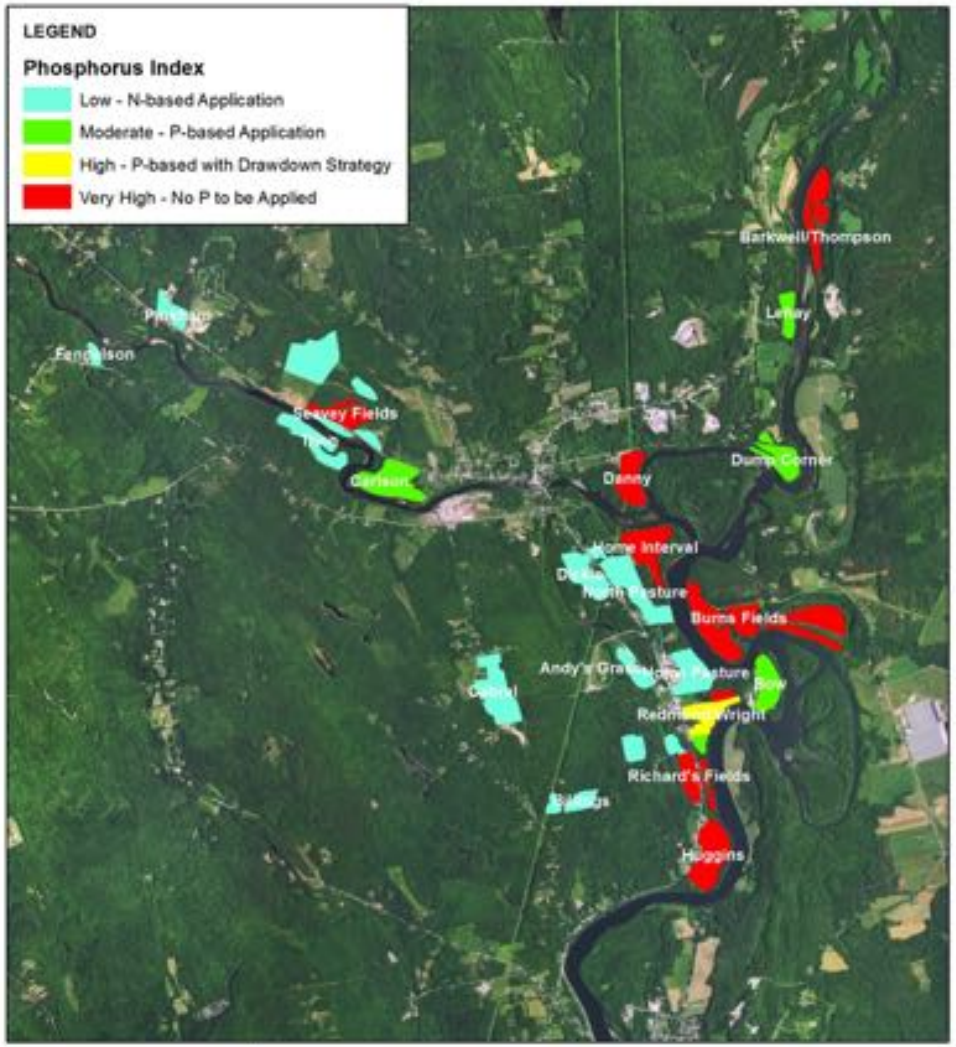
A Comparison of New England Agricultural Phosphorous Indices

