Process for Regional Factor Application to Phase 6

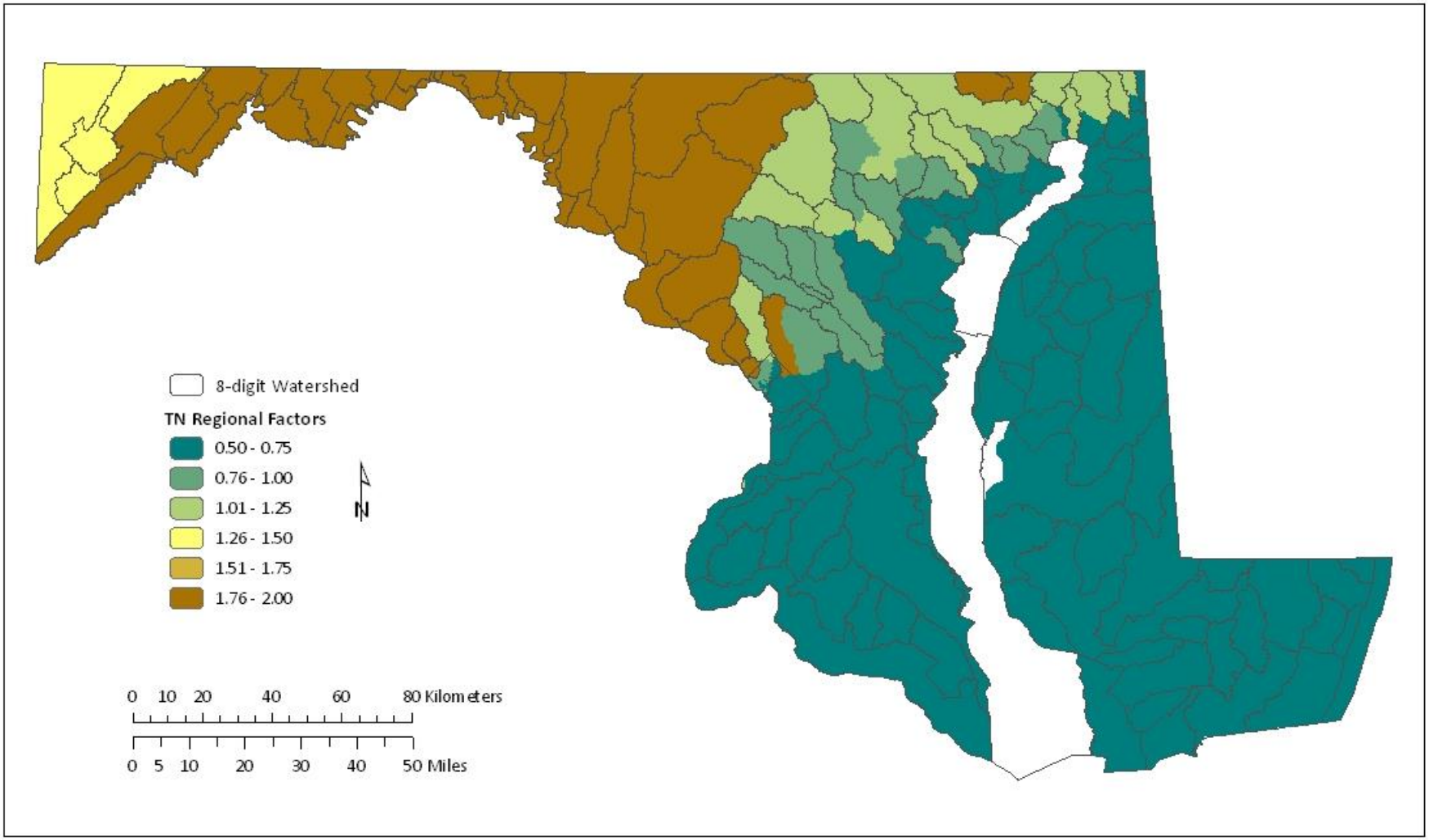
Gary Shenk

ModWG 4/4/2017

Regional Factors

- CBP-specific terminology
- Loading factors that are applied equally to all nonpoint sources upstream of a monitoring station to improve load calibration
- Ad-hoc use in Phase 2 and Phase 4
- Systematic use in Phase 5

P532 TN Regional Factors In MD



MD points out that regional factors vary over the state, resulting in variability in pound per acre loads between counties, which has implications for communicating results and for trading.





