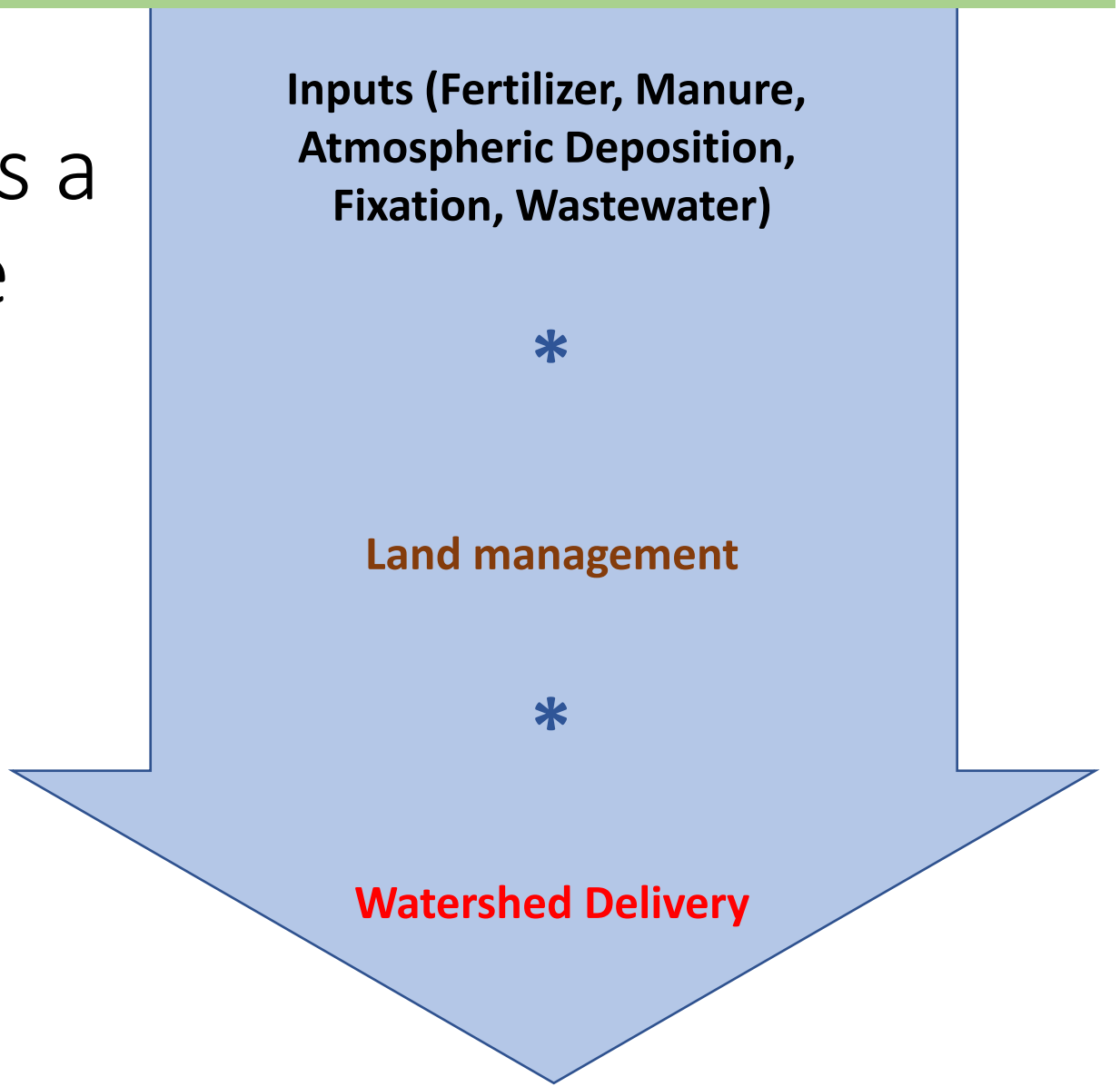
Loading Rate Factors in CAST

Gary Shenk 3/6/2024

CAST Structure

CAST is a simple model



Load by land-river segment and land use

CAST is a simple model

CAST Structure

Inputs (Fertilizer, Manure, Atmospheric Deposition, Fixation, Wastewater)