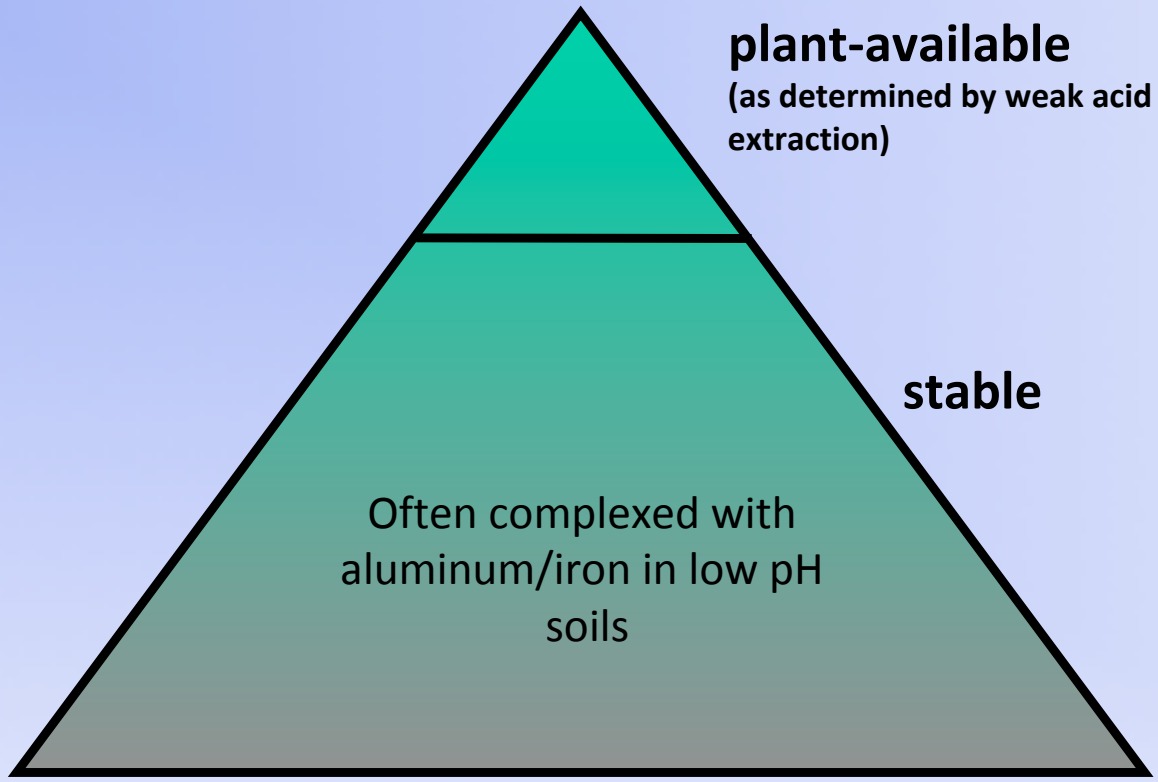
Presentation by Amanda Wheeler


LEGEND
Phosphorus Index
Low - N-based Application
Moderate - P-based Application
High - P-based with Drawdown Strategy
Very High - No P to be Applied
Barkwell/Thompson
Lemay
Seavey Fields
Danny
Home Interval
North Pasture
Burns Fields
Richard's Fields
Huggins

Matching Crop Needs with Biosolids P & N

- An 18 ton/ac corn silage crop needs a P_2O_5:N ratio of 0.6:1
- Anaerobically digested biosolids provide a P_2O_5:N ratio 1.3:1
- Applying at agronomic rates for P (assuming P in biosolids is 100% available) would mean applying N at half the rate to meet crop needs

