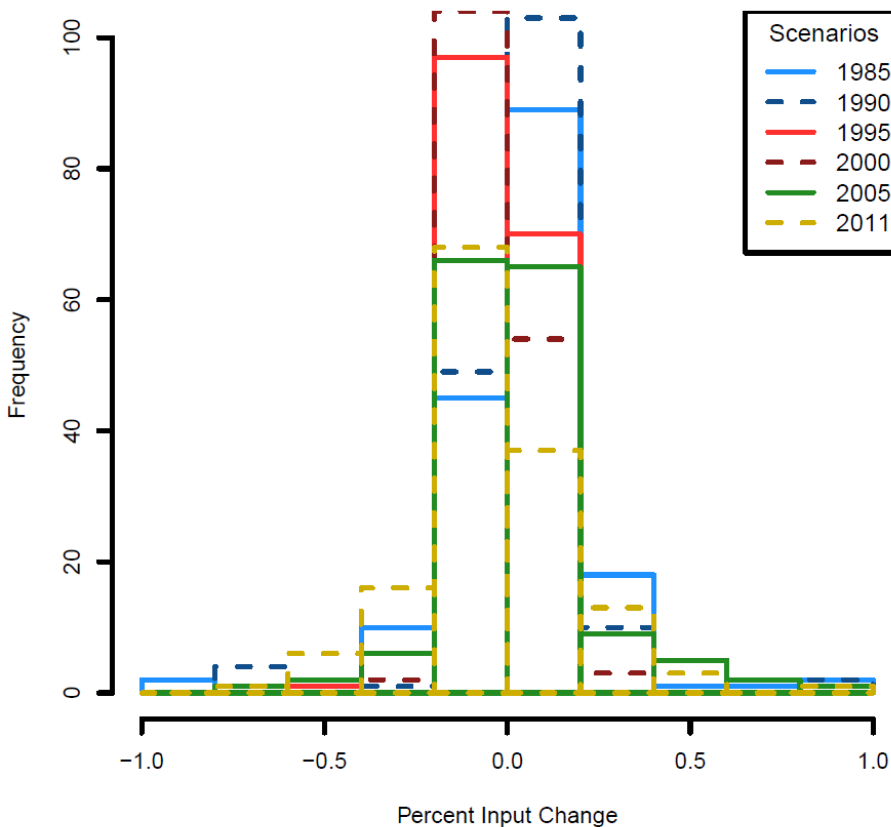


(Tian, 2013)

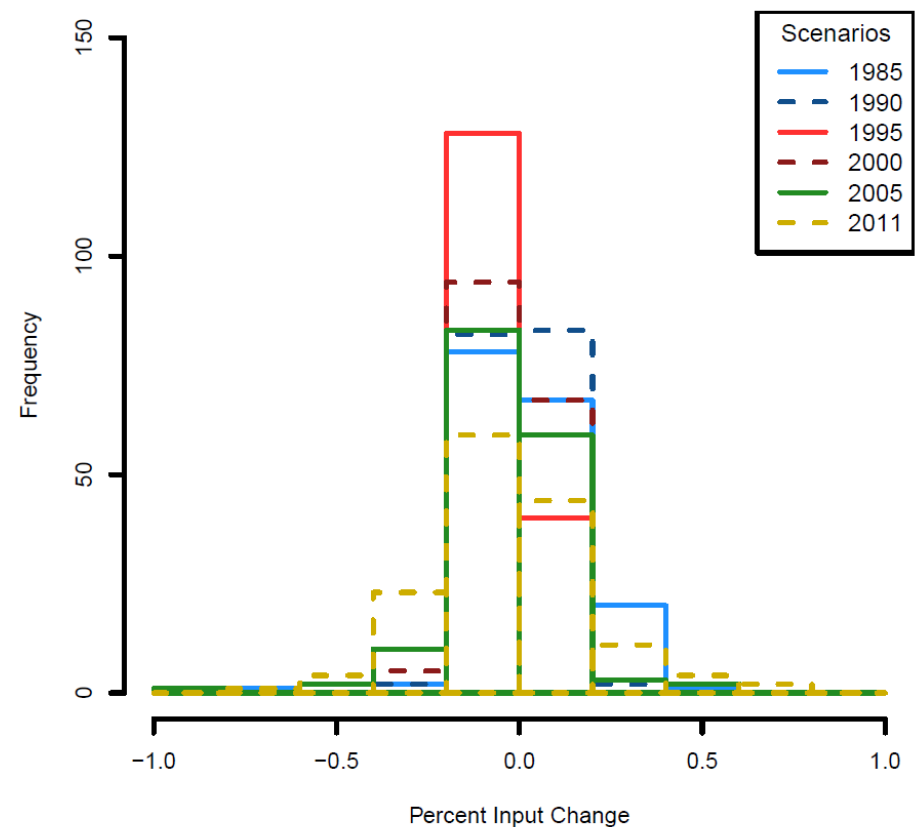
Figure 4. 3. Robustness of TN regression prediction measured by the Nash-Sutcliffe Efficiency (NSE) coefficient between model output and regression prediction on high-tillage cropland with manure (hwm). Delta input is the demeaned total nitrogen input and delta outputs are the demeaned outputs from AGCHEM (black dots) and regression prediction using both total nitrogen input (blue dots) and multi-variate regression analysis (red dots).