*

Land management

*

Watershed Delivery

Load by land-river segment and land use

CAST Structure

Average Load

+

△ Inputs * Sensitivity

*

BMPs

*

Acres

*

Land to Water

*

River Delivery

Load by land-river segment and land use

Phase 7 CAST

Average Load

Δ Inputs * Sensitivity

*

BMPs

*

Acres

*

Land to Water

*

River Delivery

Phase 6 method

Average Loads – Average edge-of-small-stream loading rate for a given land use for the entire CB watershed

Average Loads

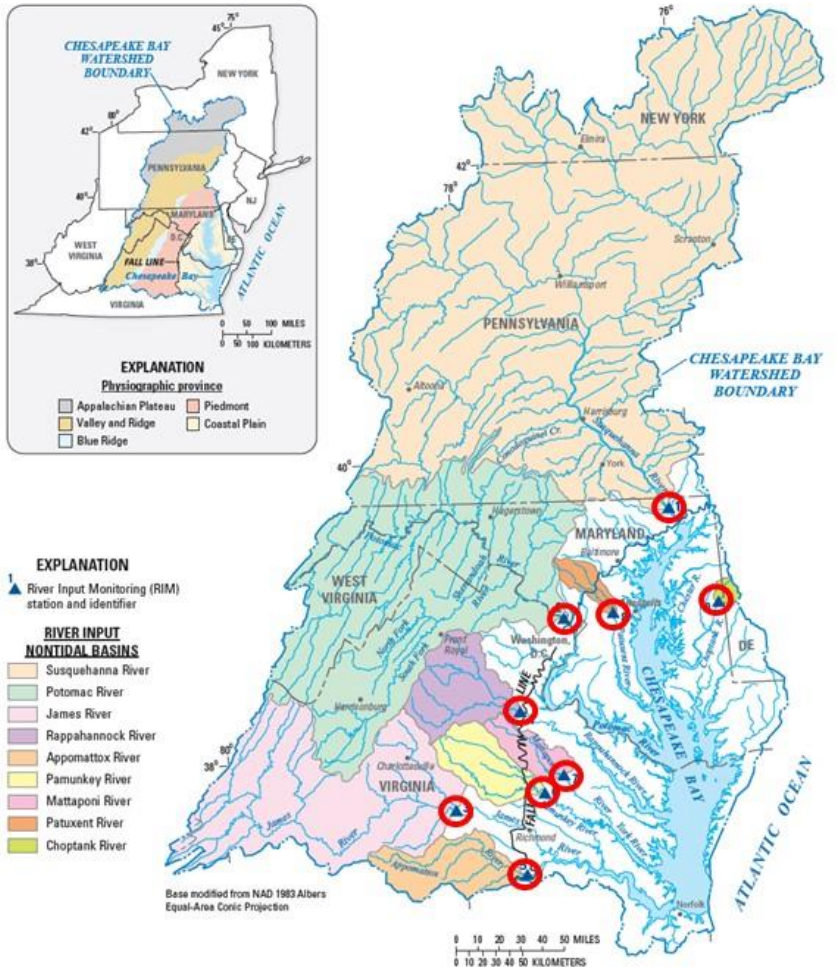
Estimate Total Non-point Source

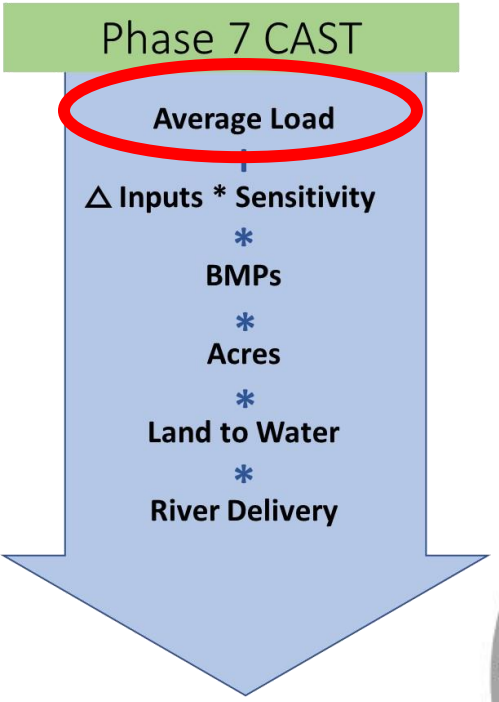
Modeling Workgroup

Monitoring Data

subtract point source

divide by transport

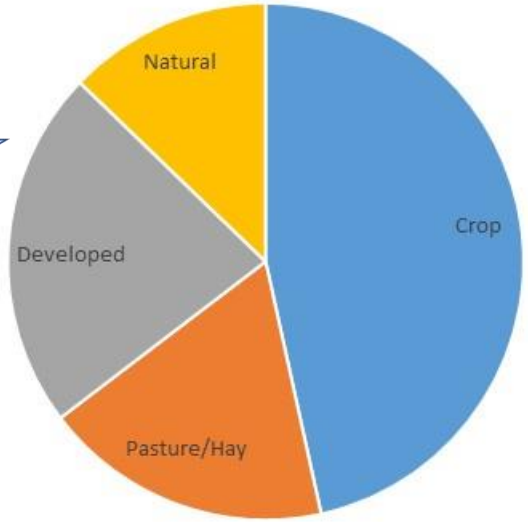




