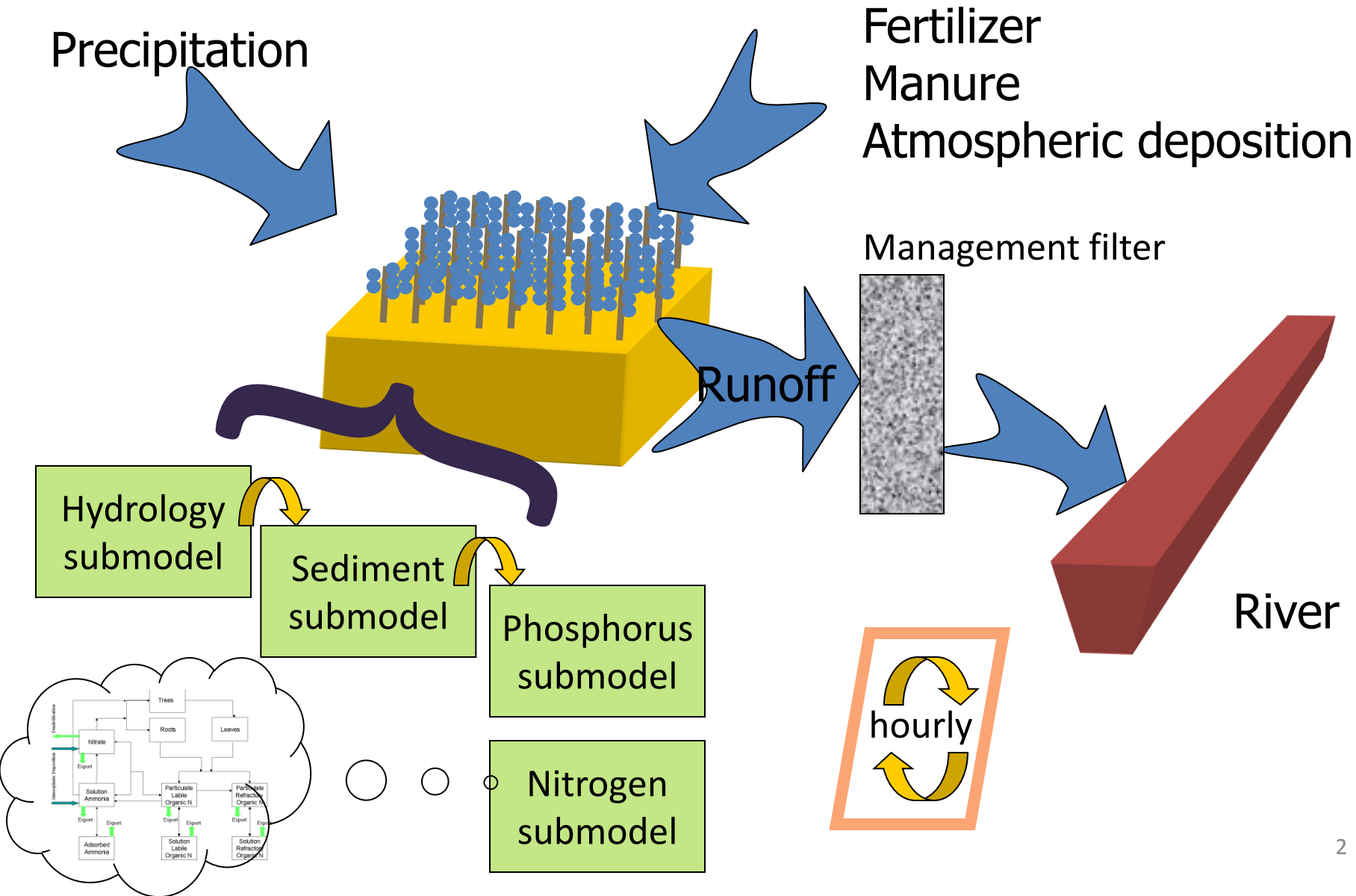
Phase 6 Sensitivities

Gary Shenk

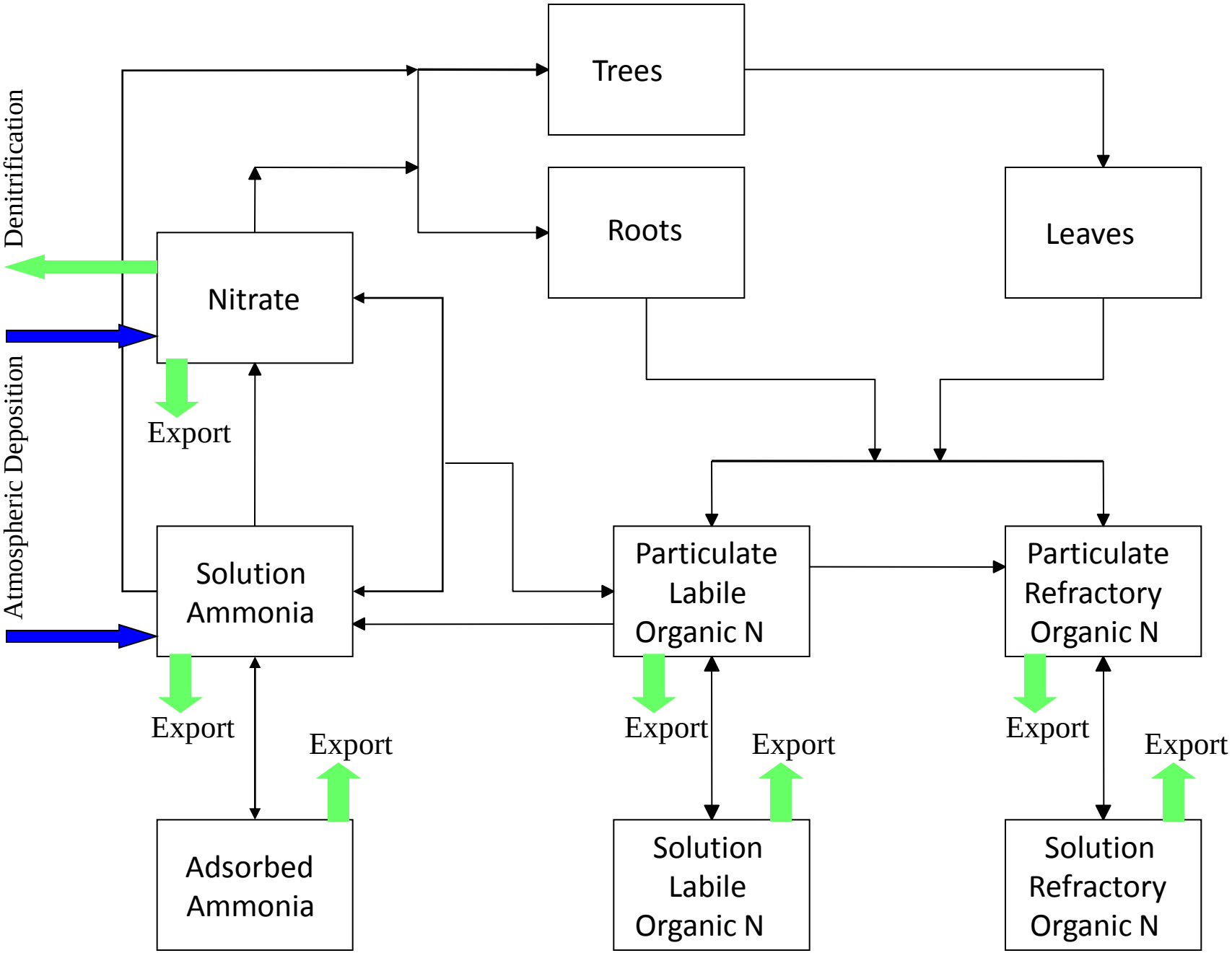
ModWG QR

7/23/13

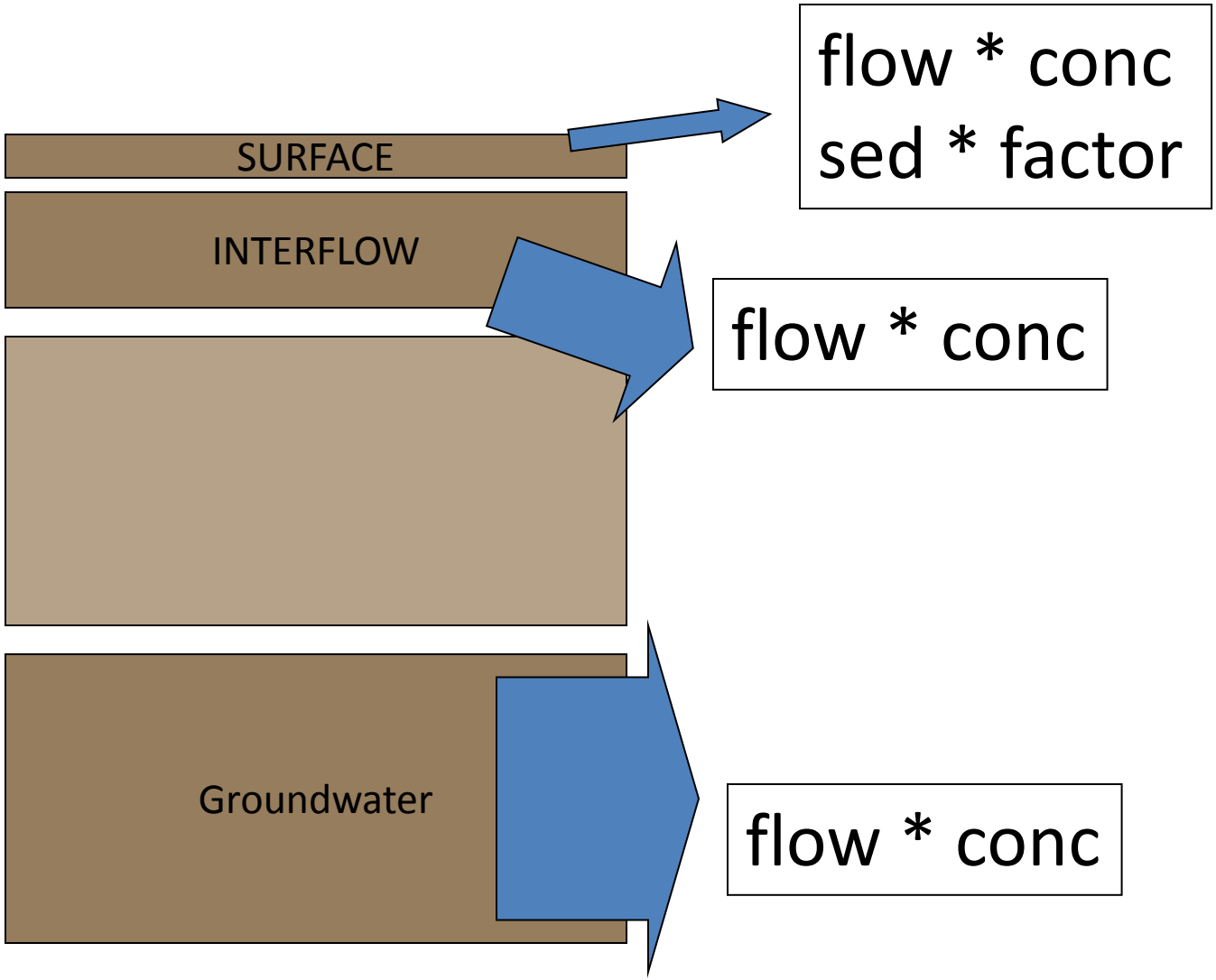
Near-Term Development Plan



