Ag Land Use Loading Ratio Subgroup
(Ad hoc subgroup of Ag Modeling Subcommittee)

- **Task:** Estimate relative edge-of-field loading ratios of N, P, and sediment for 14 Ag land uses for the phase 6 Watershed Model.

- Edge of field is defined by the ground surface boundary and by the depth limit of the rooting zone.

- Loading ratios are relative to corn or sorghum grain without manure because this crop type is widespread and may supply much of the edge of field loads in the Chesapeake Watershed.

- Loading ratios are for ag land uses without BMPs.

Loading Ratios vs. Loading Rates

- Ratios are probably less variable than loading rates.
- Loading rates vary with local soil and hydro-geological conditions as well as with crop type.
- Therefore, loading ratios of crop types vary less across regions than do loading rates.
- Fewer literature values are needed to establish ratios but must compare loads within similar conditions.

Nitrogen

- N loads are mainly from leaching of nitrate below rooting zone.
- Surface runoff of N probably has a negligible effect on total N load ratios.
- Crops with perennial cover have relatively low loads.

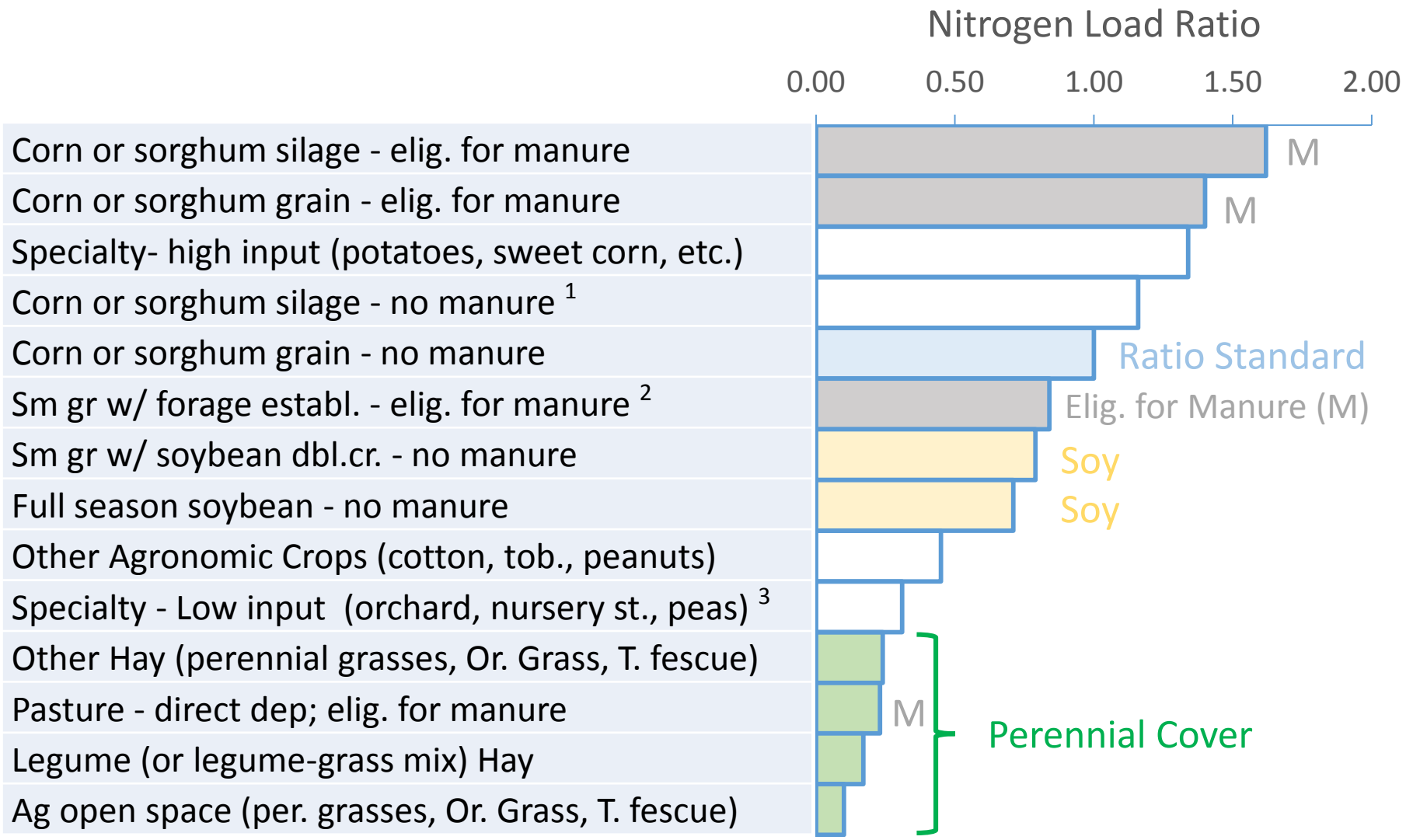
Effect of manure applications

- Manure applications increase load depending on application rate and crop N demand.

- We estimated average N load ratio for crops receiving average manure applications (assuming that manure-eligible lands get manure).

- More accurate load ratios could be estimated with information on local manure N application rates and crop N demand.

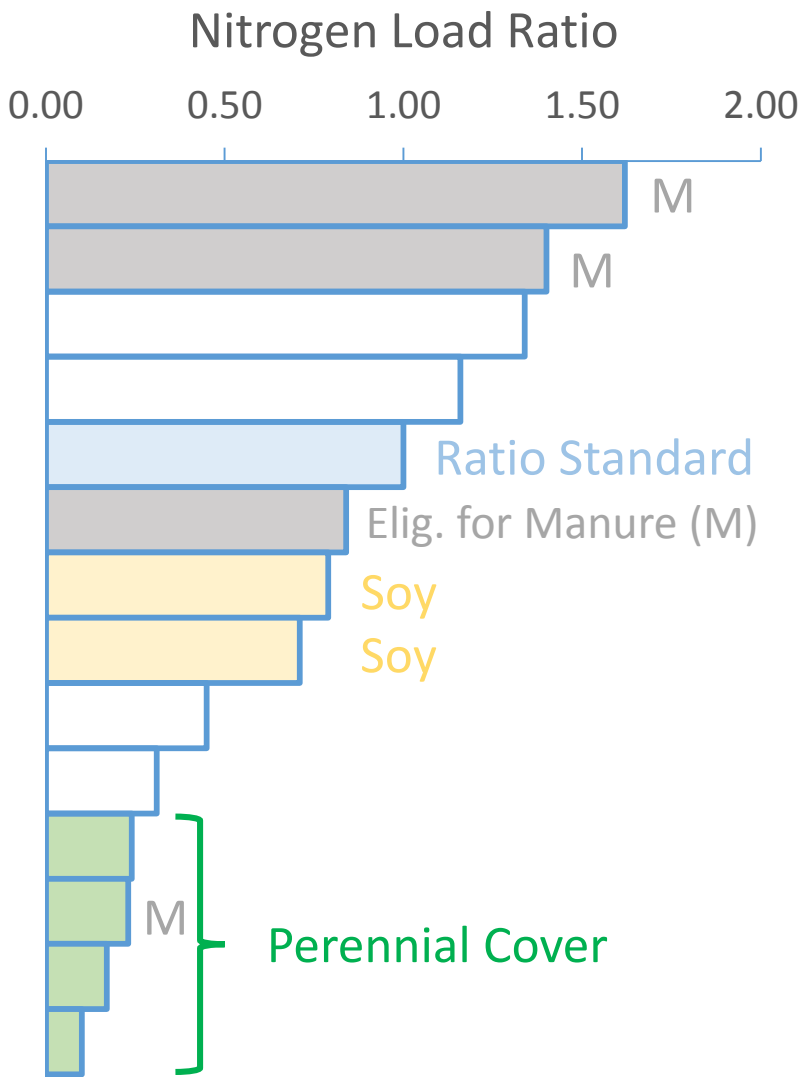
Nitrogen Load Ratio Relative to Corn (or Sorghum) Grain Without Manure