Phase 6 method

Average Loads

Average Loads – Average edge-of-small-stream loading rate for a given land use for the entire CB watershed



Divide into Broad Classes

Modeling Workgroup

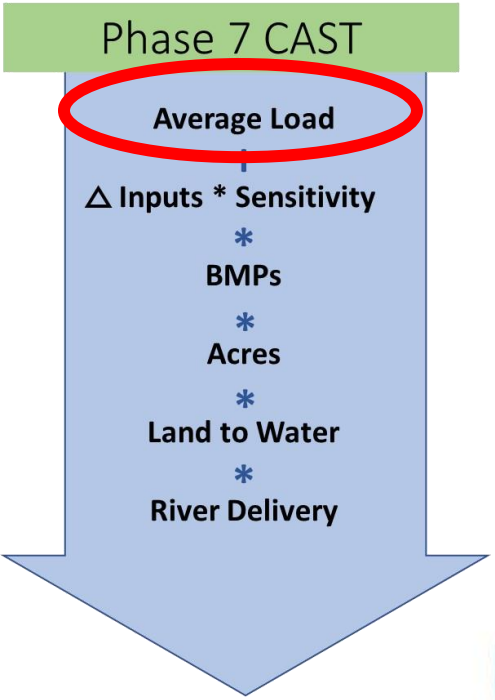
P5: Multiple models

Phase 5.3.2

Sparrow

CEAP

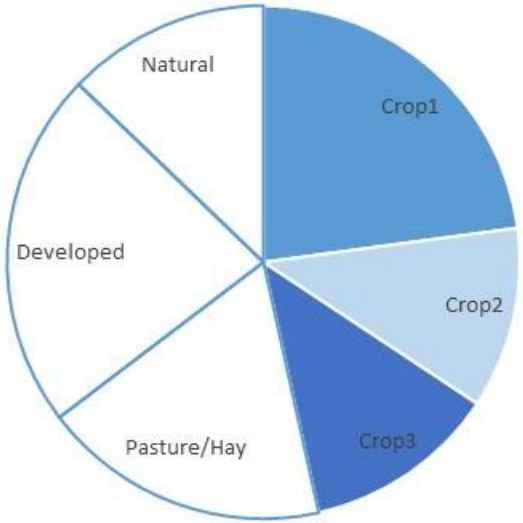
P6: Multiple Models and CalCAST



Phase 6 method

Average Loads

Average Loads – Average edge-of-small-stream loading rate for a given land use for the entire CB watershed



Split Classes into individual land uses

MWG and WQGIT Workgroups

Multiple lines of evidence to develop ratios

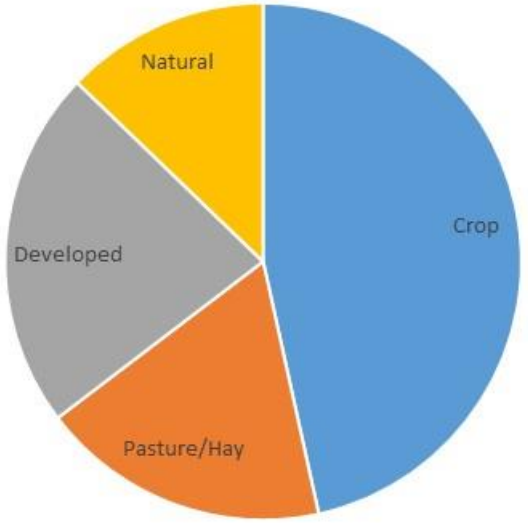
- for example silage is 16% higher than grain