# P532-AGCHEM Scenarios Input Change

TOTN FERTILIZER high-till without manure (hom)

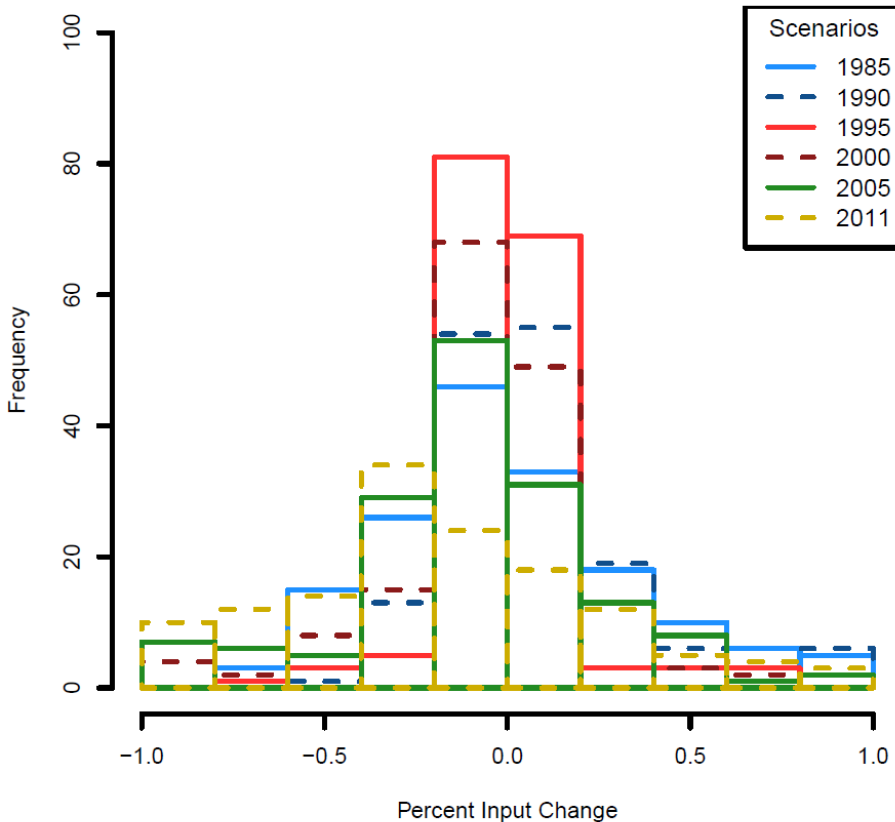


TOTN FERTILIZER high-till with manure (hwm)