Soil Phosphorus



From Craig Cogger, WSU, then haphazardly adulterated by Northern Tilth

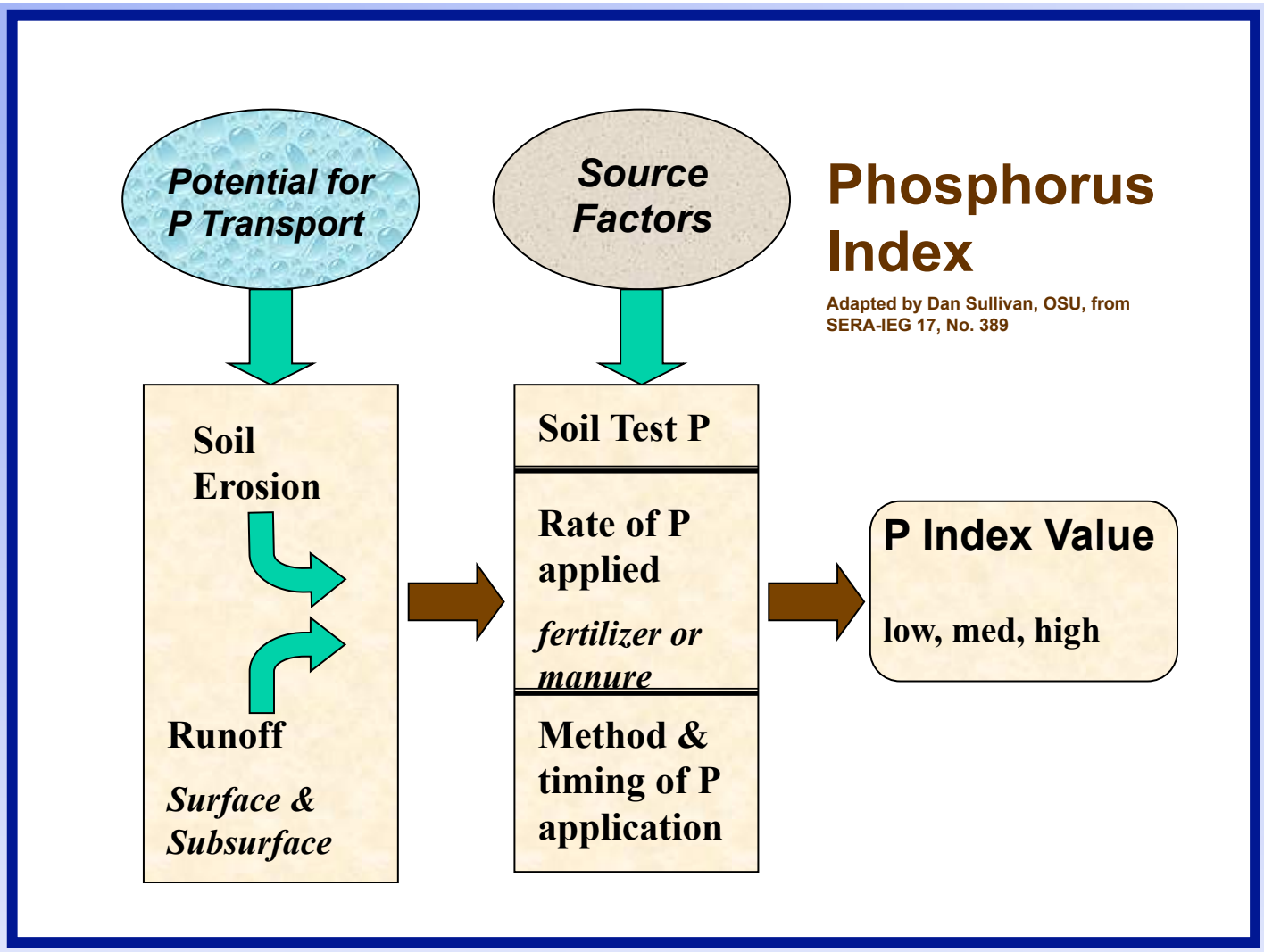
Plant-Available P on Corn Field Receiving Biosolids

