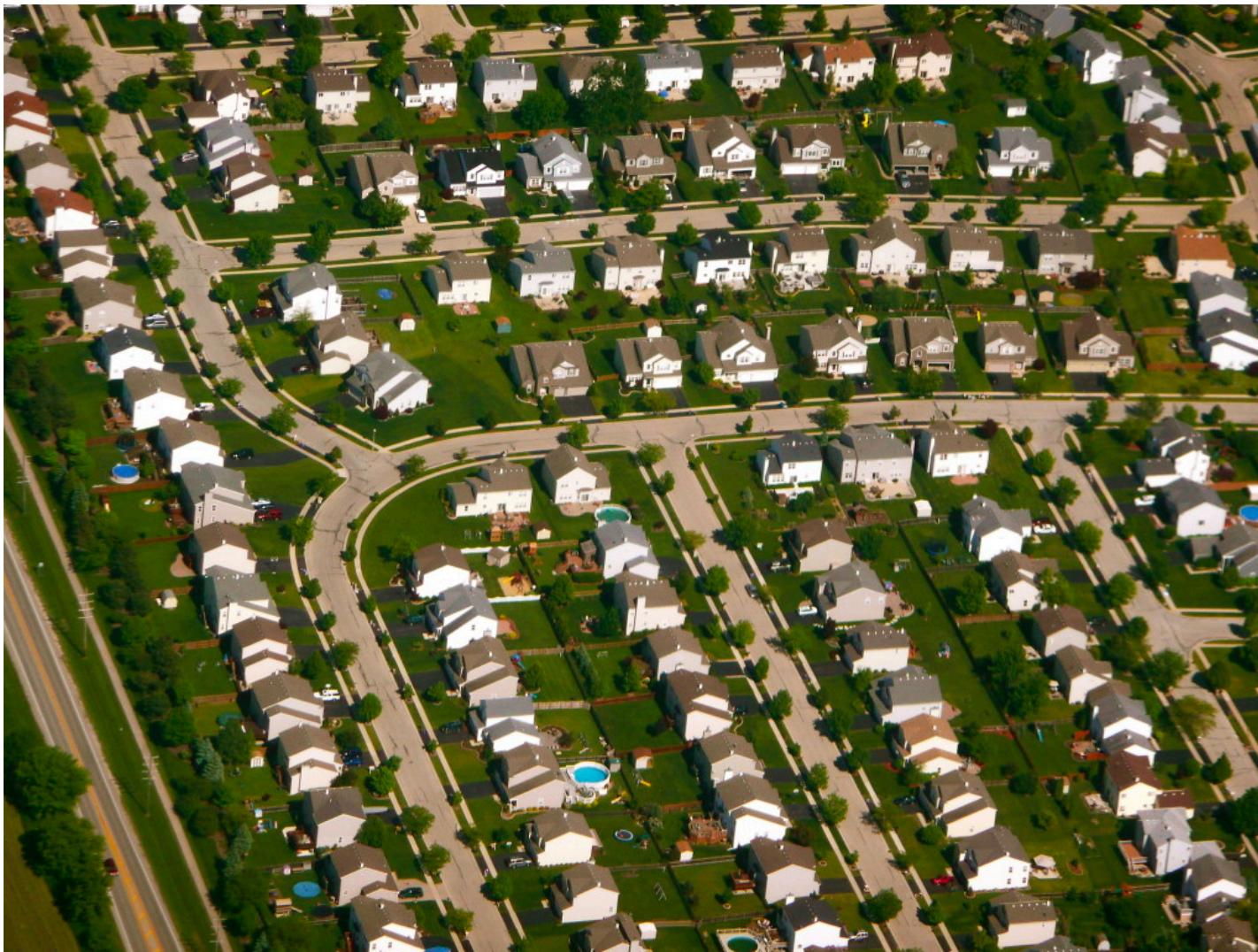
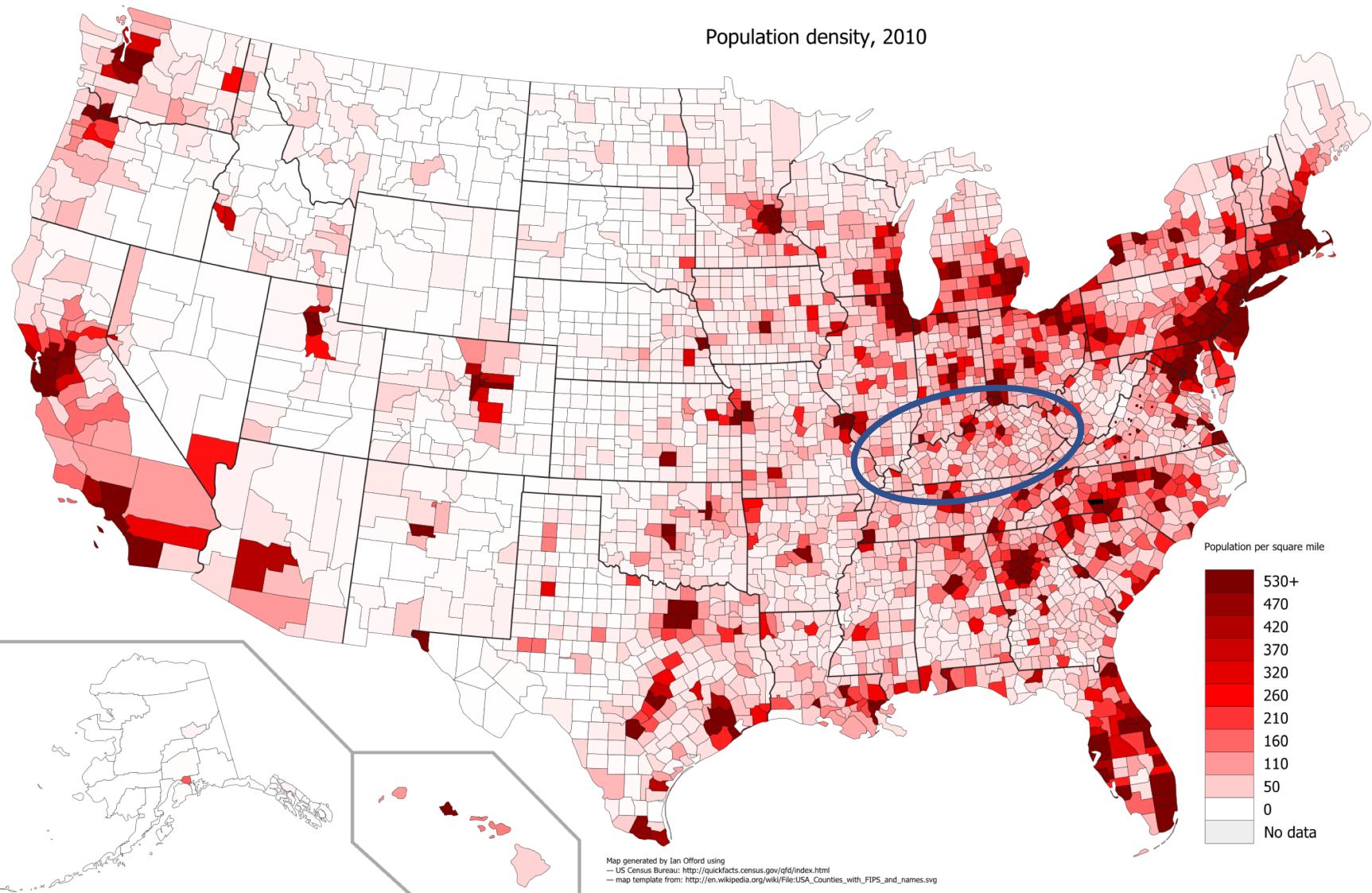


Starter Fertilizer and Lawn Establishment



Brad D. Lee, Extension Professor
Plant and Soil Sciences Dept., Univ. of Kentucky

Population density, 2010



Plant requirements

- Nitrogen (N)
- **Phosphorus (P)**
- Potassium (K)