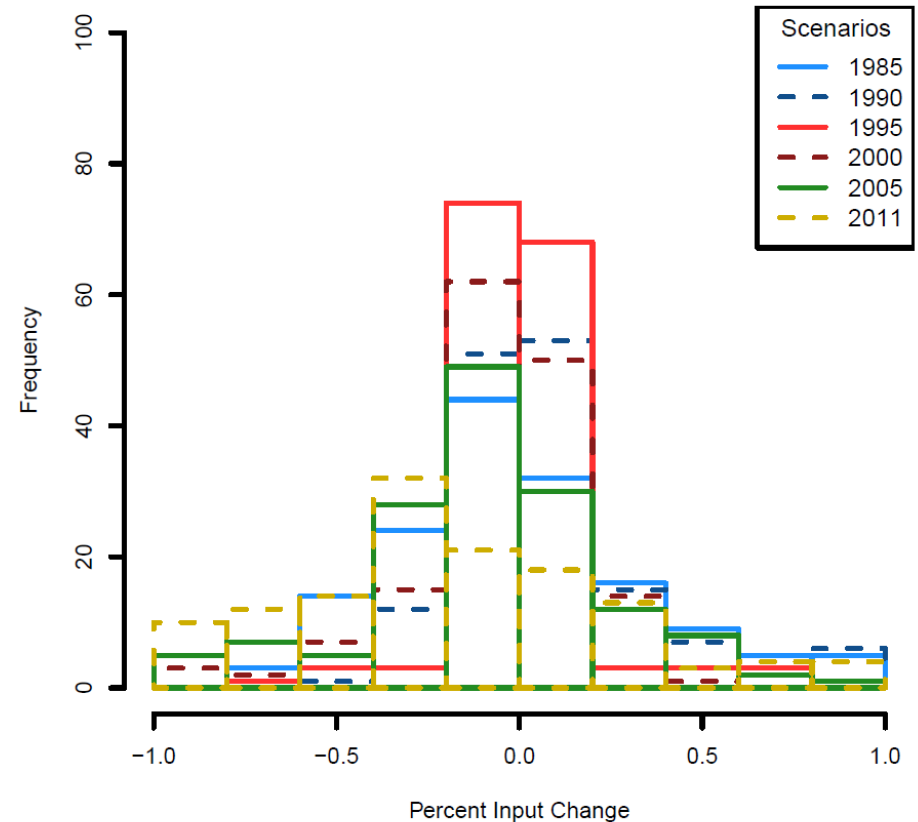


# P532-AGCHEM Scenarios Input Change

TOTN MANURE high-till with manure (hwm)



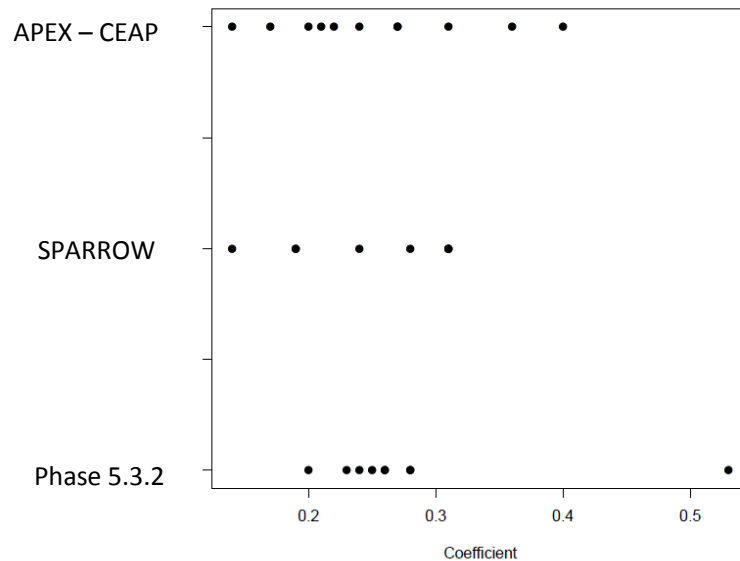
TOTN MANURE low-till with manure (lwm)