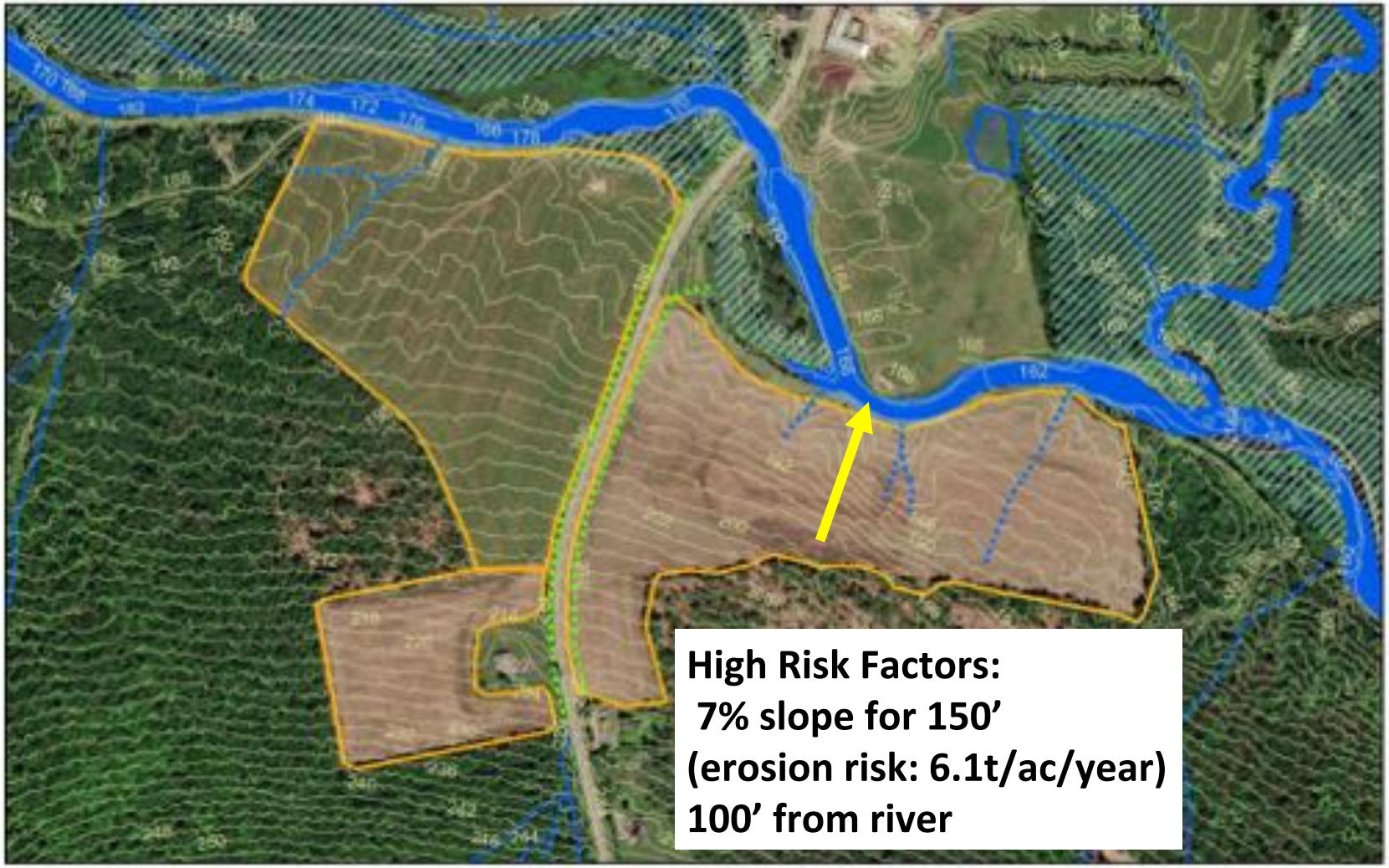
- Continuous corn – 18 ton/ac. yield
- Biosolids as primary source of P applied at approx. 180 # P_2O_5/ac. with no adjustment for P availability
- Crop uptake rate for P is approximately 90 # P_2O_5/ac.