AGCHEM Nitrogen Cycle



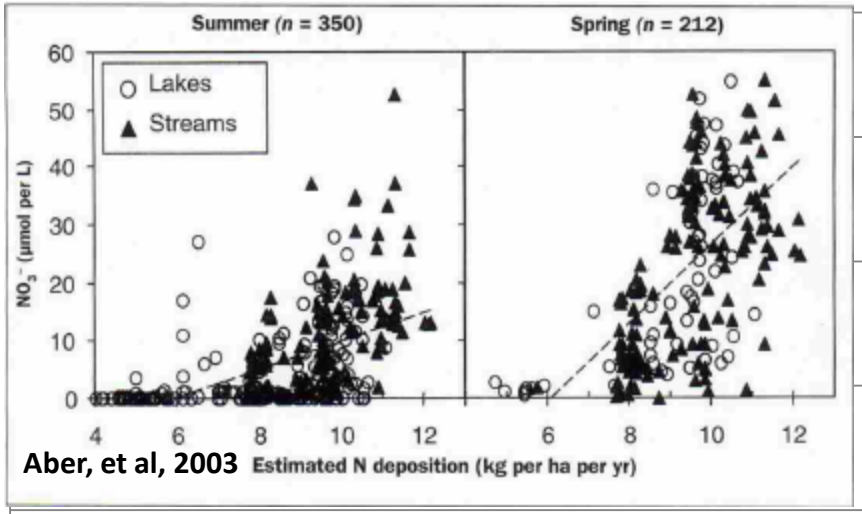
PQUAL loading model



Complex *vs* Simple

Complex	Simple
• Calibration is complex and time consuming	• Calibration is relatively simple and fast
• Calibration is imprecise	• Calibration is precise
• Longer run time	• Shorter run time
• Simulated sensitivity to inputs	• Sensitivity to inputs must be specified (by multiple research models and methods)