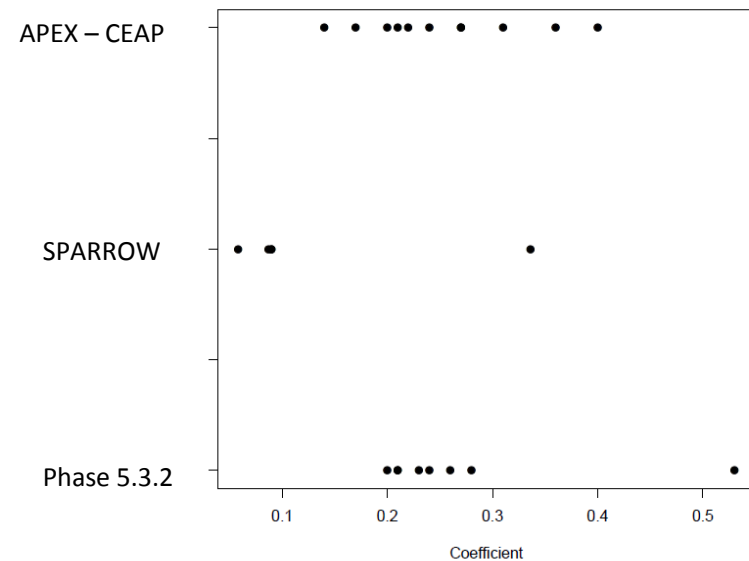
# Sensitivity to Nitrogen Inputs Analysis (2014)

- Following STAC recommendation, we evaluated the sensitivity to nitrogen inputs in the Chesapeake Bay Watershed using multiple watershed models (i.e. APEX, SPARROW, and P532-AGCHEM).
- Other models sensitivities are not contradictory to P532-AGCHEM