C, H, O, S, Ca, Mg, Mo, Cu, Co, B, Mn, Fe, Cl, Ni, Zn

Farm Nutrient Supplements



Home Nutrient Supplements



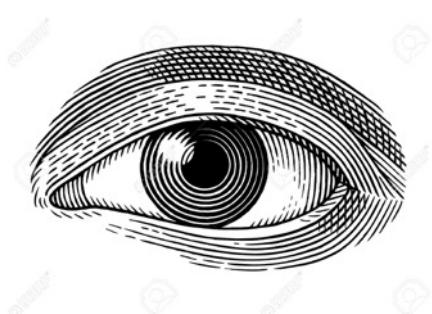
Urban



Agriculture



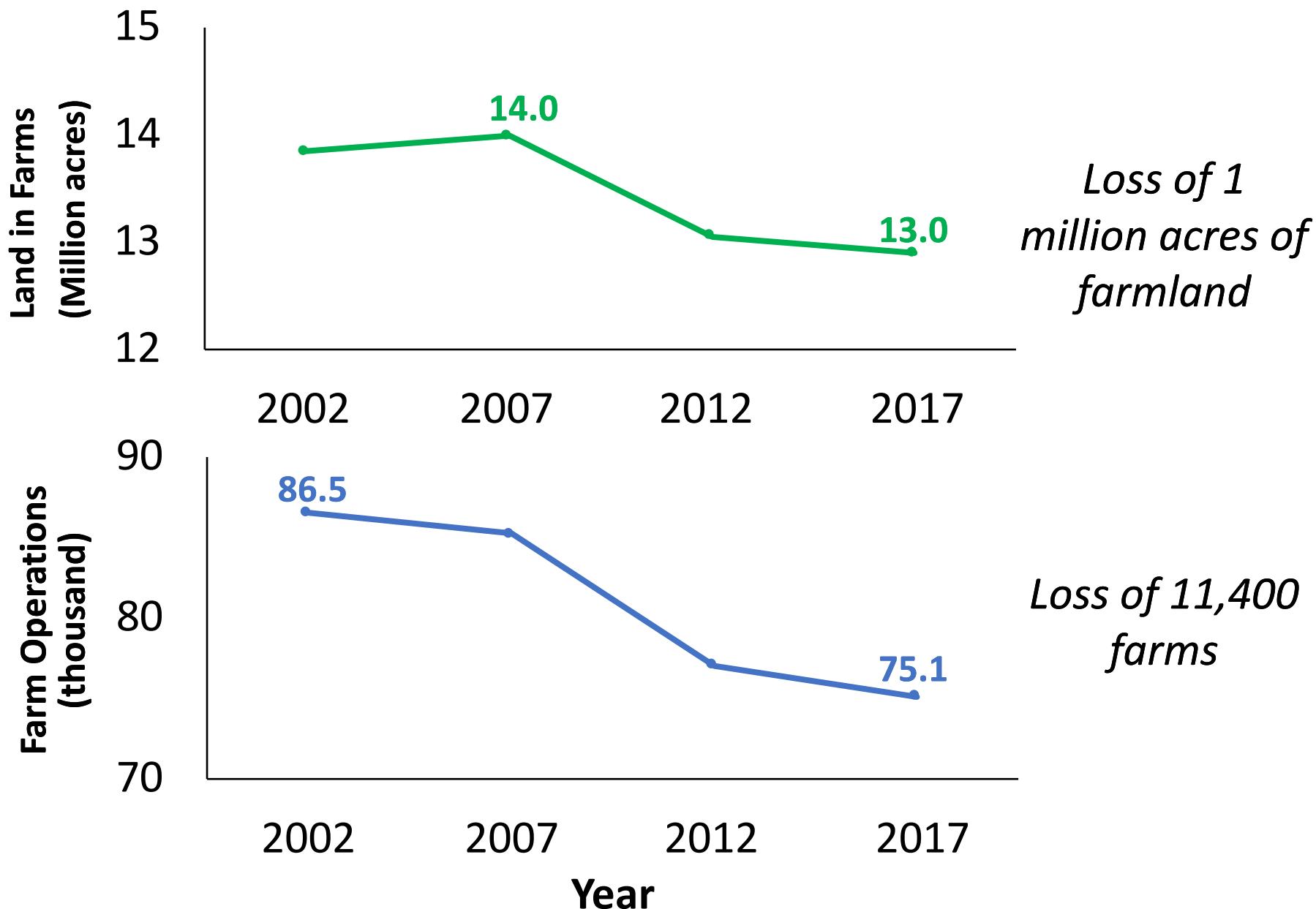
Aesthetics



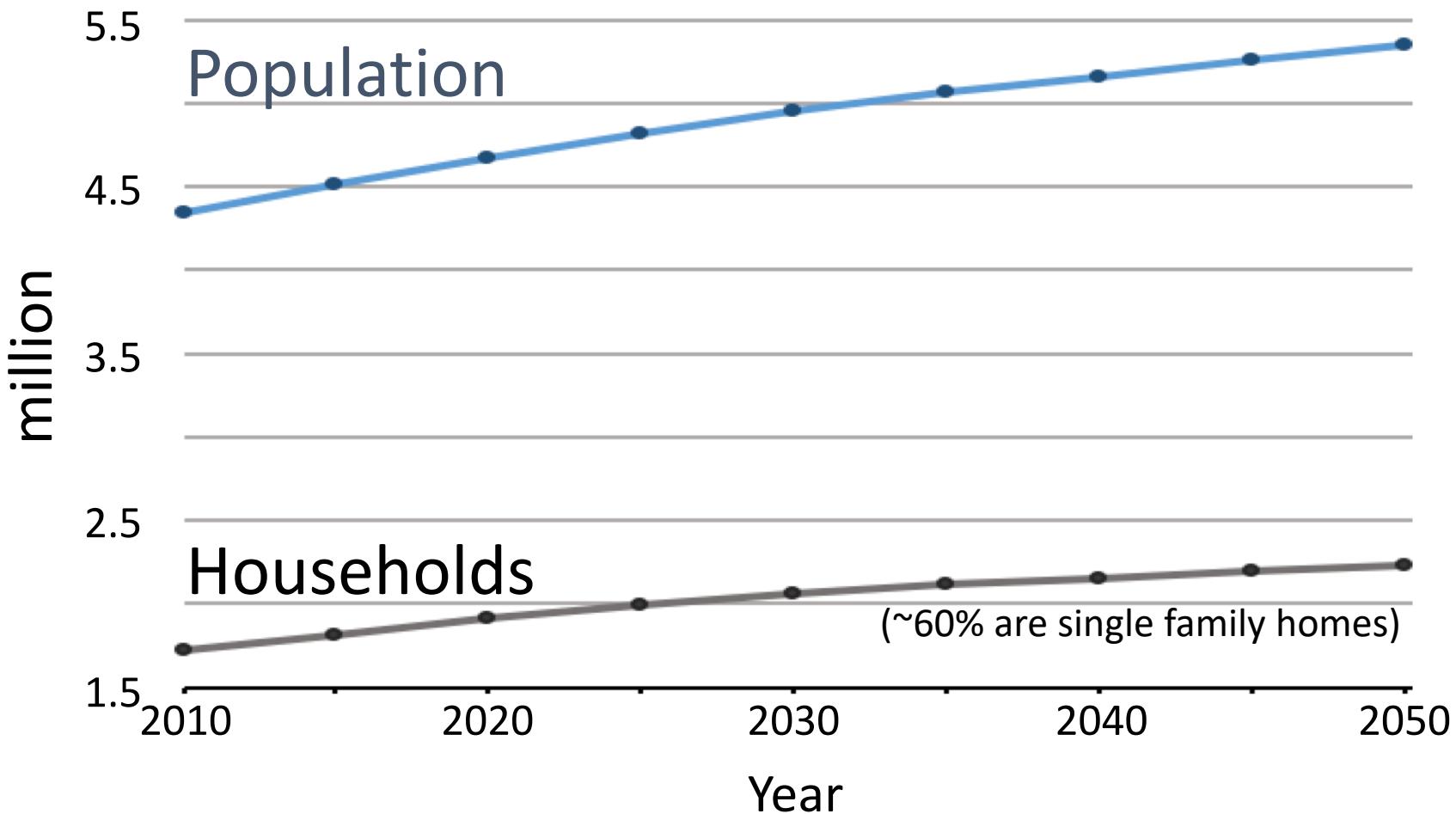
Economics



Fewer Acres Farmed by Fewer Farmers



Kentucky Population & Household Growth Projections



With development we have more impervious surfaces



1955



2005

When Precipitation > Infiltration...