Phase 6 Model Structure

Average Load + Δ Inputs * Sensitivity

*

Land Use Acres

*

BMPs

*

Land to Water

*

Stream Delivery

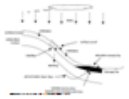
*

River Delivery

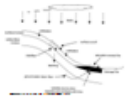
Direct Loads

Phase 6

Scale in the Chesapeake Bay Program Watershed Model

Landscape	Phase 5 Nutrients	Phase 5 Sediment	Phase 6 Nutrients	Phase 6 Sediment	Sparrow	Other Data Sources
Field   		**AG and Forest:** Used RUSLE2 to estimate EOF sediment targets **Urban**: Used Langland and Cronin To estimate pervious vs impervious loading	*Can we estimate EOF loads directly based on available information?*	*Should we update the sediment EOF estimates?*	Sources (fertilizer, manure, atdep, urban area) multiplied by global coefficients	Literature Reviews from TetraTech Sources in Phase 5 documentation Sensitivity documentation CEAP APLE
Land to stream   	Field-level, hillslope, and small stream processes are all combined in the Edge-of-Stream nutrient estimates No EOF is simulated EOS estimates are a combination of regional factors and field-scale process simulation calibrated to average export rates Informed by inputs and calibration	Hillslope and small stream processes are combined in a sediment delivery ratio that is based on the average distance between each major land use type and a major river, adjusted for the coastal plain.	*Can we estimate watershed delivery based on landscape parameters?*		Land to Water factors such as soil parameters and slopes	ICPRB/USGS Sparrow Land Data team Connected Impervious Land Data team Urban Tree Canopy
Stream to River    			*Can we estimate small stream effects?*		Explicitly simulated to NHD+ level	ICPRB/USGS Sparrow Land Data team Urban Stream Corridor Land Data team Riparian Forest Land Data team Riverine Wetlands Center for Watershed Protection CBP Grant
River to Estuary   	Directly Simulated in HSPF for river averaging at least 100 cfs Calibrated to WQ data		Directly Simulate in HSPF for river averaging at least 100 cfs Calibrate to WQ data		Explicitly simulated	Calibrate to sparrow DFS or loads?

Scale in the Chesapeake Bay Program Watershed Model

Landscape	Phase 5 Nutrients	Phase 5 Sediment	Phase 6 Nutrients	Phase 6 Sediment	Sparrow	Other Data Sources
Field   		**AG and Forest:** Used RUSLE2 to estimate EOF sediment targets **Urban:** Used Langland and Cronin To estimate pervious vs impervious loading				
Land to stream   	Field-level, hillslope, and small stream processes are all combined in the Edge-of-Stream nutrient estimates No EOF is simulated EOS estimates are a combination of regional factors and field-scale process simulation calibrated to average export rates Informed by inputs and calibration	Hillslope and small stream processes are combined in a sediment delivery ratio that is based on the average distance between each major land use type and a major river, adjusted for the coastal plain.				
Stream to River    						
River to Estuary   		Directly Simulated in HSPF for river averaging at least 100 cfs Calibrated to WQ data				

- Phase 5 had calibrated regional Factors to account for differences in small watershed and small stream delivery
- Necessary to meet water quality measurements
- Presented difficulties in communication

Scale in the Chesapeake Bay Program Watershed Model

Landscape	Phase 5		Phase 6		Sparrow	Other Data Sources
	Nutrients	Sediment	Nutrients	Sediment		
Field 		**AG and Forest:** Used RUSLE2 to estimate EOF sediment targets **Urban:** Used Langland and Cronin To estimate pervious vs	*Can we estimate EOF loads directly based on available information?*	*Should we update the sediment EOF estimates?*	Sources (fertilizer, manure, atdep, urban area) multiplied by global coefficients	Literature Reviews from TetraTech Sources in Phase 5 documentation Sensitivity documentation CEAP APLE
Land to stream 					Land to Water factors such as soil parameters and slopes	ICPRB/USGS Sparrow Land Data team Connected Impervious Land Data team Urban Tree Canopy
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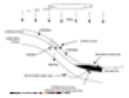
- If we can describe the function of hillslopes and small streams ….