***Sensitivity to fertilizer TN inputs***



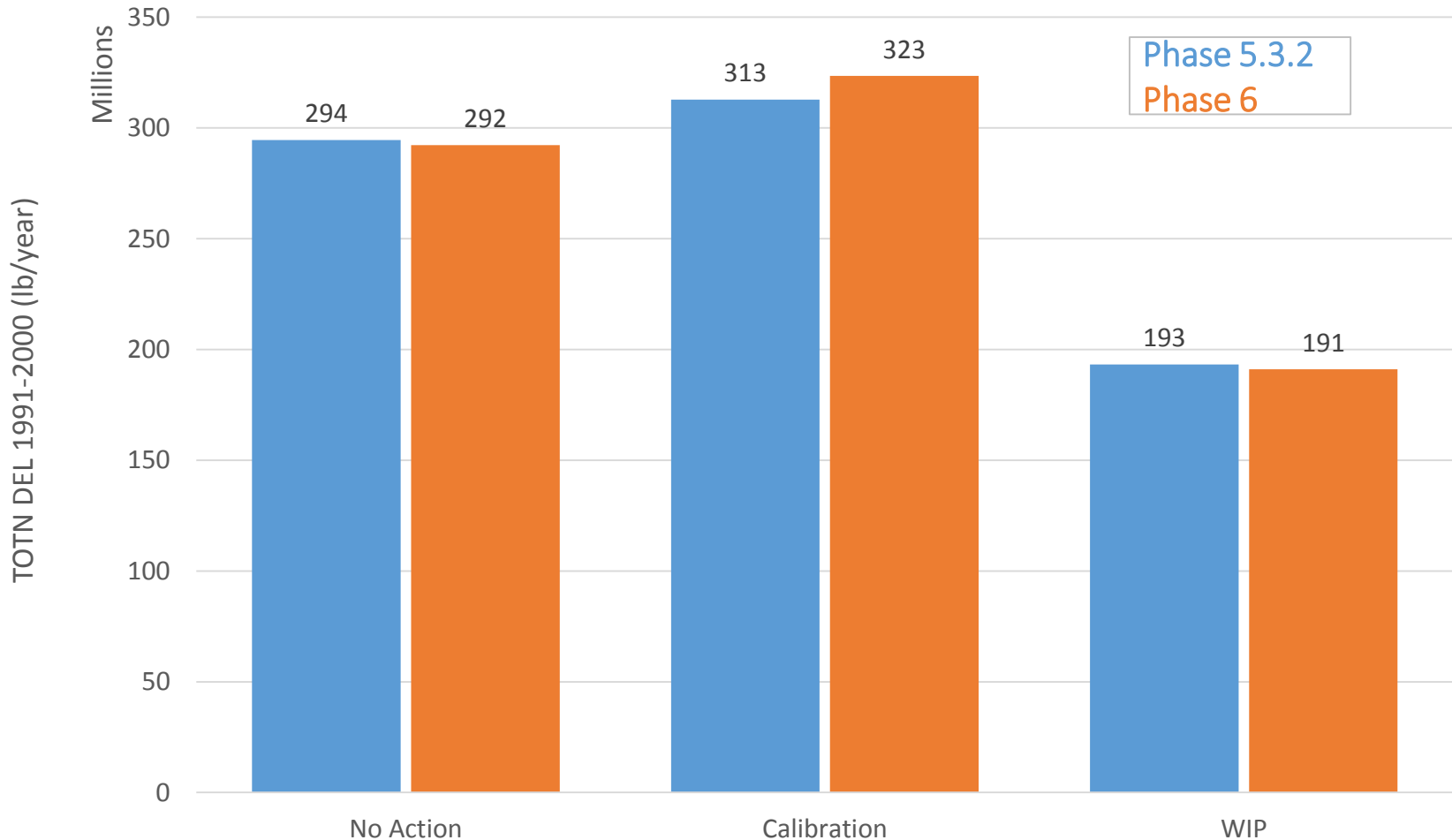
***Sensitivity to manure TN inputs***



1. APEX – CEAP: Ratio between output and input (No-practice, 2006, and 2011 scenarios including all input sources in cropland areas)
  2. SPARROW: source specific coefficient (Various studies in the Chesapeake bay and Northeastern and Mid-Atlantic regions) \*
  3. Phase 5.3.2: Ratio between input and output, slope of multivariate regression, and slope between output and input (14 scenarios , hwm, hom, lwm, alf, and hyw)
- \* Preston and Brakebill (1999), Ator et al. (2011), Moore et al. (2011), and Preston et al. (2011).