Urban



Increases with development
Development = **tax revenue \$**

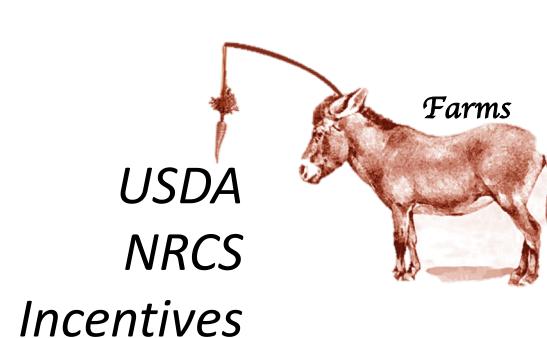
*EPA
Regulations*



Agriculture



Soil loss = Crop loss
Crop loss = **Business loss \$**



Stormwater



Urban



Agriculture

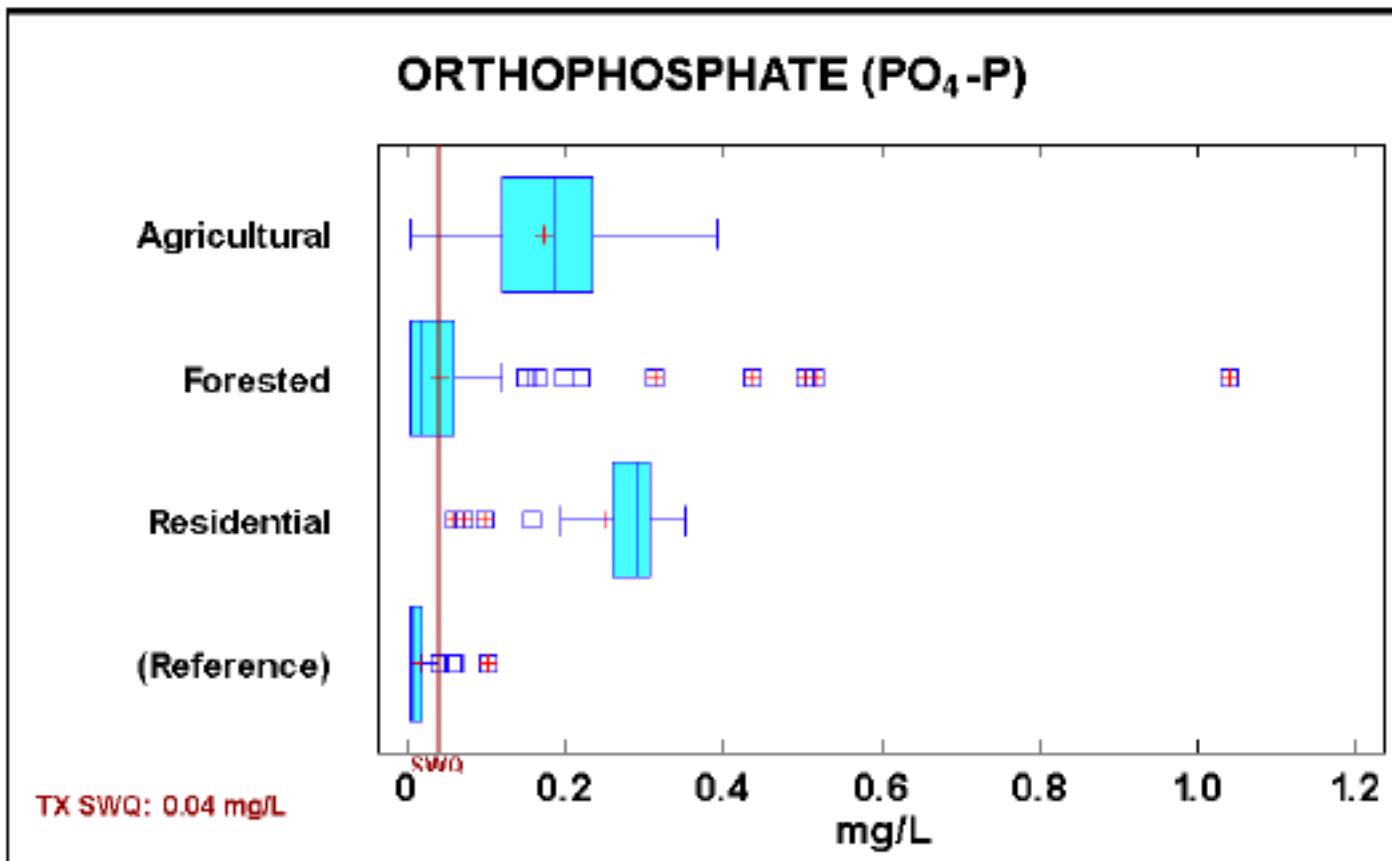


Global Developer

Corn Belt Senator

There is a lot of finger pointing regarding which land use is responsible for water quality impairments.

Land use impacts on groundwater & spring water Ortho-P concentration

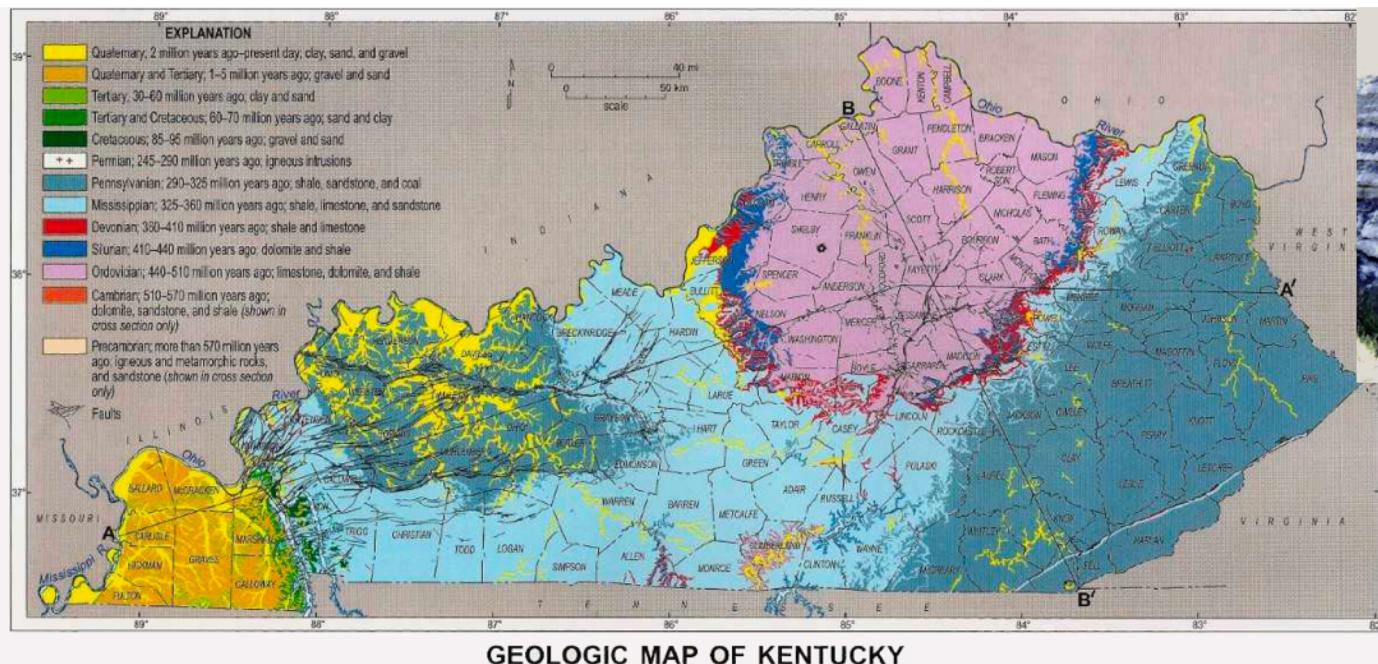


Boxplot of orthophosphate-P and land use in the Kentucky River Basin.
(n = 459 spring and well water samples)

KYDOW: Moderate positive correlation w/ residential & agriculture development

Land use impacts to surface water

Kentucky surface water quality is impacted by the parent rock more than land use with one exception - residential land use



Thomas and Crutchfield, 1974. Nitrate-nitrogen and phosphorus contents of streams draining small agricultural watersheds in Kentucky. JEQ 3:46-49.