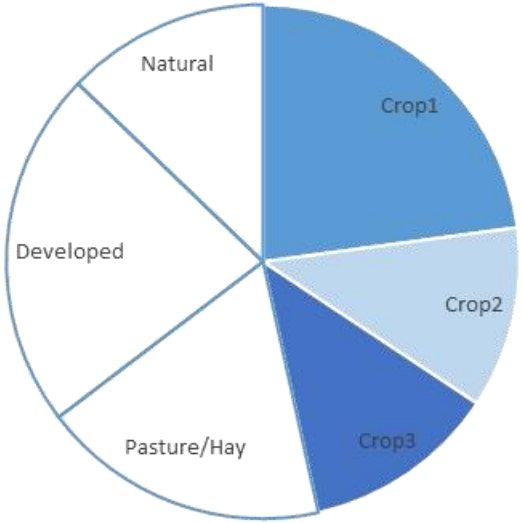
Phase 7 CAST

Average Load
+
Δ Inputs * Sensitivity
*
BMPs
*
Acres
*
Land to Water
*
River Delivery

Phase 7 method

Simultaneous Estimation with CalCAST





$$\mathrm{NPS}_{l,c,t} = \left(\mathrm{CLR} \times \mathrm{RC}_{cl_l} \times \mathrm{RL}_l + \sum_i \left(\left(\mathrm{Input}_{i,l,c,t} - \widehat{\mathrm{Input}}_{i,l} \right) \times \mathrm{Sens}_{i,cl_l} \times \mathrm{RL}_l \right) \right) \times \mathrm{Acres}_{l,c,t} \times BMP_{i,c,t}$$

Phase 7 CAST

Average Load
+
Δ Inputs * Sensitivity
*
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Land to Water
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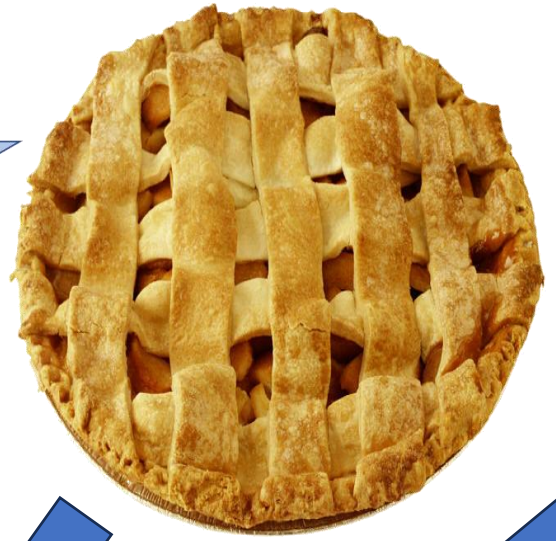
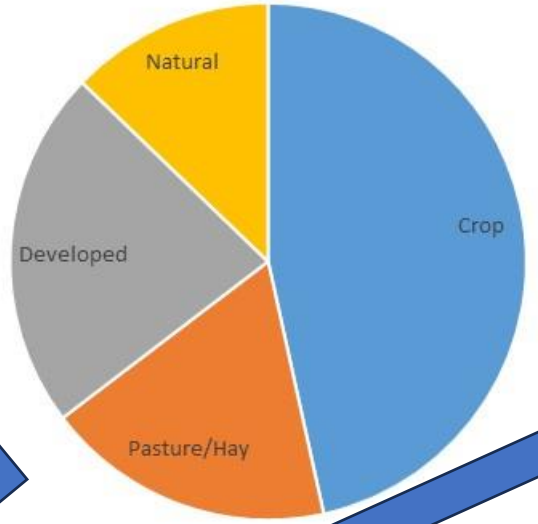
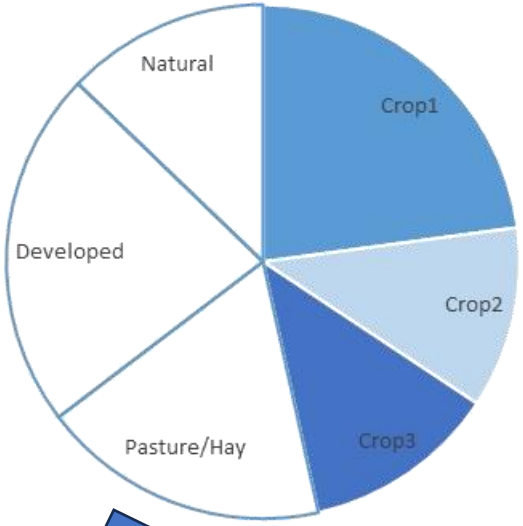
River Delivery