Scale in the Chesapeake Bay Program Watershed Model

Landscape	Phase 5 Nutrients	Phase 5 Sediment	Phase 6 Nutrients	Phase 6 Sediment	Sparrow	Other Data Sources
Field   		**AG and Forest:** Used RUSLE2 to estimate EOF sediment targets **Urban**: Used Langland and Cronin To estimate pervious vs impervious loading	*Can we estimate EOF loads directly based on available information?*	*Should we update the sediment EOF estimates?*	Sources (fertilizer, manure, atdep, urban area) multiplied by global coefficients	Literature Reviews from TetraTech Sources in Phase 5 documentation Sensitivity documentation CEAP APLE
Land to stream   	Field-level, hillslope, and small stream processes are all combined in the Edge-of-Stream nutrient estimates No EOF is simulated EOS estimates are a combination of regional factors and field-scale process simulation calibrated to average export rates Informed by inputs and calibration	Hillslope and small stream processes are combined in a sediment delivery ratio that is based on the average distance between each major land use type and a major river, adjusted for the coastal plain.	*Can we estimate watershed delivery based on landscape parameters?*			
Stream to River    			*Can we estimate small stream effects?*			CBP Grant
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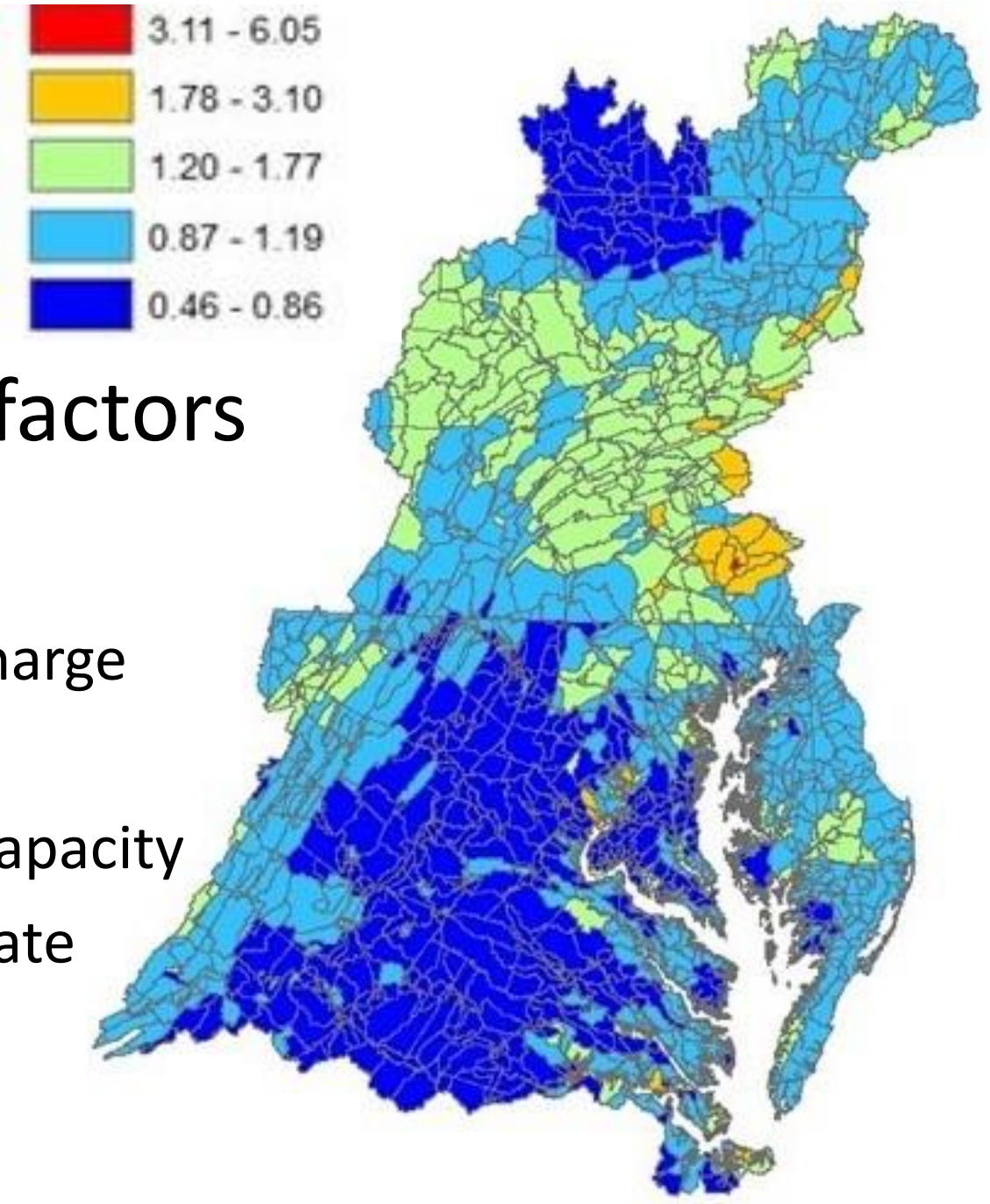
… we can put them into phase 6