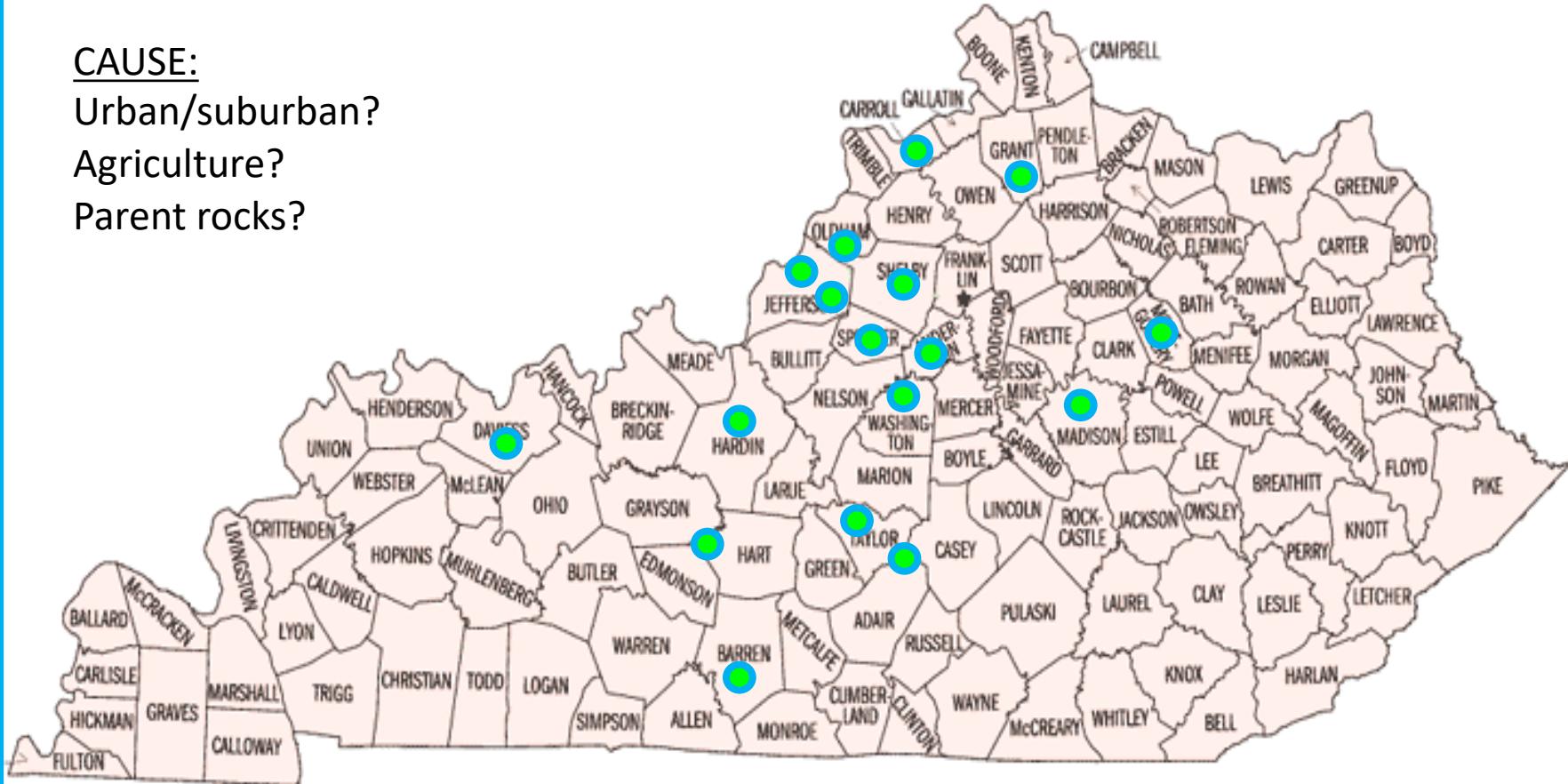
Thomas, Hazler and Crutchfield. 1992. Nitrate-nitrogen and phosphate-phosphorus in seven Kentucky streams draining small agricultural watersheds: Eighteen years later. JEQ 21:147-150

“Changes in the timing and method of applying agricultural fertilizer are the primary drivers behind the increasing amounts of phosphorus entering Lake Erie and causing toxic algal blooms and a large dead zone...”



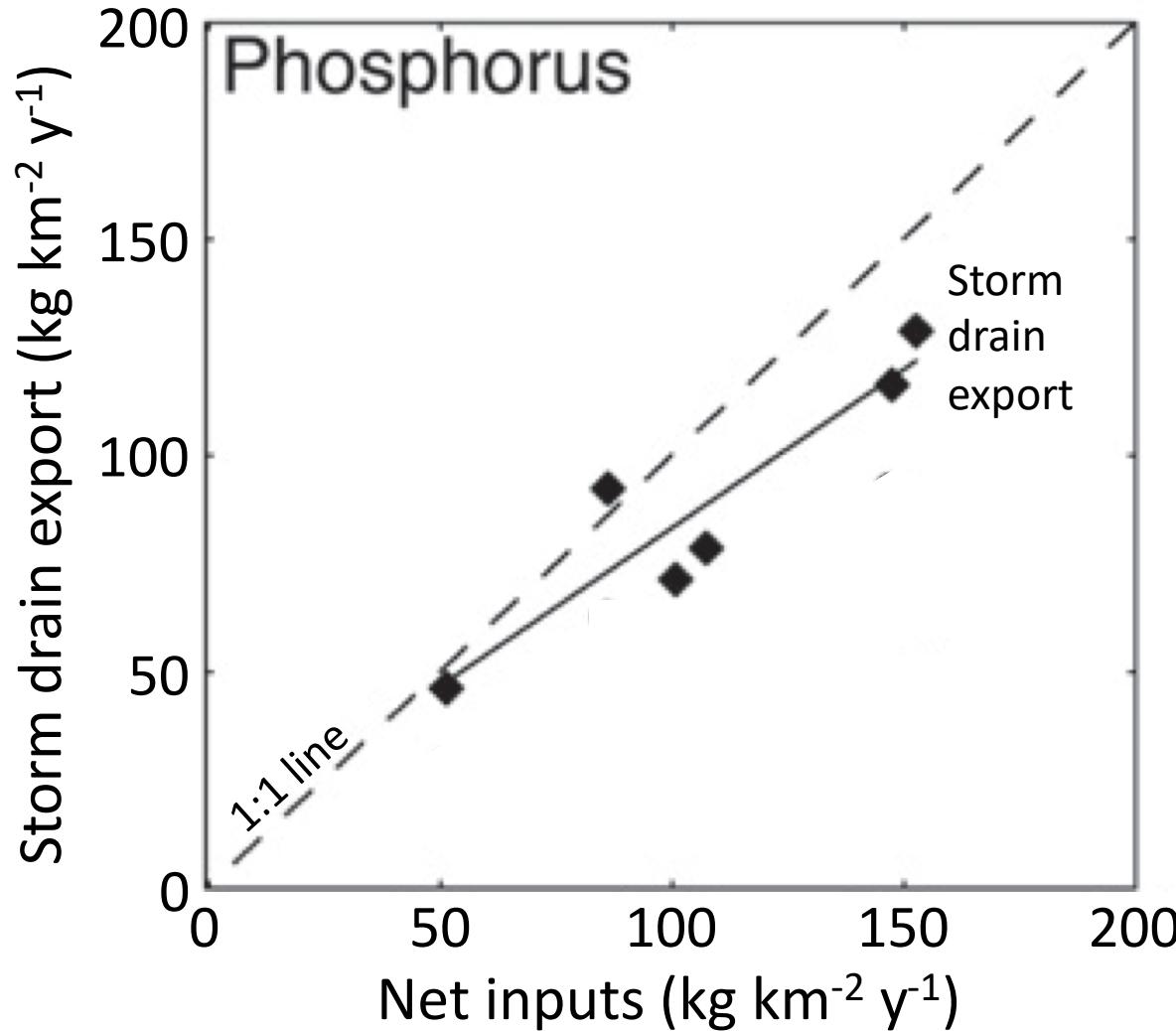
CAUSE:

Urban/suburban?
Agriculture?
Parent rocks?



● Hazardous Algal Blooms (HABs) Lake Recreational Advisories,
Kentucky Division of Water 2014 - 2016

STORMWATER: Direct relationship between P inputs and storm drain exports



Urban Kentucky P inputs and outputs

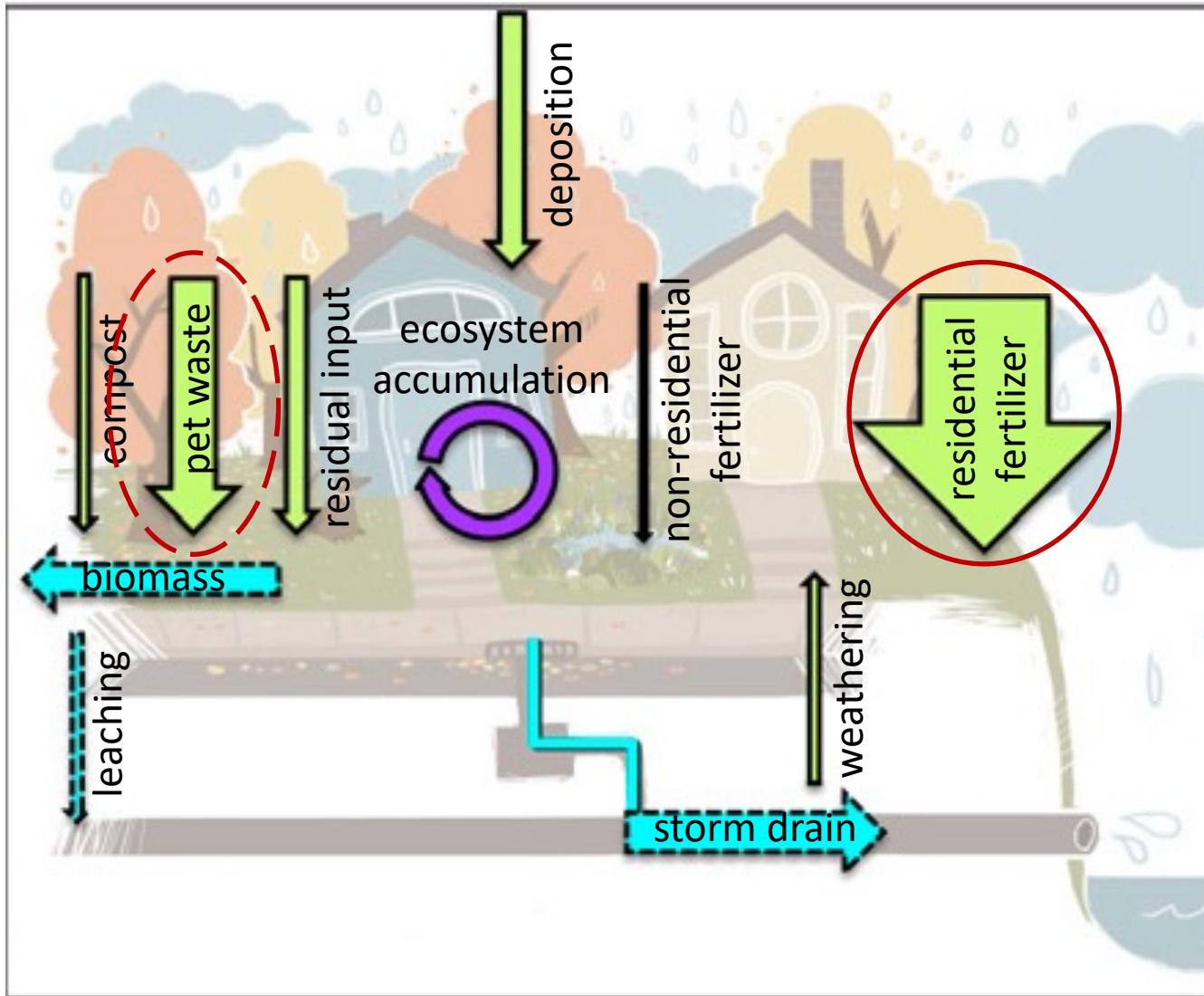
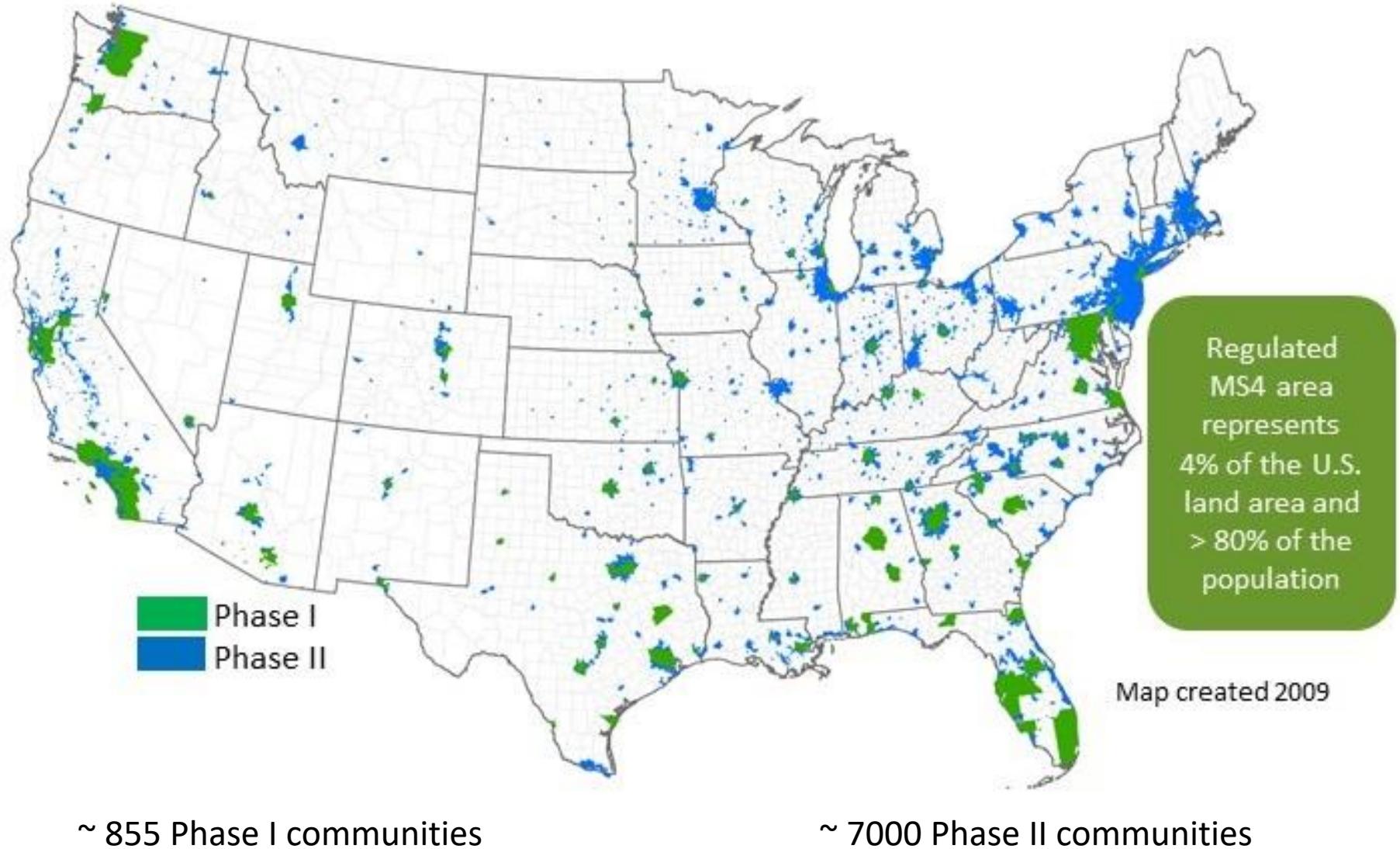