Reduction in forest loads from 1985 to CAIR

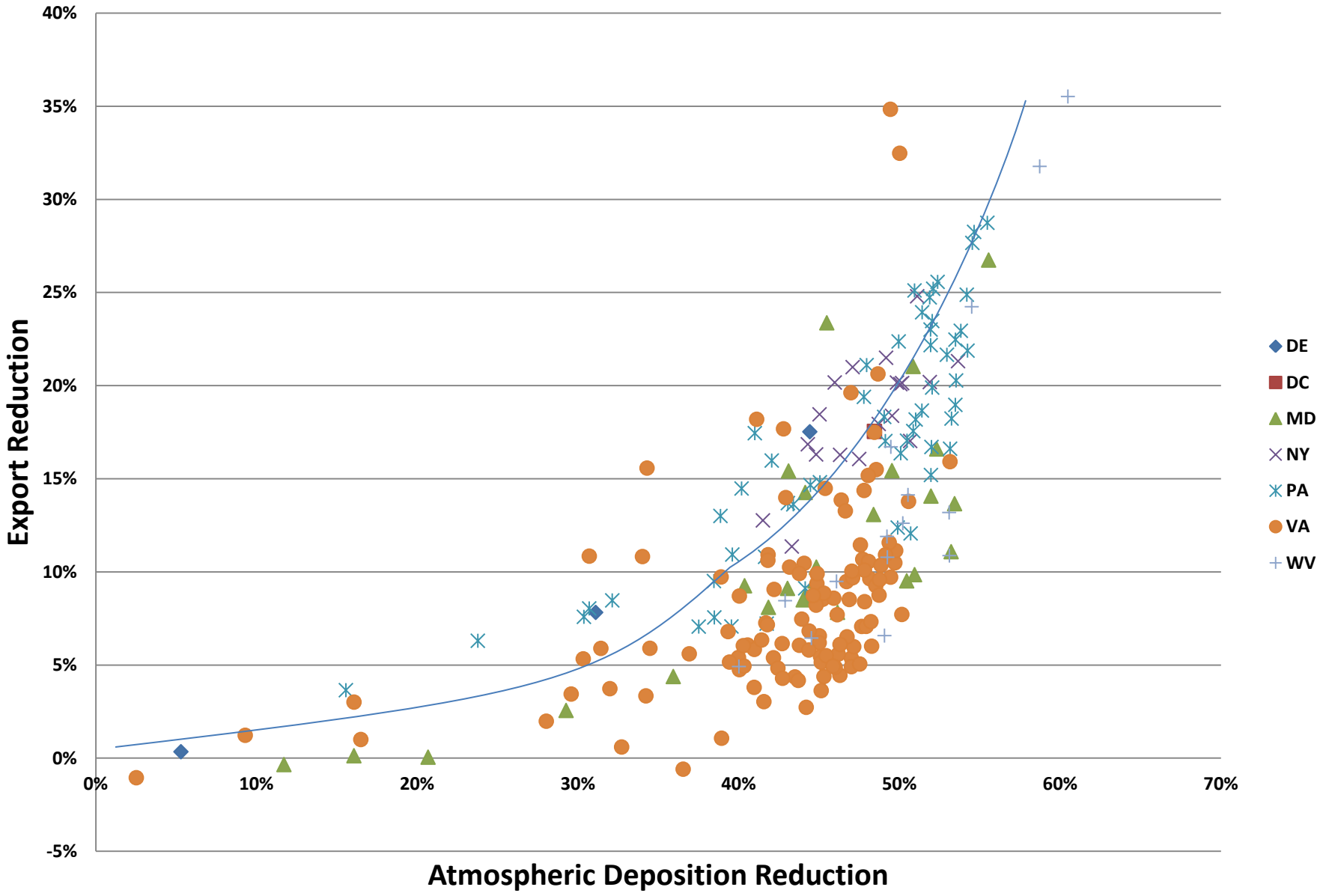


Export Reduction

40%
35%
30%
25%
20%
15%
10%
5%
0%
-5%

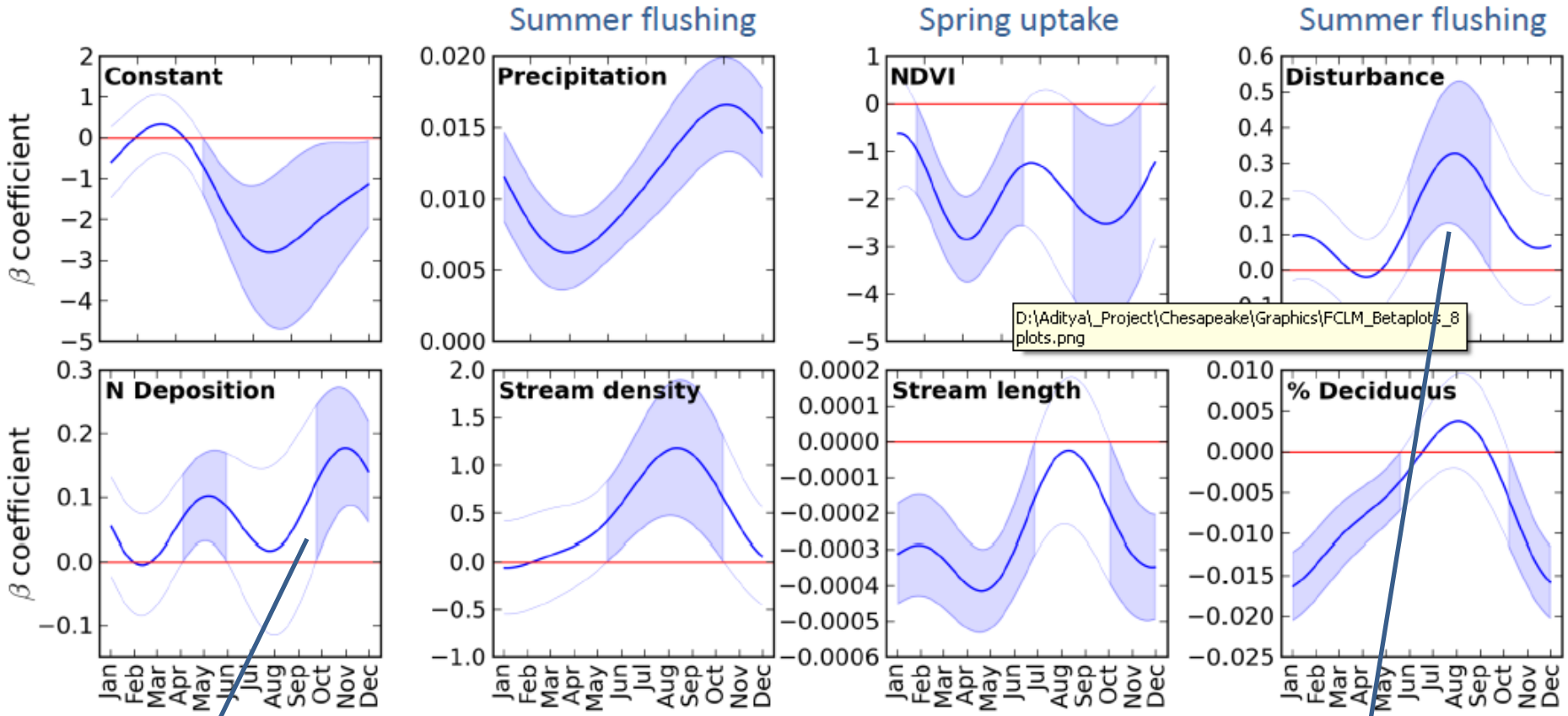
0%
10%
20%
30%
40%
50%
60%
70%

Atmospheric Deposition Reduction


Reduction in forest loads 1985 to CAIR
Export Reduction
Atmospheric Deposition Reduction
40%
35%
30%
25%
20%
15%
10%
5%
0%
-5%
0%
10%
20%
30%
40%
50%
60%
70%
DE
DC
MD
NY
PA
VA
WV

Results:

Regression of monthly nitrate yield – Preliminary Results



Estimating nitrate export from Chesapeake Bay watersheds using MODIS and climate data