Sparrow-calculated Land to Water factors

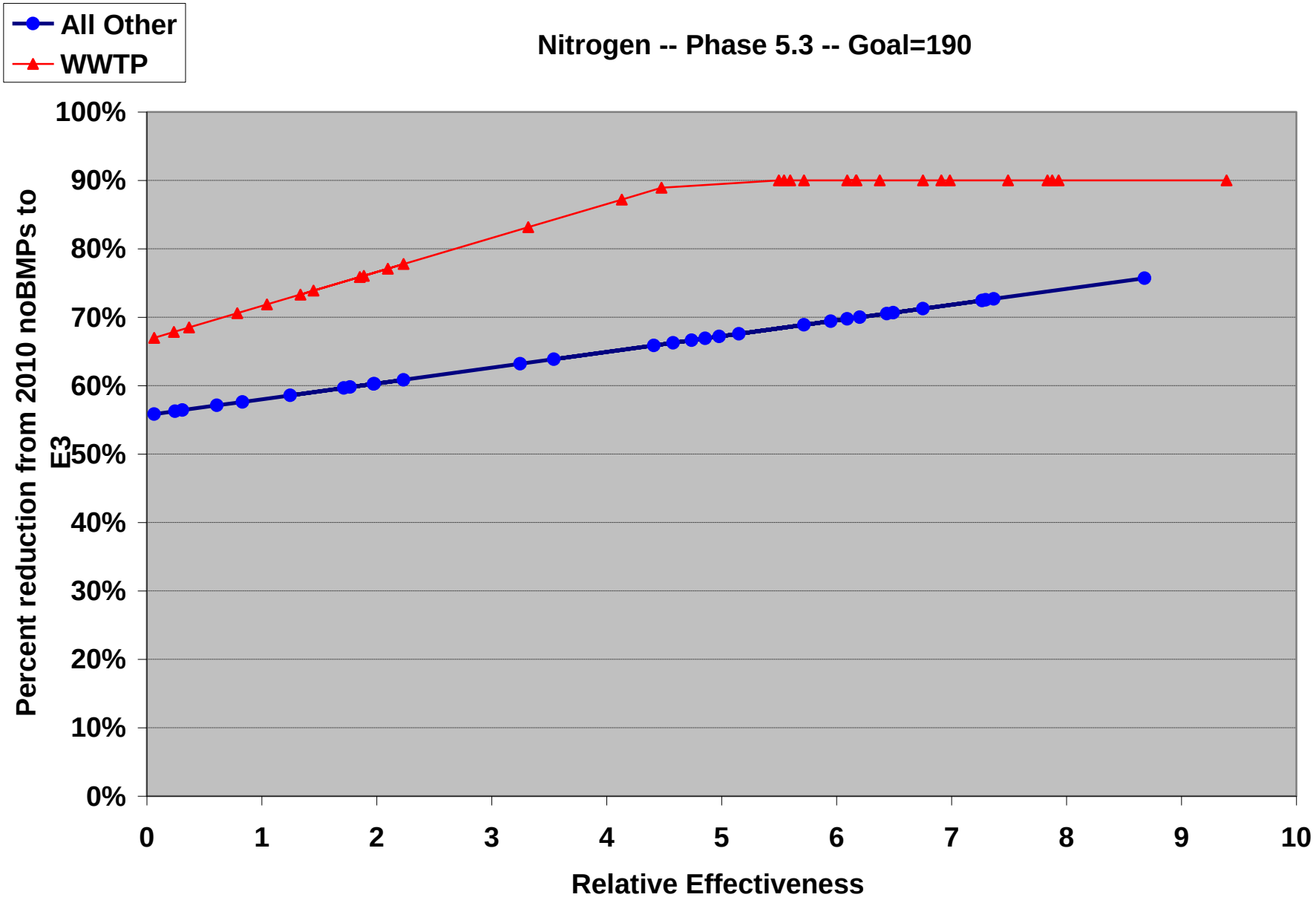


- Due to
  - Groundwater recharge
  - Vegetative Index
  - Available Water Capacity
  - Piedmont Carbonate

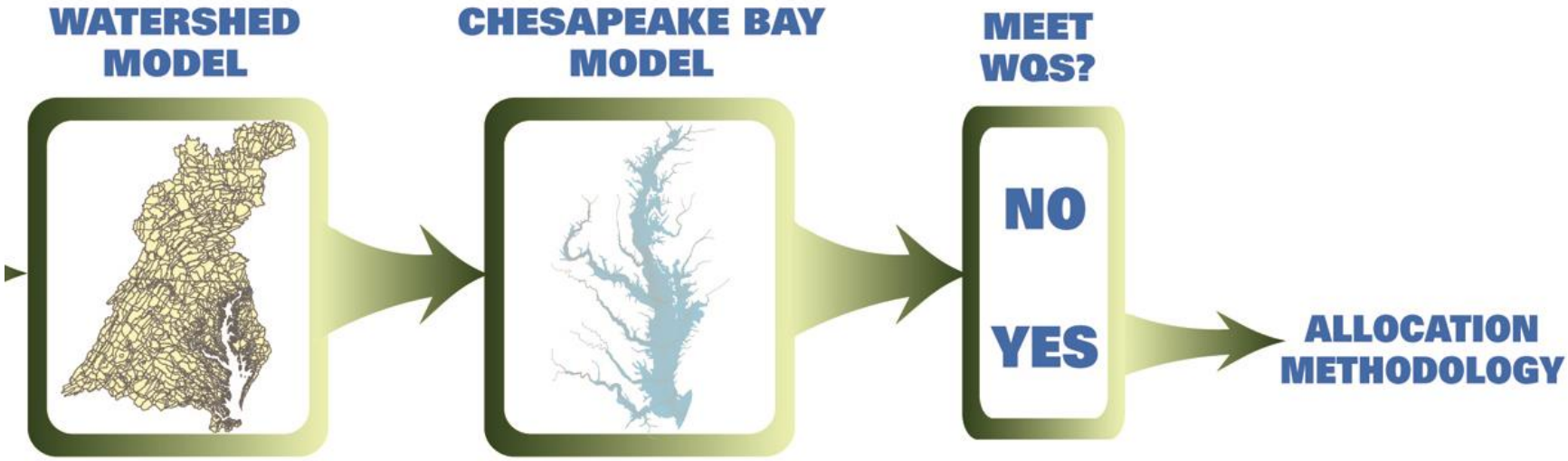
Question to be asked in May

- Were we successful in our attempt to avoid using calibrated regional factors?
- Is the calibration without calibrated regional factors as good as the Phase 5 calibration with calibrated regional factors?
- Would any gain in load accuracy with the addition of calibrated regional factors be worth the loss in explanatory power?