Figure liberally modified (in red) from Hobbie et al., 2017
(MN does not allow P fertilizer)

Nutrient regulations in cities

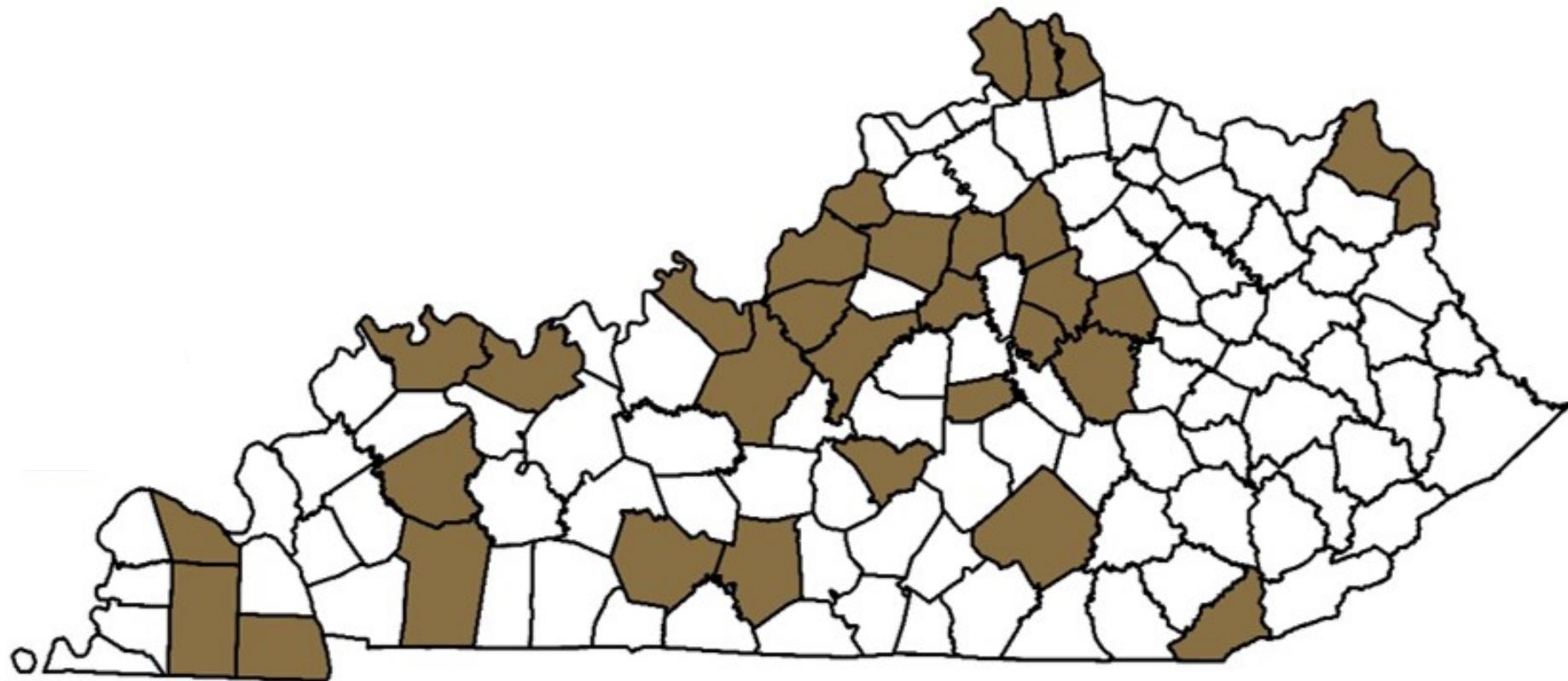
- Municipal Separate Storm Sewer System (MS4)
Communities are regulated by the EPA via National Pollution Discharge Elimination System Permit (Clean Water Act 1972)
 - 1990 - Phase I regulations (population > 100,000)
 - 1999 – Phase II regulations (population > 10,000)
- *Think of these as discharge permits for city stormwater runoff*