Phase 7 method

Simultaneous Estimation with CalCAST







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Phase 7 CAST

Average Load
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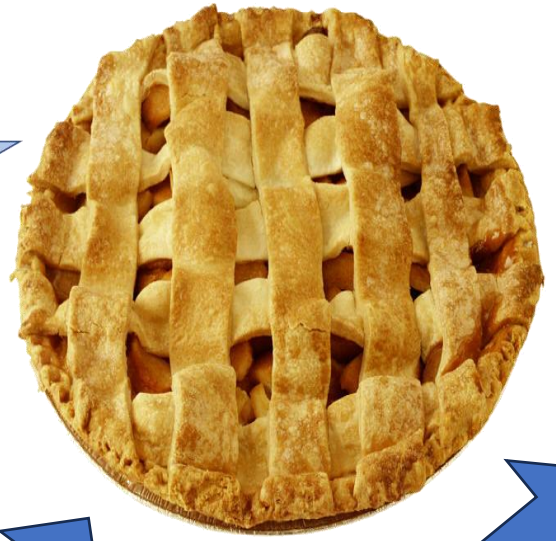
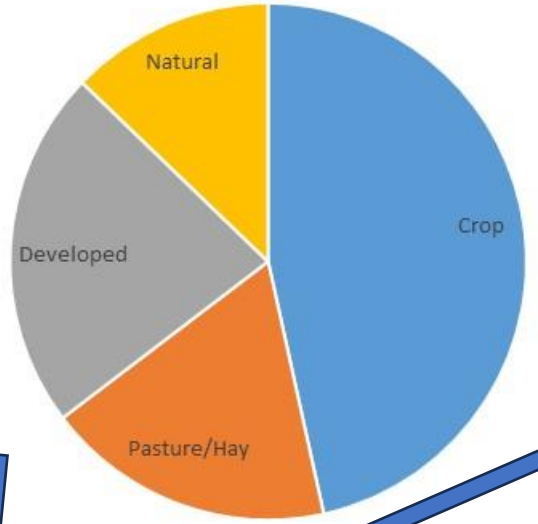
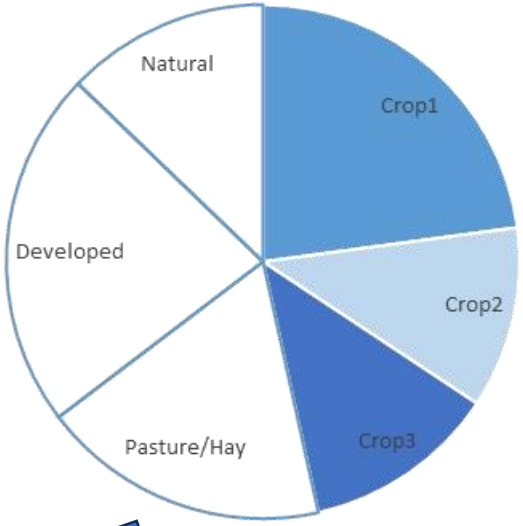
Phase 7 method

CalCAST can help identify parameters







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Nitrogen Ratios

Land class	Land Use	Loading Rate Ratio
Cropland	Double Cropped Land	0.79
	Full Season Soybeans	0.71
	Grain with Manure	1.4
	Grain without Manure: Reference land use	1
	Other Agronomic Crops	0.45
	Silage with Manure	1.62
	Silage without Manure	1.16
	Small Grains and Grains	0.84
	Specialty Crop High	1.34
	Specialty Crop Low	0.31
Pasture	Ag Open Space	0.43
	Legume Hay	0.74
	Other Hay	1.04
	Pasture: Reference Land Use	1