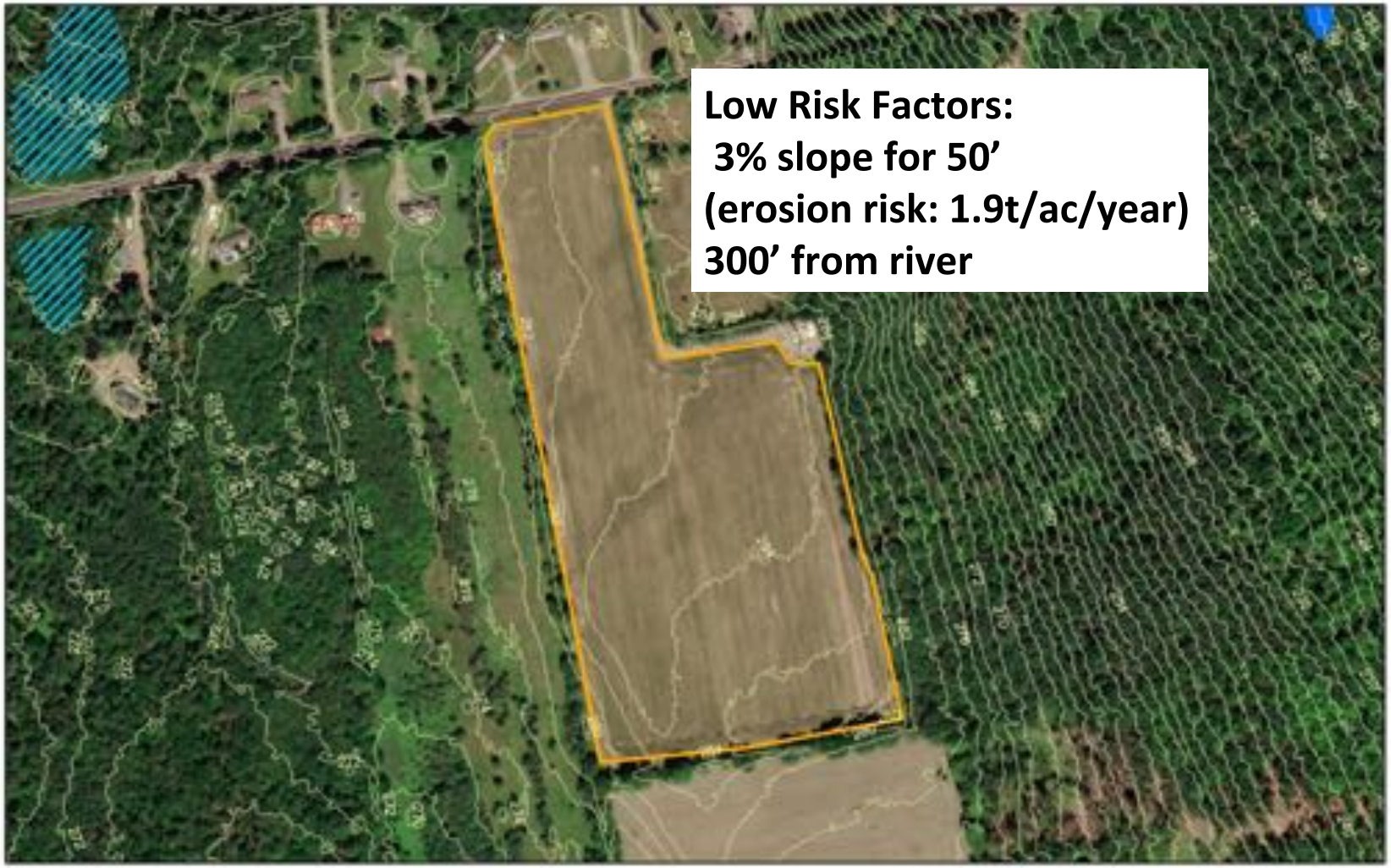
P that shows up in soil tests = plant available P, includes P that is environmentally significant

	measured	calculated
Year	weak Bray P (ppm)	
2008	139	
2009	118	159
2010	110	178
2011	113	198
2012	NT	218
2013	93	237
2014	106	257

Total P accumulating in soil from biosolids application


Potential for P Transport
Source Factors
Phosphorus Index
Adapted by Dan Sullivan, OSU, from SERA-IEG 17, No. 389
Soil Erosion
Runoff
Surface & Subsurface
Soil Test P
Rate of P applied
fertilizer or manure
Method & timing of P application
P Index Value
low, med, high


High Risk Factors:
7% slope for 150’
(erosion risk: 6.1t/ac/year)
100’ from river