[1, 2, 3] BPJ estimate by analogies to other crops

Nitrogen Load Ratio Relative to Corn (or Sorghum) Grain Without Manure

	Load Ratio	Std Err
Corn Silage Manure	1.62	
Corn Grain Manure	1.40	0.20
Specialty High	1.34	
Corn Silage *	1.16	
Corn Grain	1.00	
Sm Grain & Forage M.*	0.84	
Sm Grain & Soy	0.79	0.09
Full Season Soy	0.71	0.11
Other Ag Crops	0.45	
Specialty Low *	0.31	
Other Hay	0.24	0.06
Pasture Manure	0.23	0.06
Legume or Mix	0.17	0.02
Ag Open	0.10	0.01

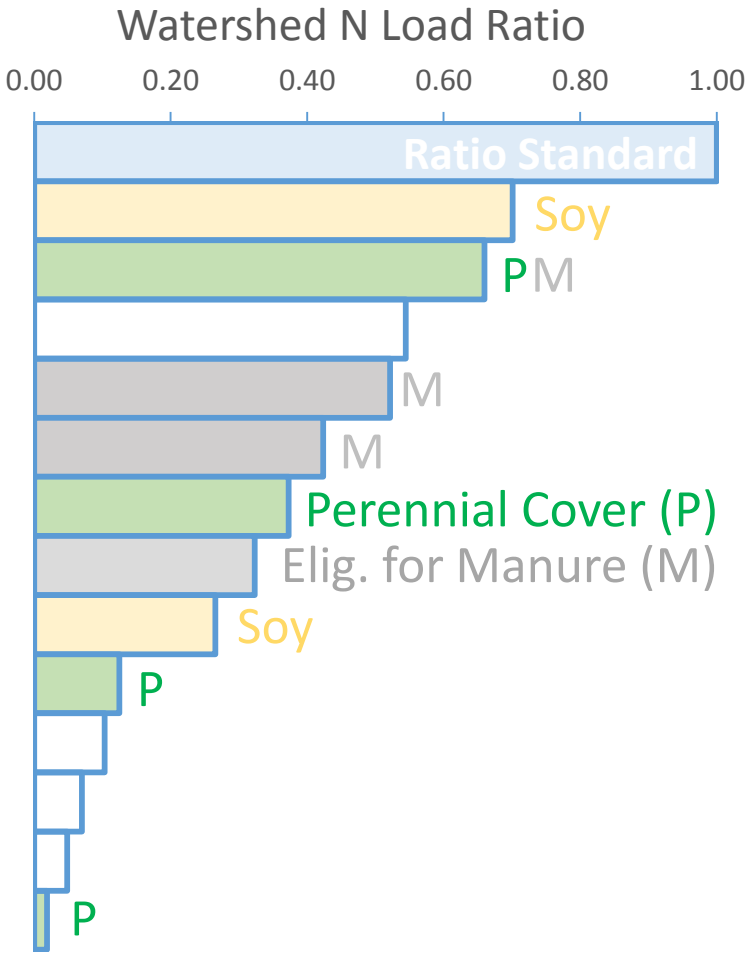


* BPJ estimate by analogies to other crops

What is the relative N load when we consider the area of the land use in the Chesapeake Bay watershed?

Area Weighted N Load Ratio Relative to Corn (or Sorghum) Grain Without Manure
(Areas are coverage throughout the C. Bay watershed)

Abbrev Land Use	Load Ratio	Std Err	Acres	Area Wted Ratio
Corn Grain	1.00		1,253,584	1.00
Full Season Soy	0.71	0.11	1,237,398	0.70
Pasture M	0.23	0.06	3,595,223	0.66
Corn Silage	1.16		588,338	0.54
Corn Grain M	1.40	0.20	466,948	0.52
Sm Gr Forage M	0.84		631,886	0.42
Other Hay	0.24	0.06	1,947,683	0.37
Corn Silage M	1.62		250,184	0.32
Sm Gr Soy M	0.79	0.09	421,504	0.27
Legume or Mix	0.17	0.02	921,761	0.13
Specialty High	1.34		96,808	0.10
Other Ag Crops	0.45		195,099	0.07
Specialty Low	0.31		195,141	0.05
Ag Open	0.10	0.01	234,842	0.02