Mark Dubin to discuss ratios

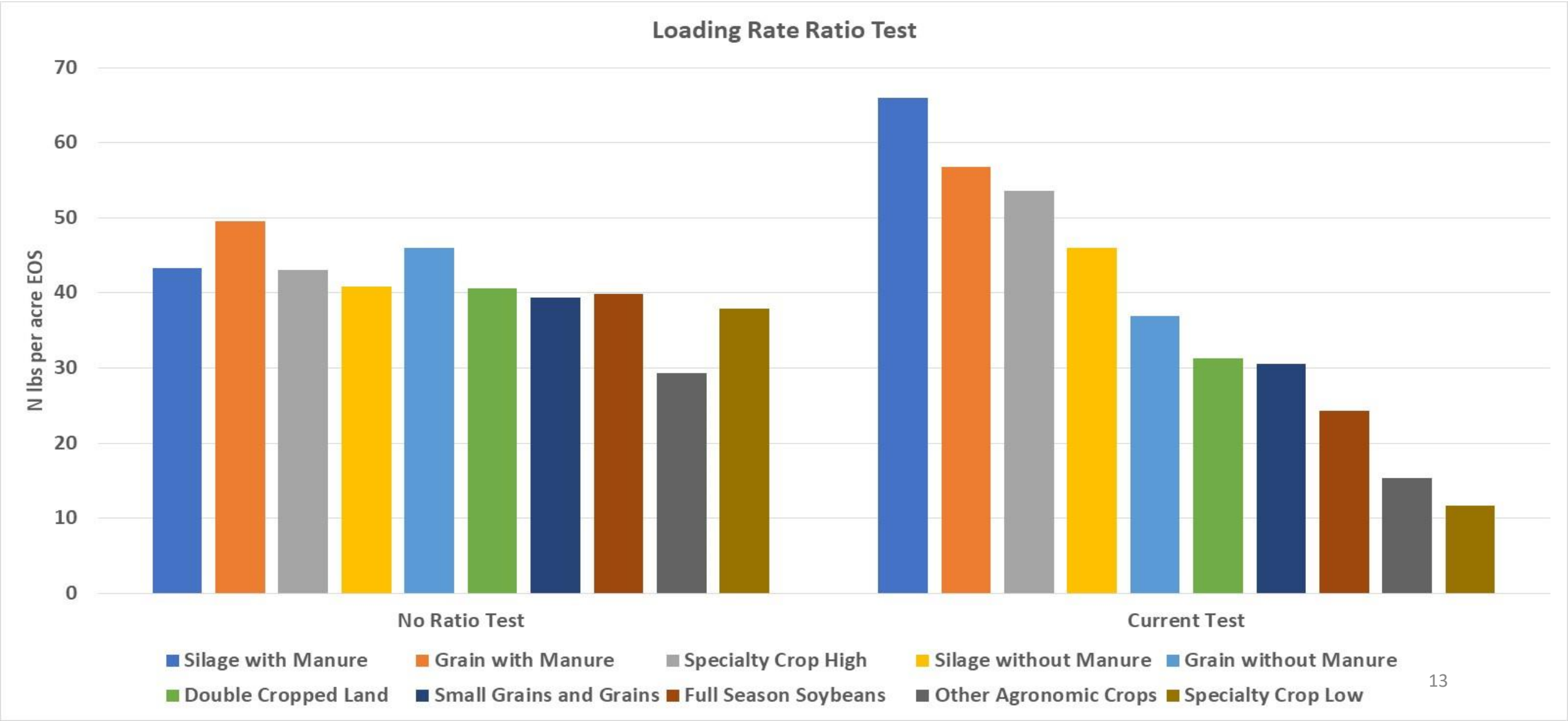
Phosphorus Ratios

Relative inputs determine relative load

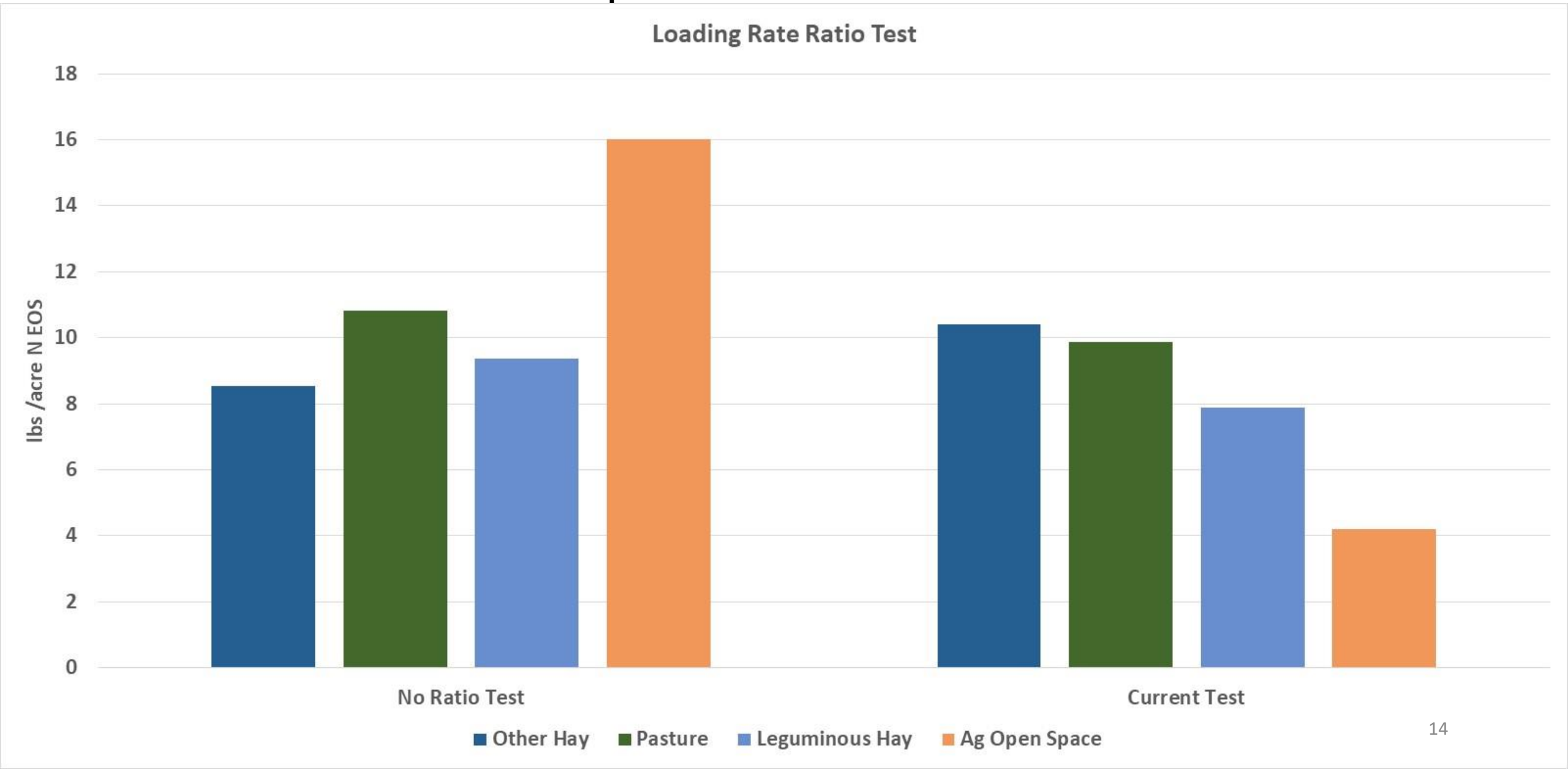
What if we treated nitrogen the same way?

Land class	Land Use	Loading Rate Ratio
Cropland	Double Cropped Land	1
	Full Season Soybeans	1
	Grain with Manure	1
	Grain without Manure: Reference land use	1
	Other Agronomic Crops	1
	Silage with Manure	1
	Silage without Manure	1
	Small Grains and Grains	1
	Specialty Crop High	1
	Specialty Crop Low	1
Pasture	Ag Open Space	1
	Legume Hay	1
	Other Hay	1
	Pasture: Reference Land Use	1

Nitrogen loading rates with/without ratios



Current Test compared to **No Ratio Test** 1995



Considerations

- The total crop load will be similar in either method
- The total pasture load will be similar in either method

- Changes can take place geographically or through scenarios
- Scenarios run without ratios will be less prone to variability as land uses change over time.

- We can eventually test this in CalCAST later this year