Aditya Singh and Phil Townsend

Angélica Gutiérrez-Magness

Keith Eshleman

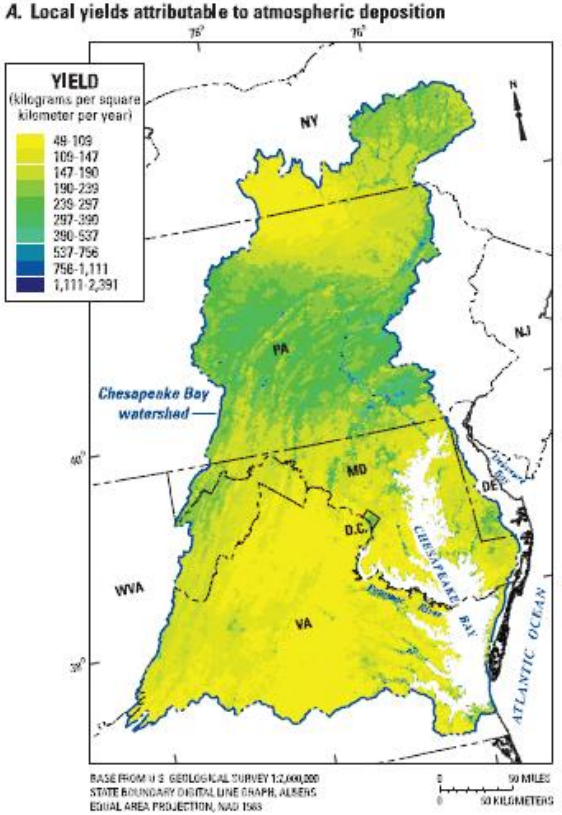
Brenden McNeil

Deposition is Important in the spring and fall

Disturbance is Important in the summer

SPARROW Surface Water-Quality Modeling

NAWQA Home | Model Description | Fact Sheet | Decision Support System | FAQs



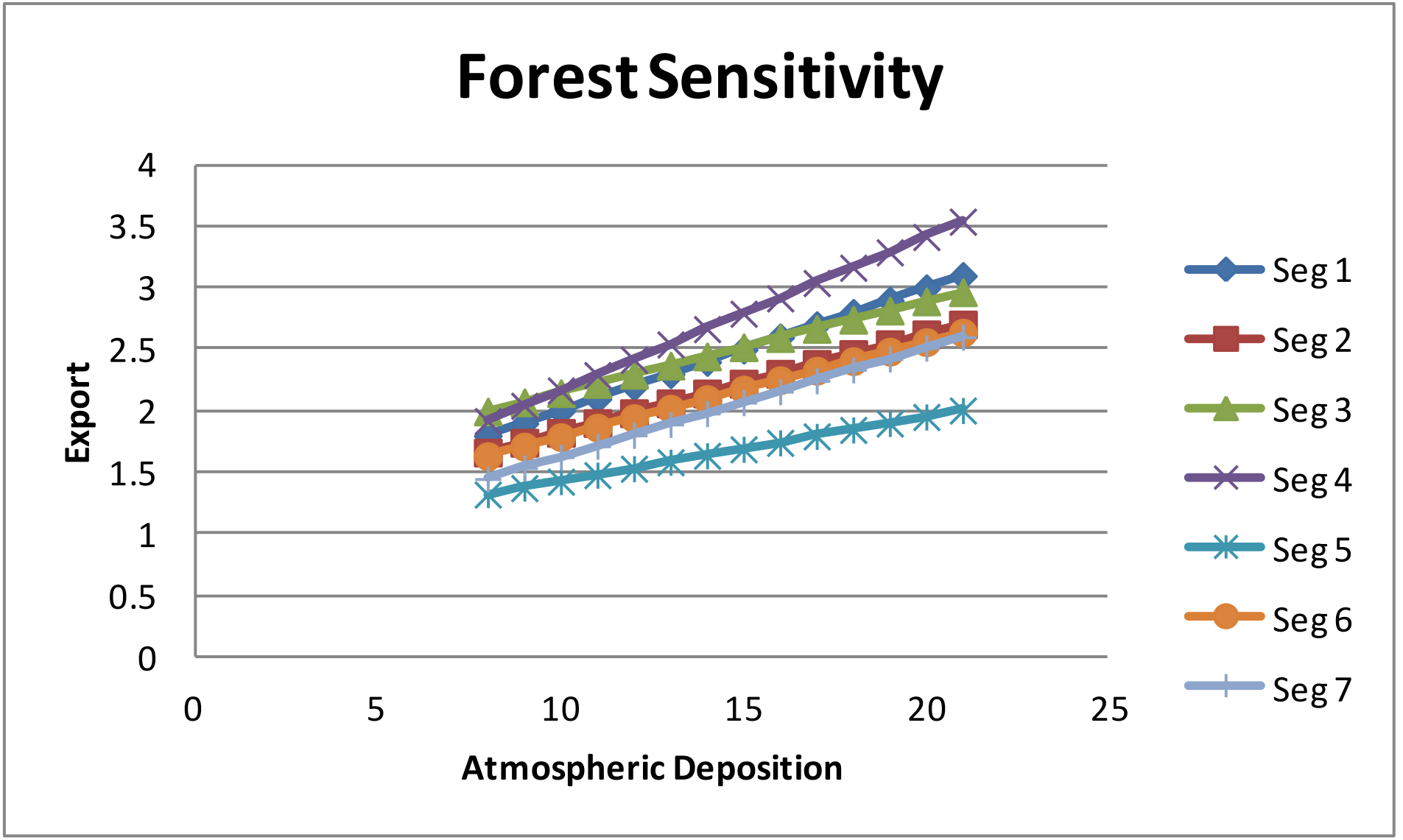
Total Nitrogen, 2002
(n = 181, MSE = 0.0836, RMSE = 0.289, flux R^2 = 0.978, yield R^2 = 0.858

Explanatory variables	Estimate	Units	90-percent confidence interval	Standard error	p[1]
Sources					
Point sources (kg yr^{-1})	0.774		0.375 – 1.17	0.242	0.0008
Crop fertilizer and fixation (kg yr^{-1})	0.237		0.177 – 0.297	0.0363	< 0.0001
Manure (kg yr^{-1})	0.0582		0.0138 – 0.103	0.0269	0.0157
Atmospheric deposition (kg yr^{-1})	0.267		0.179 – 0.355	0.0533	< 0.0001
Urban[2] (km^2)	1,090	kg km^{-2} yr^{-1}	707 – 1,480	234	< 0.0001
Land-to-water delivery					
ln[Mean EVI for WY02 (dimensionless)]	-1.70		-2.65 – -0.737	0.580	0.0039
ln[Mean soil AWC (fraction)]	-0.829		-1.26 – -0.401	0.260	0.0016
ln[Groundwater recharge (mm)]	0.707	mm^{-1}	0.499 – 0.916	0.126	< 0.0001
ln[Piedmont carbonate (percent of area)]	0.158		0.0755 – 0.241	0.0500	0.0018