Low Risk Factors:
3% slope for 50’
(erosion risk: 1.9t/ac/year)
300’ from river

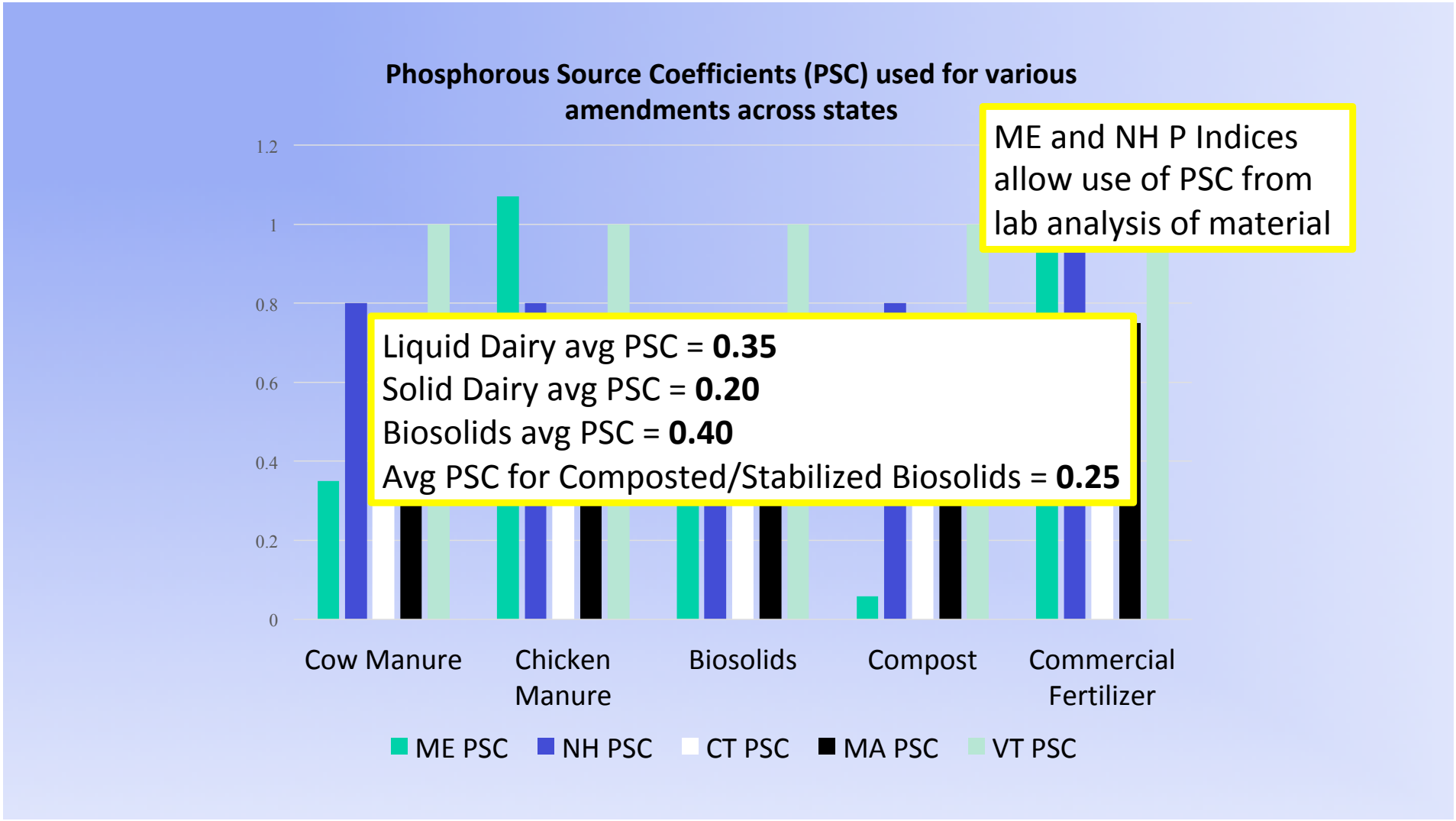
Nuance of the P Index: much more than soil P