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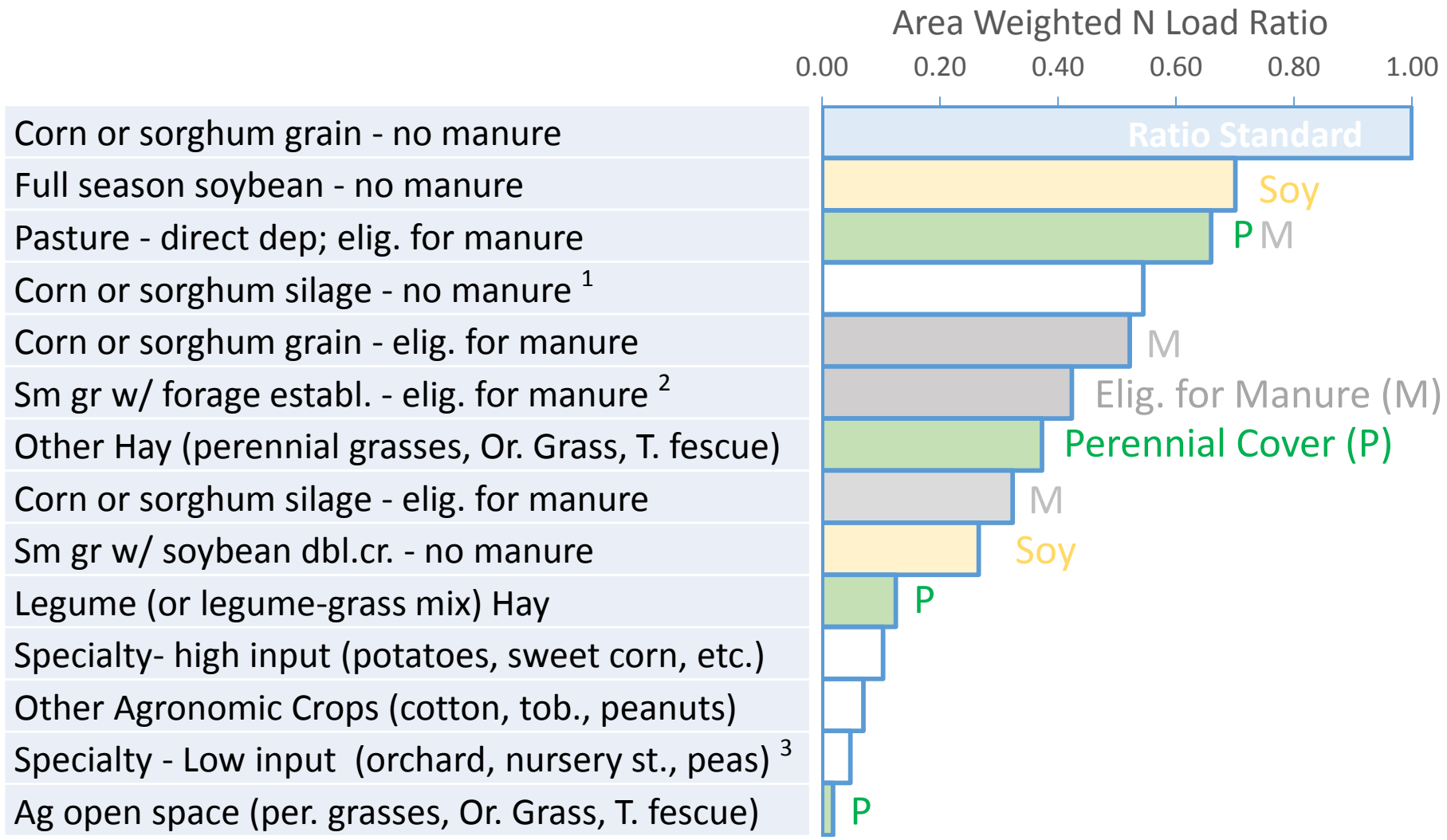