Sensitivity incorporation

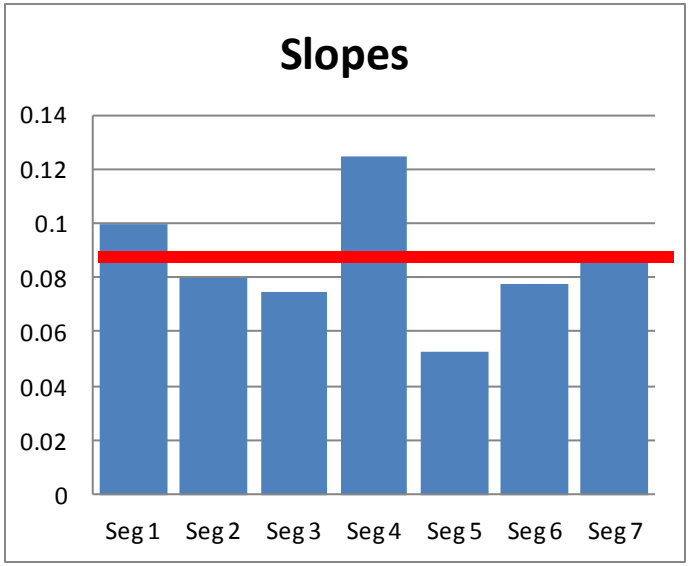
1. Determine generalized sensitivity from AGCHEM
2. Literature / model search for sensitivities to input
3. Decision on sensitivity approach from the Modeling Workgroup
4. Implementation of sensitivity in the phase 6 model

Fake model runs



Purpose of analysis:
see how the model output changes from the calibration under different loading scenarios

Fake model runs

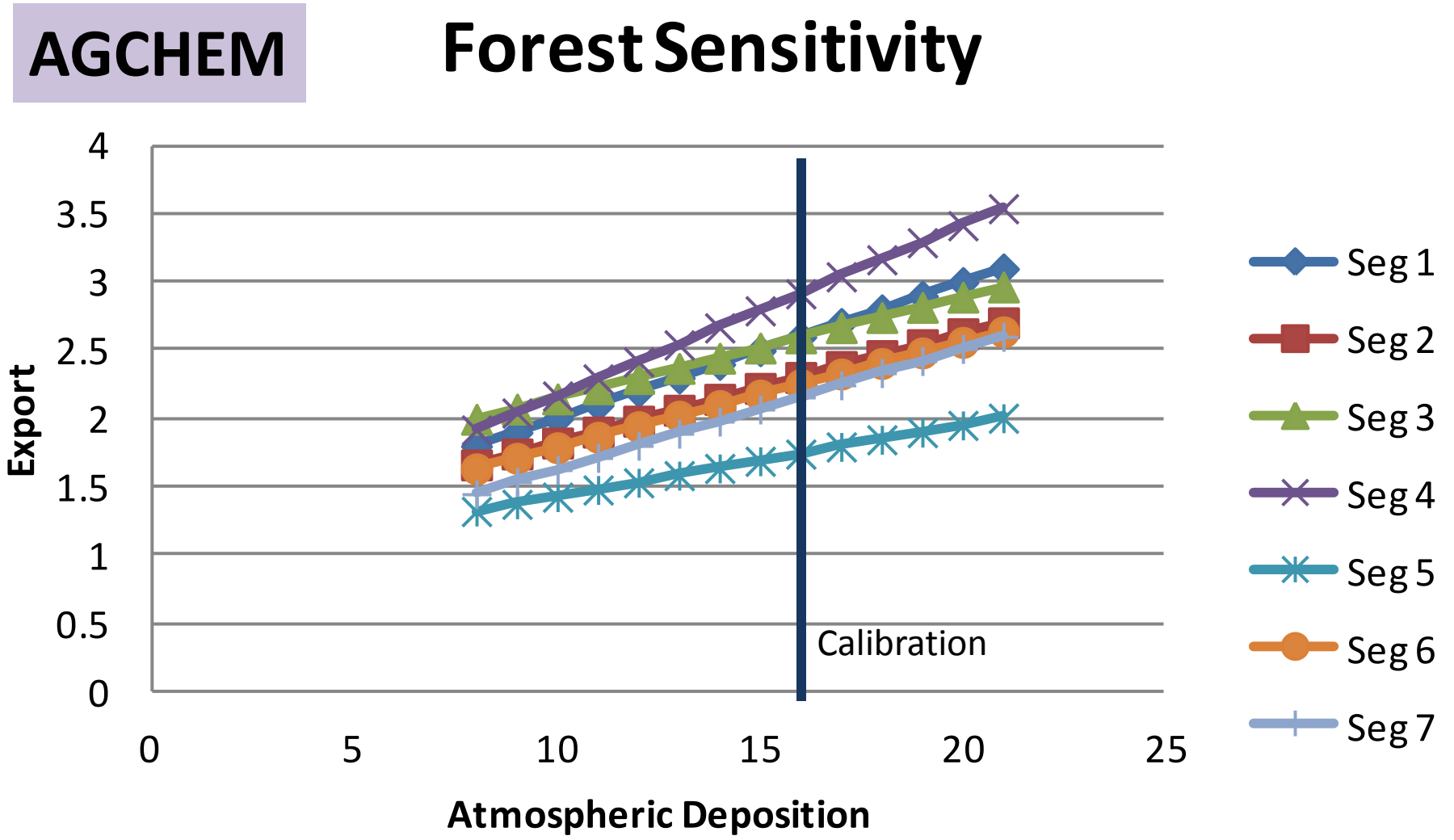


Central tendency is 0.085 pounds out per pound in

How would it work out if we used that sensitivity everywhere

Fake model runs

AGCHEM



Purpose of analysis:

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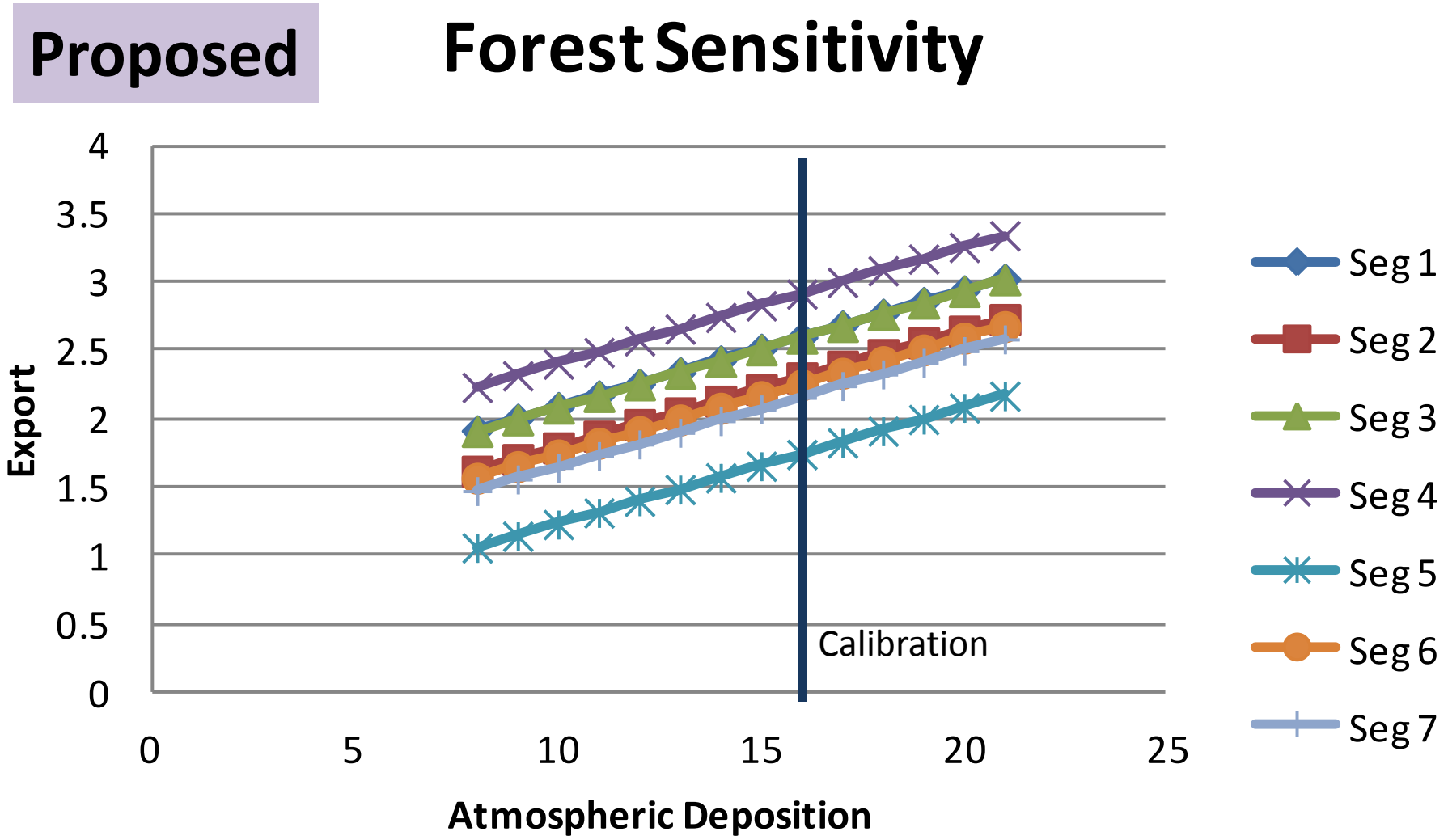
Fake model runs

Proposed



Purpose of analysis:
see how the model output changes from the calibration under different loading scenarios

Questions

- Are the slopes linear?
- Do the slopes vary spatially?
- Do the slopes vary by constituent (DIN vs ORGN?)
- How well does the proposed PQUAL sensitivities match the AGCHEM sensitivities?
- How do the slopes vary across land uses?
- How do the slopes compare to other models?