National Map of Regulated MS4s



Communities can be added to list as population grows – US Census

>100 MS4 Communities in 32 Counties

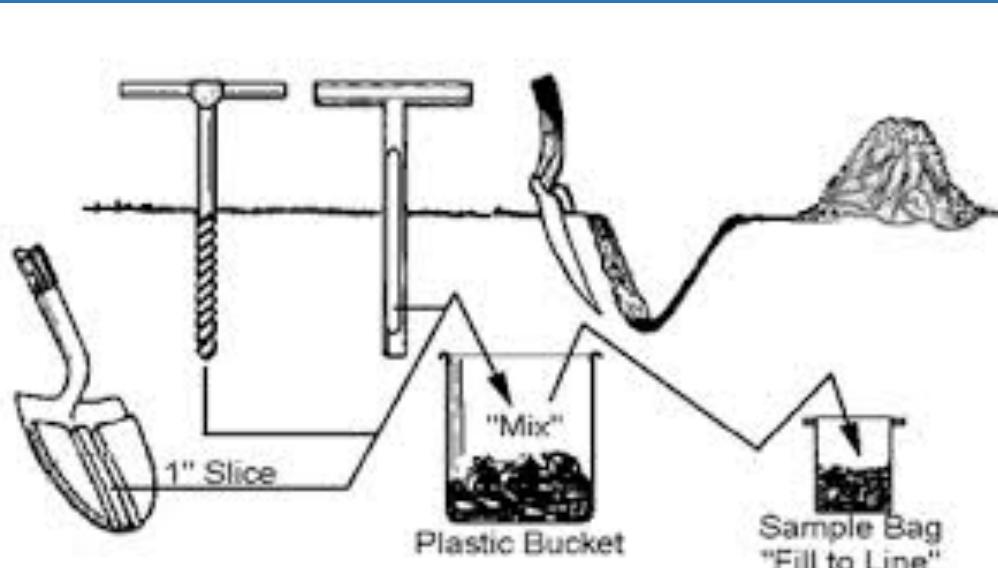


Minimum Control Measures

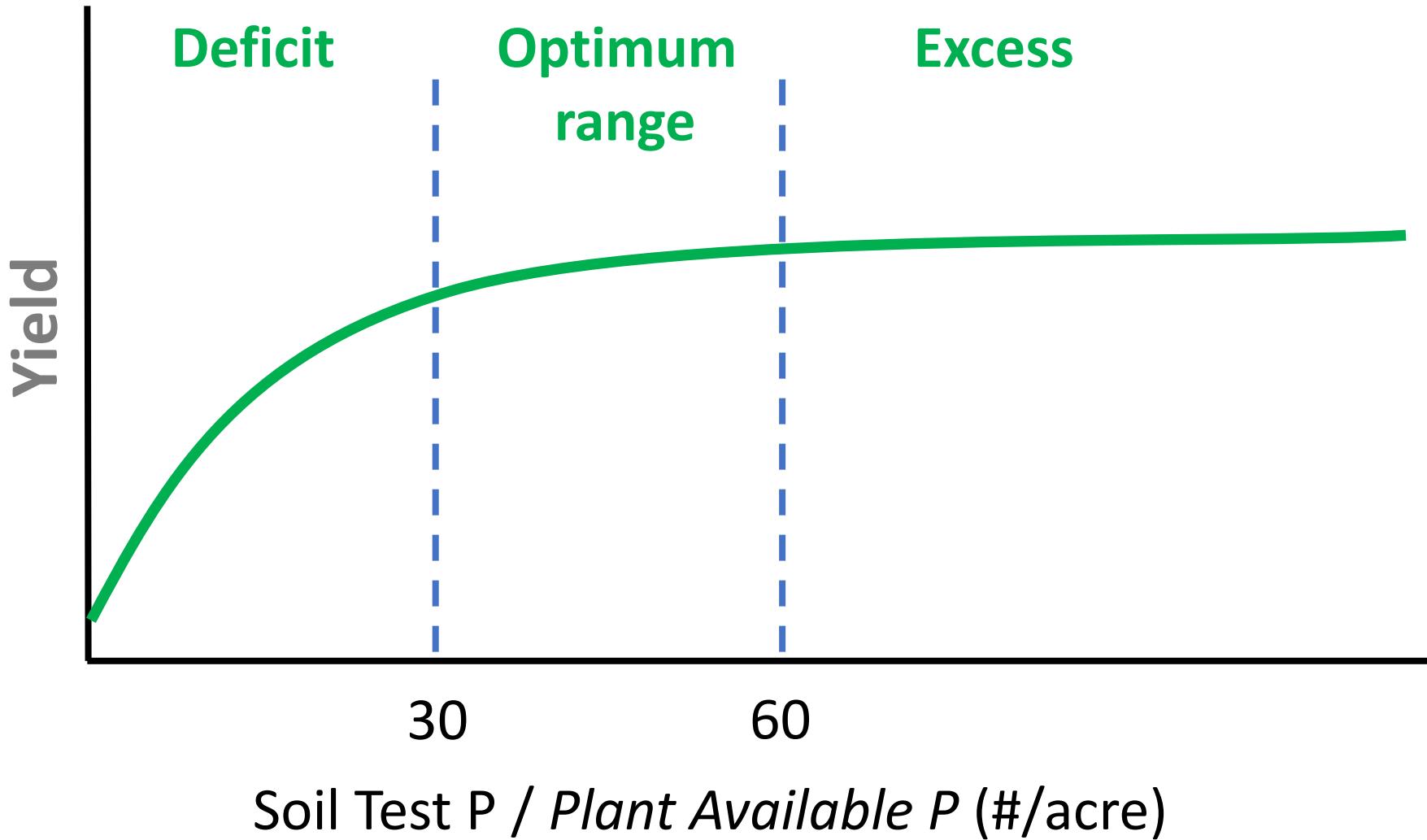
- 1. Public Education & Outreach**
 - **Number of soil tests**
2. Public Participation/Involvement
3. Illicit Discharge Detection & Elimination
4. Construction Site Runoff Control
5. Post-Construction Runoff Control
6. Pollution Prevention/Good Housekeeping

UK Extension Conducts Soil Tests

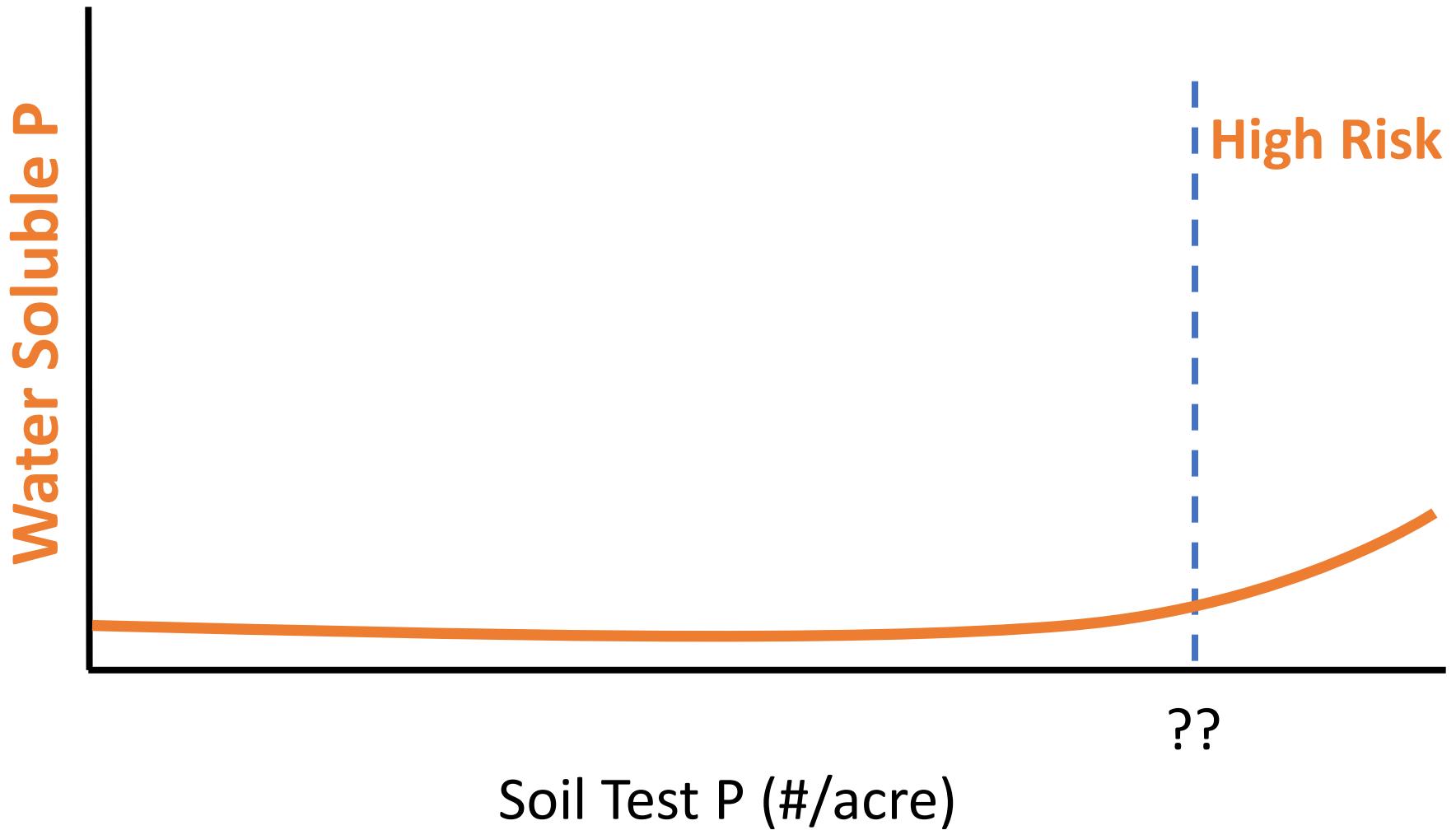
Fertilizer recommendation is made based on test results by UK for the desired crop