ME Farm - Phosphorus Index Results - High P Fields

	Source Factors	***Transport Factors***				
Field Name	Soil Test P (lb/ac)	RUSLE2 Soil Loss (tons/ac)	Surface Water Setback	***Final Transport Sum***	**P Index Sum**	**Recommended Manure App. Rate (gall/ac)**
High P Low Runoff Risk	80	1.90	4	***0.41***	**91**	**7,000**
High P High Runoff Risk	80	6.10	6	***0.67***	**134**	**0**

Impacts of Source and Transport factors on P Index results in Maine

Phosphorus Index Results - 10,000 gallon manure app rate								
	Source Factors				***Transport Factors***			
Field Name	Soil Test P (lb/ac)	Manure App Method	Manure P Coefficient	***Source Factor***	RUSLE2 Soil Loss (tons/ac)	Surface Water Setback	***Final Transport Sum***	**P Index Sum**
Control	21.4	0.4	0.4	***42***	3.00	6	***0.54***	**45**
Larger Buffer	21.4	0.4	0.4	***42***	3.00	4	***0.46***	**38**
Higher PSC	21.4	0.4	0.6	***50***	3.00	6	***0.54***	**54**
No-Till Cover Crop	21.4	0.6	0.4	***50***	0.12	6	***0.42***	**42**


Phosphorous Source Coefficients (PSC) used for various amendments across states
ME and NH P Indices allow use of PSC from lab analysis of material
Liquid Dairy avg PSC = 0.35
Solid Dairy avg PSC = 0.20
Biosolids avg PSC = 0.40
Avg PSC for Composted/Stabilized Biosolids = 0.25
1.2
1
0.8
0.6
0.4
0.2
0
Cow Manure
Chicken Manure
Biosolids
Compost
Commercial Fertilizer
ME PSC
NH PSC
CT PSC
MA PSC
VT PSC

Challenges to using custom PSC: our recent chicken manure PSC update

Phosphorous availability of 1.07 causes both fields' P Index sums to skyrocket with N-based applications of chicken manure

ME Farm - Ph					n low P fields	
					Factors	
Field Name				e r ck	***Final Transport Sum***	**P Index Sum**
Chicken					*0.4*	**126**
Chicken no-till CC					*0.3*	**174**