# P532-AGCHEM Sensitivities (2014) on Phase 6

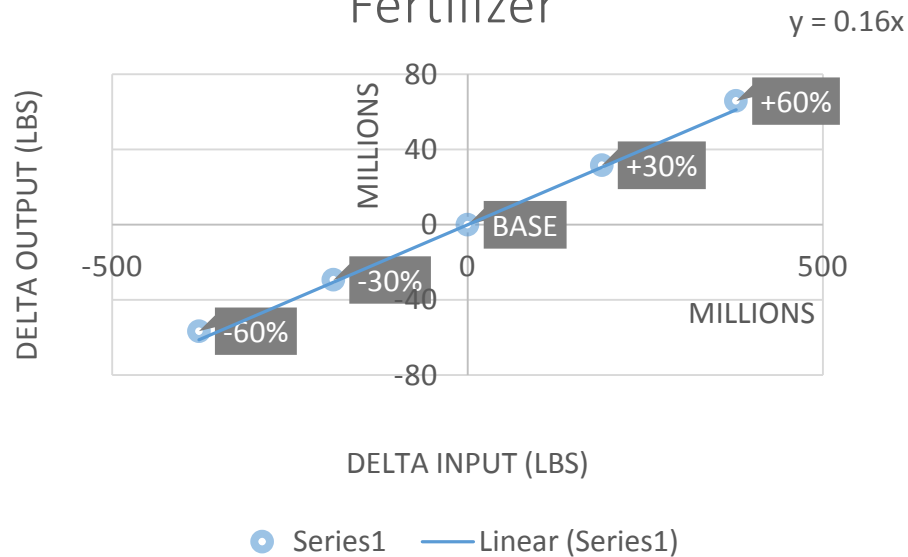


# New Nitrogen Sensitivity Analysis Approach

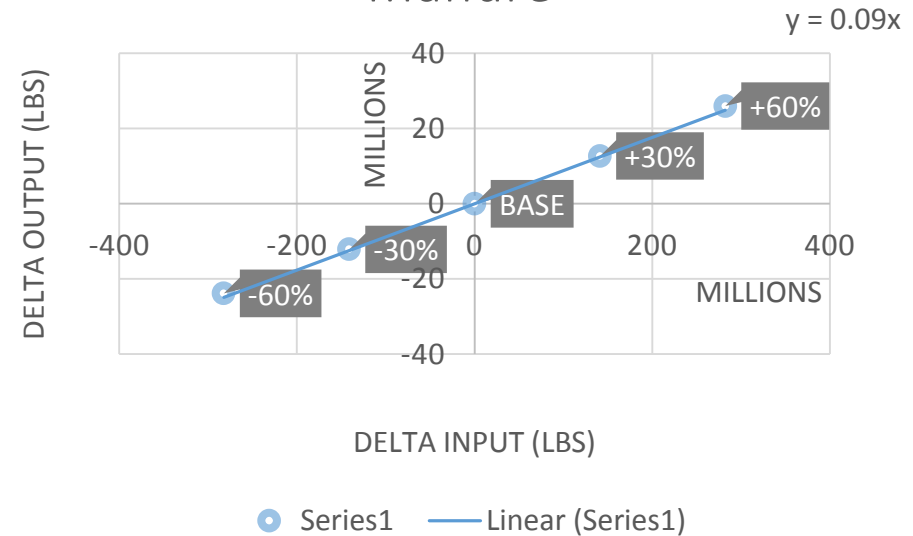
- Run all AGCHEM land uses for EOF output
  - hom hwm lwm alf for pas hyo npd
- Base scenario 1997 No Action
- Fertilizer, Manure, Atdep, Crop Uptake, Fixation, and Crop Cover (6)
- -60% -30% 0% +30% +60% (4)
- TN, NO<sub>3</sub>, NH<sub>3</sub>, and ORGN (4)
- All land segments (367)
  - $6 \times 4 + 1 = 25$  scenarios

# New Nitrogen Sensitivity Analysis Approach

Sensitivity Analysis - TOTN  
Fertilizer

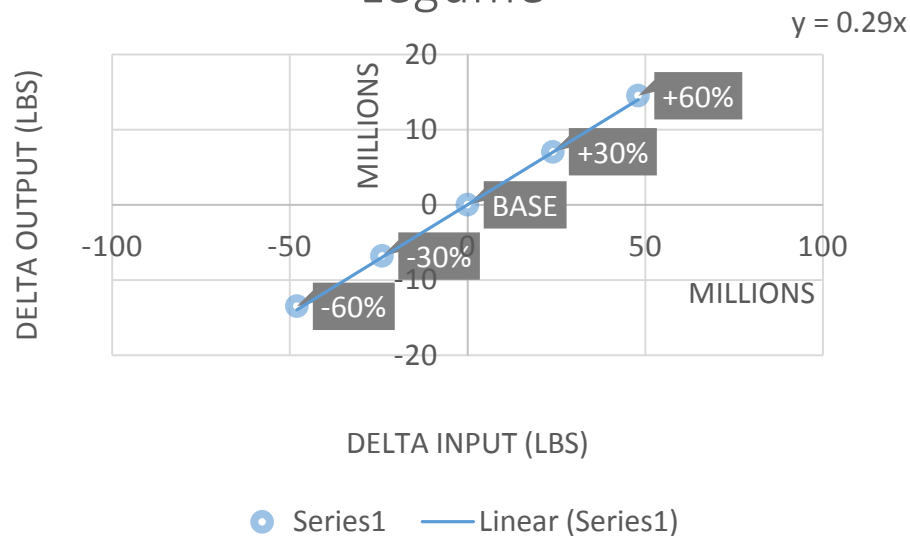


Sensitivity Analysis - TOTN  
Manure



# New Nitrogen Sensitivity Analysis Approach

Sensitivity Analysis - TOTN  
Legume



Sensitivity Analysis - TOTN  
ATDEP