[1, 2, 3] BPJ estimate by analogies to other crops

Sediment Loading Ratios

- Crop type alone does not determine sediment load.
- Sediment loads are also affected by rainfall-runoff, soil erodibility, slope, etc.
- These factors are incorporated into the Revised Universal Soil Loss Equation (RUSLE), a field research-based model of sediment load.
- RUSLE2 is being used for the Chesapeake Bay Watershed Model.
- RUSLE2 – best option for assessing relative sediment loading rates.

Phosphorus Loading Ratios

- P loads are being estimated by the Annual Phosphorus Loss Estimator (APLE).
- Sediment-attached P load is a function of RUSLE2 erosion rates and soil P content.
- Dissolved P load is estimated by APLE from information on manure and fertilizer application rates and soil P content.

Possible problems with RUSLE2 and APLE

- RUSLE2: Possible errors in some sub-factor values, including crop canopy and crop residue for pasture and hay for some states and crop management zones.

- APLE: Initial estimated pasture P loads were high compared to literature values, possibly due to inability to distinguish effects of spread manure vs. manure deposited by grazing animals.

- Our group will check loading rate estimates as RUSLE2 and APLE are being revised.

Final P6 Land Use Relative Loading Ratios

P6 Landuse		Relative N Loadings	Relative P Loadings		Relative Sediment Loadings
		(leaching + runoff)	(sediment-attached P)[4]	(dissolved P)[5]	(runoff)[6]
1	**Corn or sorghum grain - elig. for manure** (1, 2, 3, 10, 11)	1.40	**1.00**	**1.00**	**1.00**
2	**Corn or sorghum silage - elig. for manure** (10)	1.62			
3	**Corn or sorghum grain - no manure**	**1.00**			
4	**Corn or sorghum silage - no manure** [1]	1.16			
5	**Sm gr w/ soybean dbl.cr. - no manure** (9)	0.79			
6	**Full season soybean - no manure** (3, 10, 45)	0.71			
7	**Sm gr w/ forage establ. - elig. for manure** [2]	0.84			
8	**Other Agronomic Crops (cotton, tob., peanuts)** (15)	0.45			
9	**Pasture - direct dep; elig. for manure** (12, 13, 14)	0.23			
10	**Legume (or legume-grass mix) Hay** (6, 7)	0.17			
11	**Other Hay (perennial grasses, Or. Grass, T. fescue)** (12, 13)	0.24			
12	**Ag open space (per. grasses, Or. Grass, T. fescue)** (8)	0.10			
13	**Specialty- high input (potatoes, sweet corn, etc.)** (10)	1.34			
14	**Specialty - Low input (orchard, nursery st., peas)** [3]	0.31			

Notes: [1] Est. from ratio (Corn/Sor. Silage w/ man.)/(Corn/Sor. Grain w/ man.) = 1.62/1.4 = 1.16

[2] Est. from Sm gr w/ sb dc w/o manure, adjusted to only Sm gr, plus a w/ manure factor. First estimate sb dc factor, with dc Sb = 50% of Full Sea. Sb, so Sm gr alone = 0.79 - (0.71/2) = 0.44. Then, Sm gr w/ manure factor = 0.44 + (corn w/ man. - corn gr w/o man.) = 0.44 + (1.40 -1.00) = 0.84

[3] Est. from Other Hay + 0.07 (due to greater loading w/ annuals) = 0.24 + 0.07 = 0.31

[4] Common factor adjustment to LRseg-based RUSLE2 erosion estimates.

[5] Common factor adjustment to LRseg-based APLE dissolved P estimates based on county soil test data.

[6] Common factor adjustment to LRseg-based RUSLE2 erosion estimates.