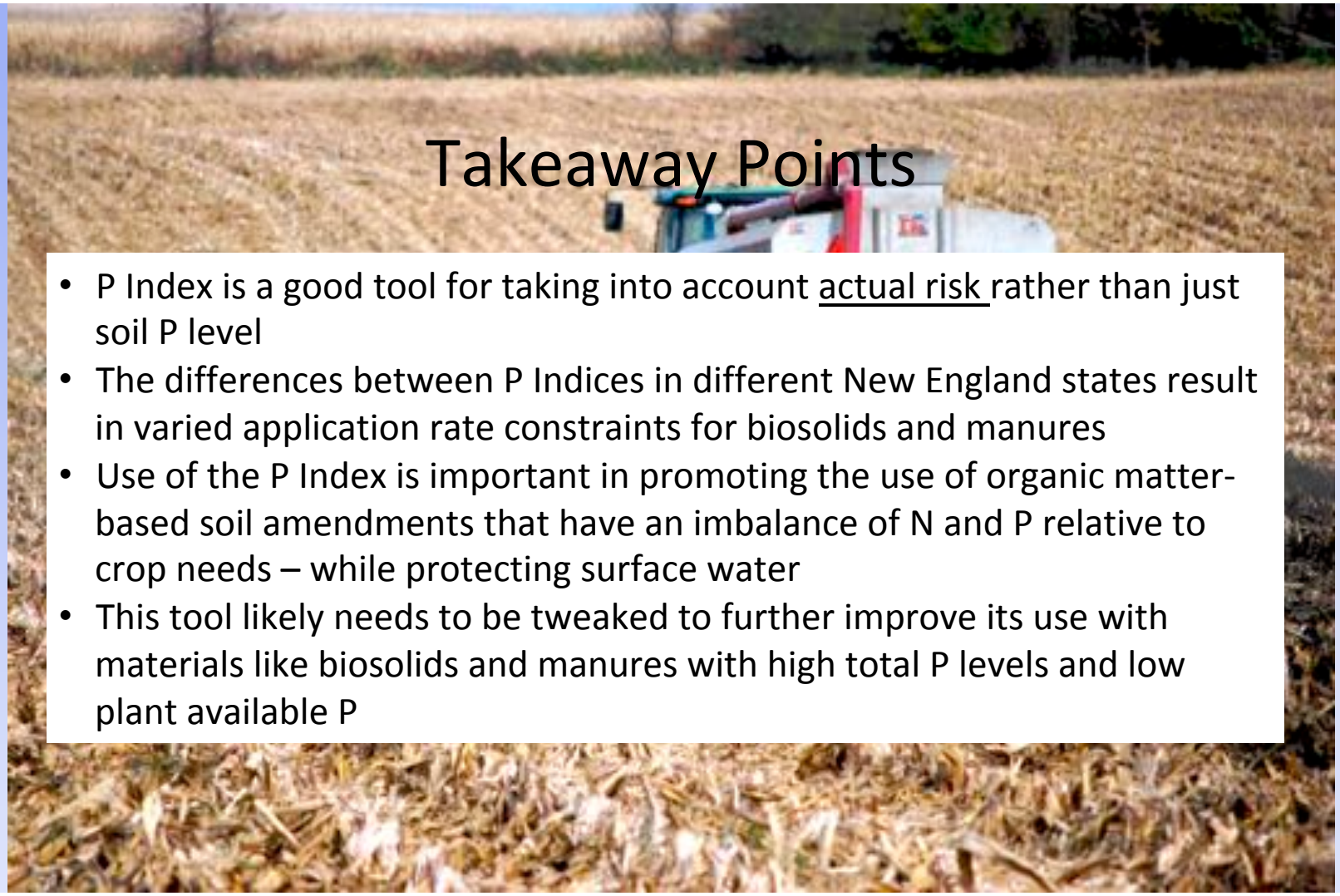
Each field is receiving an application rate of chicken manure to satisfy crop N needs

P Index Results and Recommended Application Rates Across States

Field Name	Soil Test P (ppm)	VT P Index Sum	NH P Index Sum	MA P Index Sum	ME P Index Sum	CT P Index Sum
Control	10.7	66	56	61	48	51
Larger Buffer	10.7	63	48	43	41	36
Higher PSC	10.7	66	56	61	54	51
No-Till Cover Crop	10.7	75	61	84	46	71
High P Low Risk	40	100	74	40	91	37
High P High Risk	40	181	98	100	134	100

Meeting crop N needs would require:
13 tons biosolids/ac or
12,000 gallons liquid manure/ac

	Crop	Soil Test P (ppm)	ME P Index Score	Recommended manure app. rate (gall./acre)	ME P Matrix Result	Recommended manure ap rate (gall./acre)
Field 1	Corn Silage	653	**898**	0	**P-based**	8,500
Field 2	Corn Silage	412	**525**	0	**P-based**	8,500
Field 3	Corn Silage	140	**203**	0	**N-based**	11,000
Field 4	Corn Silage	77	**106**	0	**N-based**	11,000
Field 5	Corn Silage	44	**73**	8,500	**N-based**	10,000
Field 6	Pasture	14.7	**28**	6,000	**N-based**	4,000 plus pasture drop
Field 7	Mixed Grass	8.9	**30**	8,500	**N-based**	equivalent of 7,500 plus pasture drop



Takeaway Points

- P Index is a good tool for taking into account actual risk rather than just soil P level
- The differences between P Indices in different New England states result in varied application rate constraints for biosolids and manures
- Use of the P Index is important in promoting the use of organic matter-based soil amendments that have an imbalance of N and P relative to crop needs – while protecting surface water
- This tool likely needs to be tweaked to further improve its use with materials like biosolids and manures with high total P levels and low plant available P