Remember how the model is used

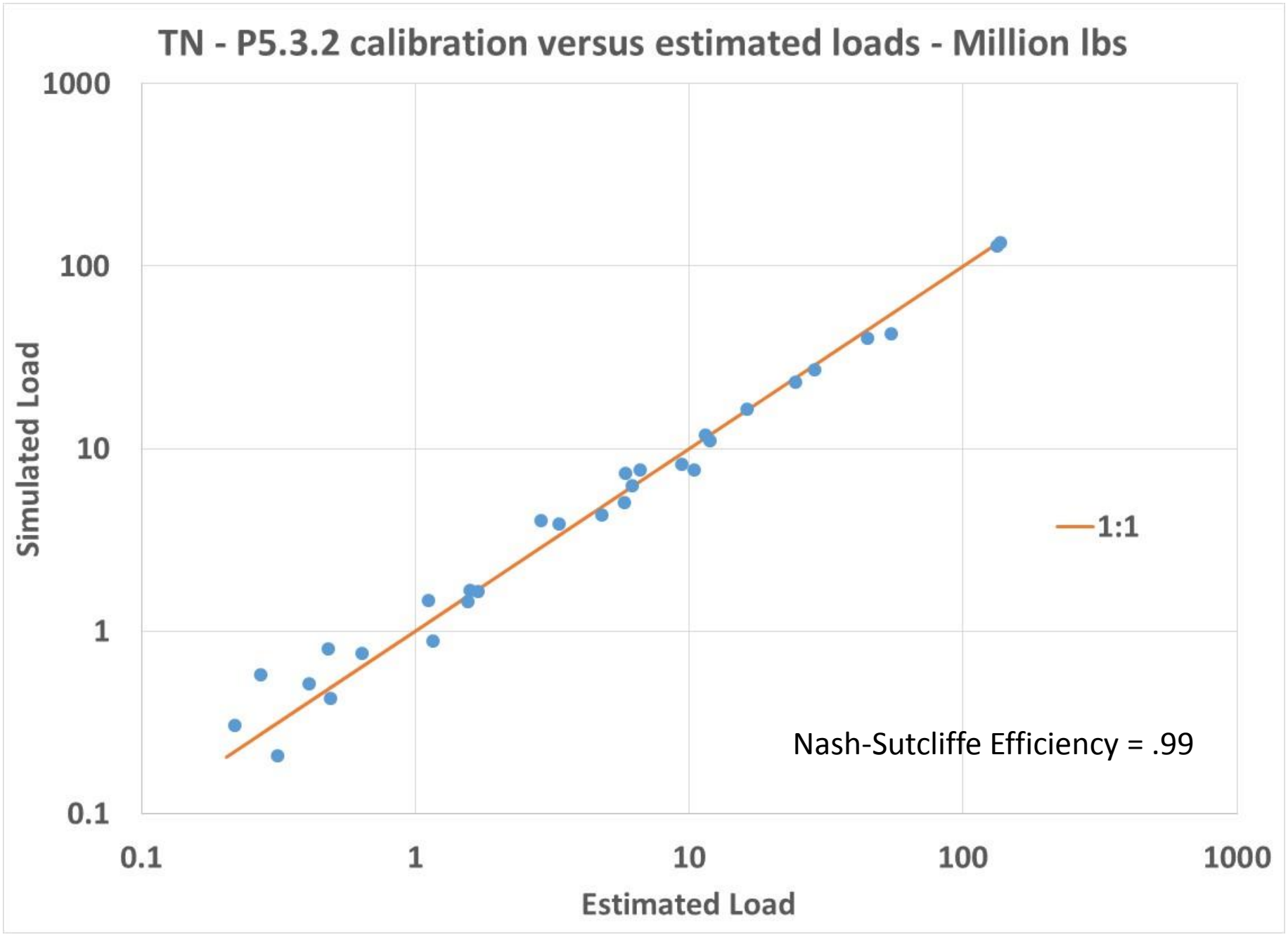


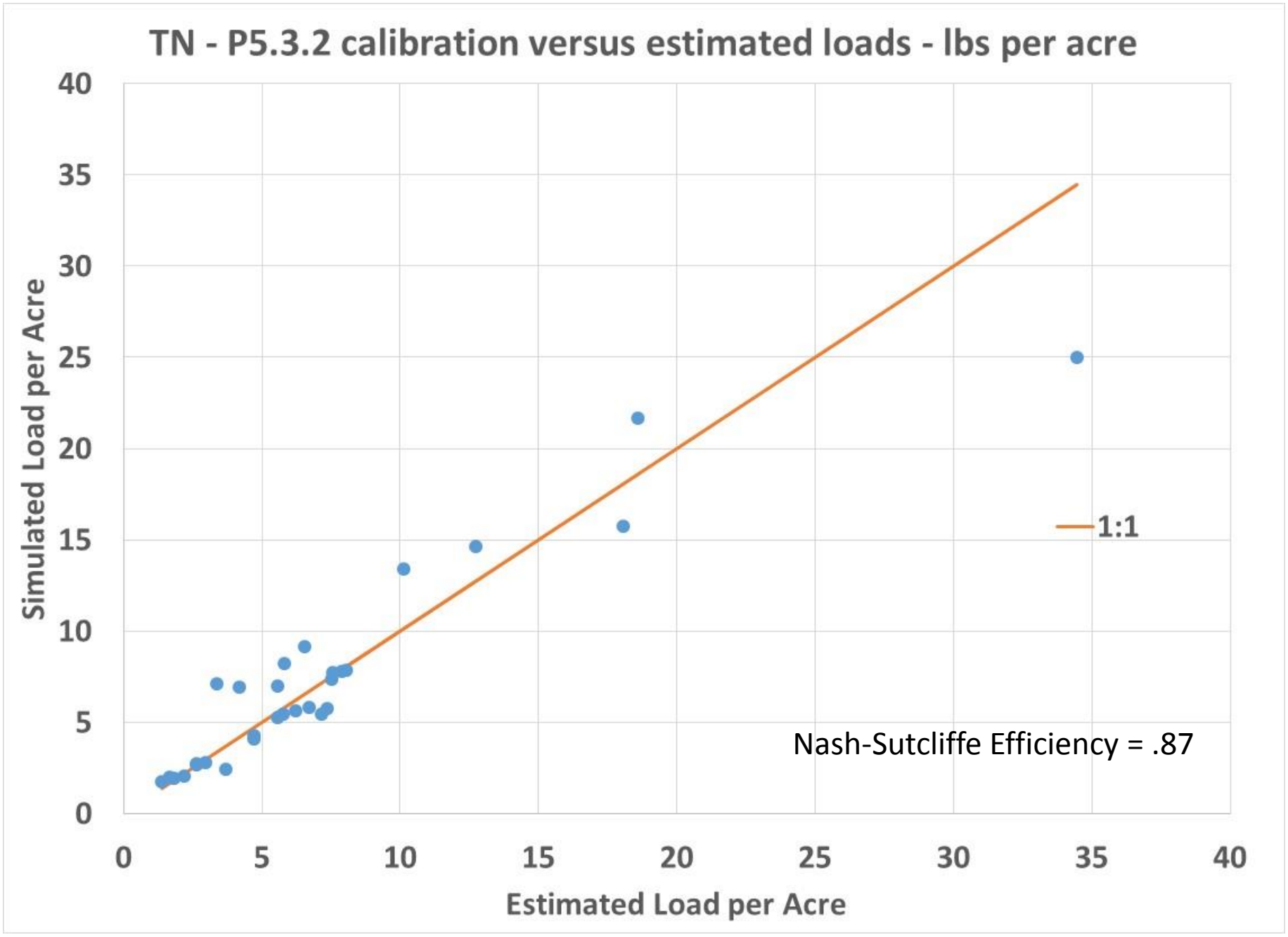
Remember how the model is used

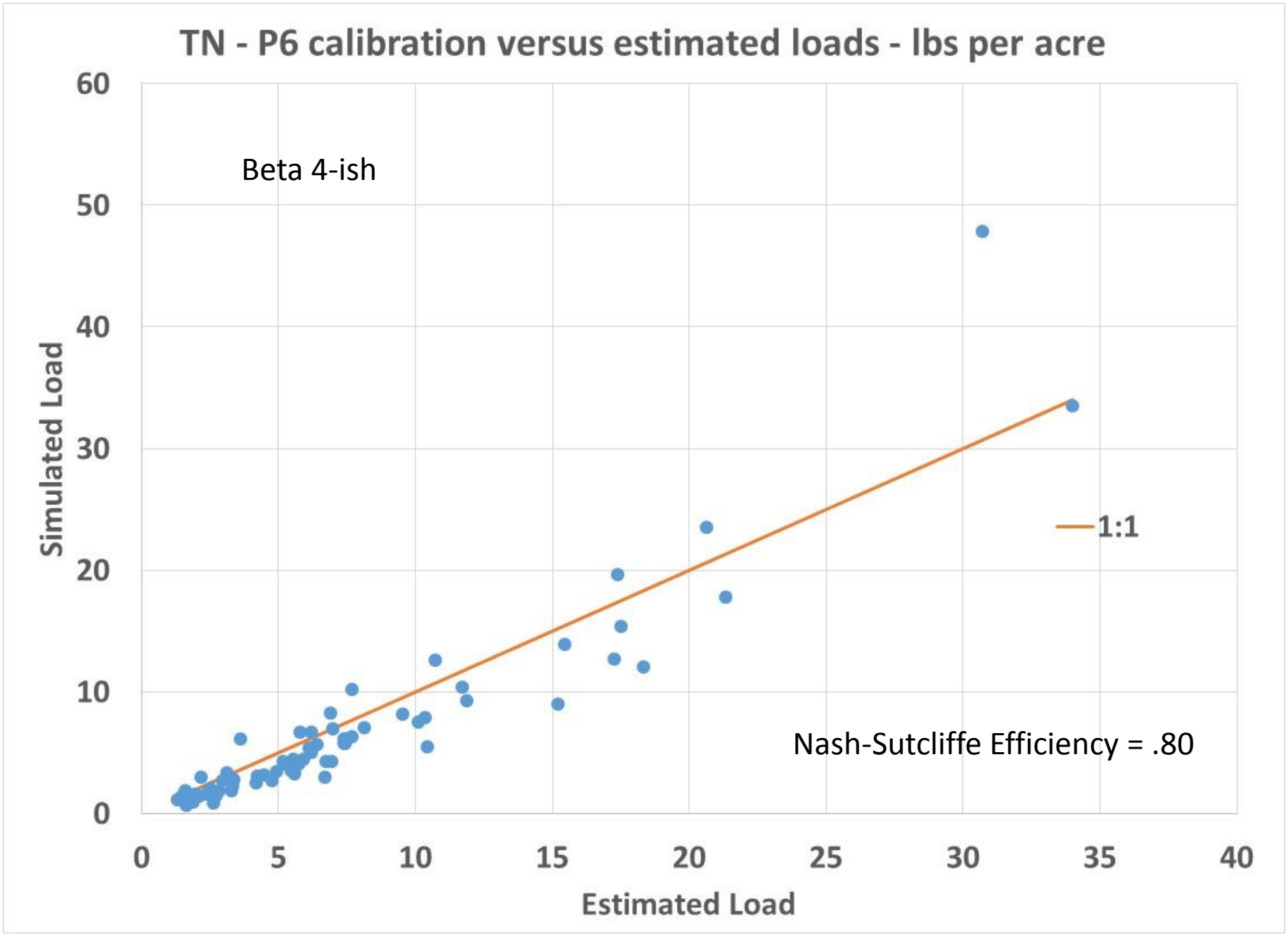


Should deliver accurate loads for calibration

…but this method is an estimate of relative change


TN - P5.3.2 calibration versus estimated loads - Million lbs
1000
100
10
1
0.1
Simulated Load
0.1
1
10
100
1000
Estimated Load
1:1
Nash-Sutcliffe Efficiency = .99


TN - P5.3.2 calibration versus estimated loads - lbs per acre
Simulated Load per Acre
Estimated Load per Acre
0
5
10
15
20
25
30
35
40
1:1
Nash-Sutcliffe Efficiency = .87


TN - P6 calibration versus estimated loads - lbs per acre
Beta 4-ish
Simulated Load
Estimated Load
1:1
Nash-Sutcliffe Efficiency = .80
0
10
20
30
40
50
60
0
5
10
15
20
25
30
35
40

Question to be asked in May

- Were we successful in our attempt to avoid using calibrated regional factors?
- Is the calibration without calibrated regional factors as good as the Phase 5 calibration with calibrated regional factors?
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What we hope to say in June (IMHO)

- Working together in the Chesapeake Bay Program Partnership, the Phase 6 Watershed Model has significant improvements in input data, in the representation of watershed processes through multiple models, and in understandability by the partnership
- The agreement with loads estimated from monitoring data is similar to previous models
- The partnership can be confident in using the Phase 6 model in similar ways as it used the Phase 5 model.