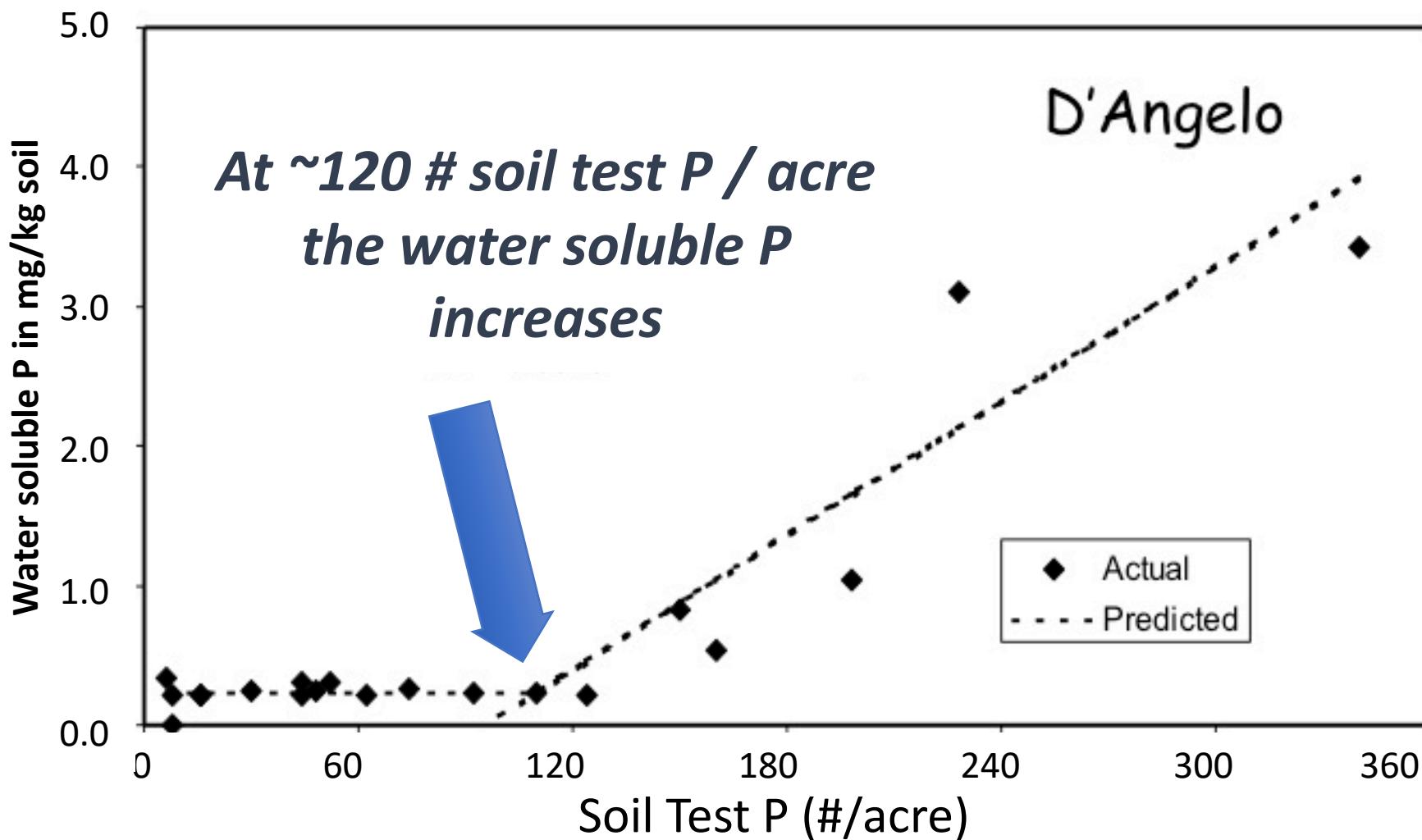
Soil Test P



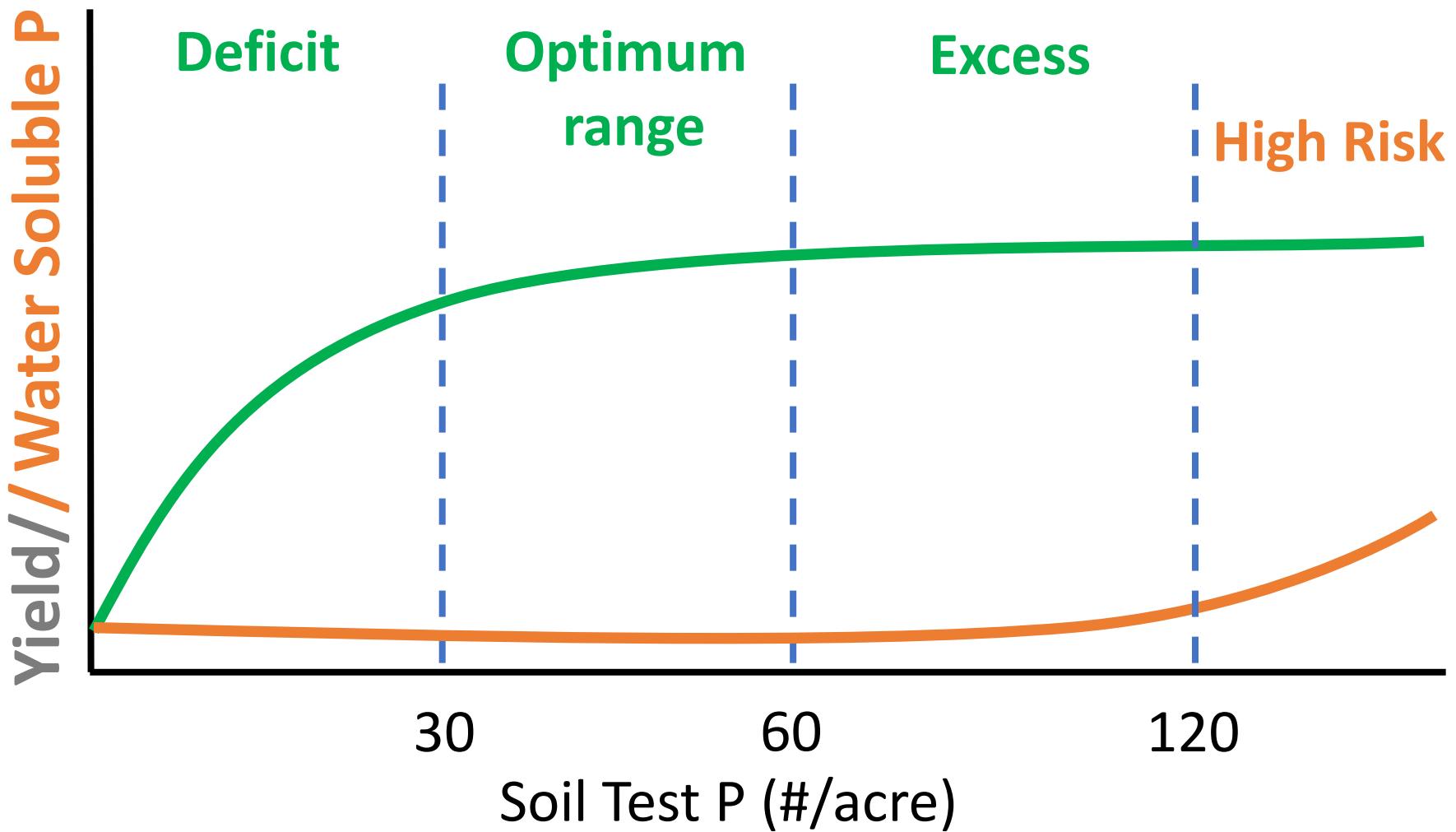
Soil Test P



Predicting Water Soluble P from Soil Test P on Twenty Kentucky Soils



Soil Test P



Kentucky County Soil Tests

1990 – 2014

(n = 990,162)

Home and Garden (H code)

- Total = 179,184
- Max = 17,691
- Min = 52
- Mean = 1493
- Median = 747

Agriculture (A code)

- Total = 810,978
- Max = 52,245
- Min = 116
- Mean = 6758
- Median = 4886

25 year soil test summary for Fayette County

1990-2014	Samples (n)	Low (%) <30 #/Ac.	Med (%) 30-60 #/Ac.	High (%) 60-120 #/Ac.	Very High (%) >120 #/Ac.
Agriculture	12359	6	10	56	28
Urban	16156	3	3	10	84



No benefit to plant growth



Maximum recommended soil P level

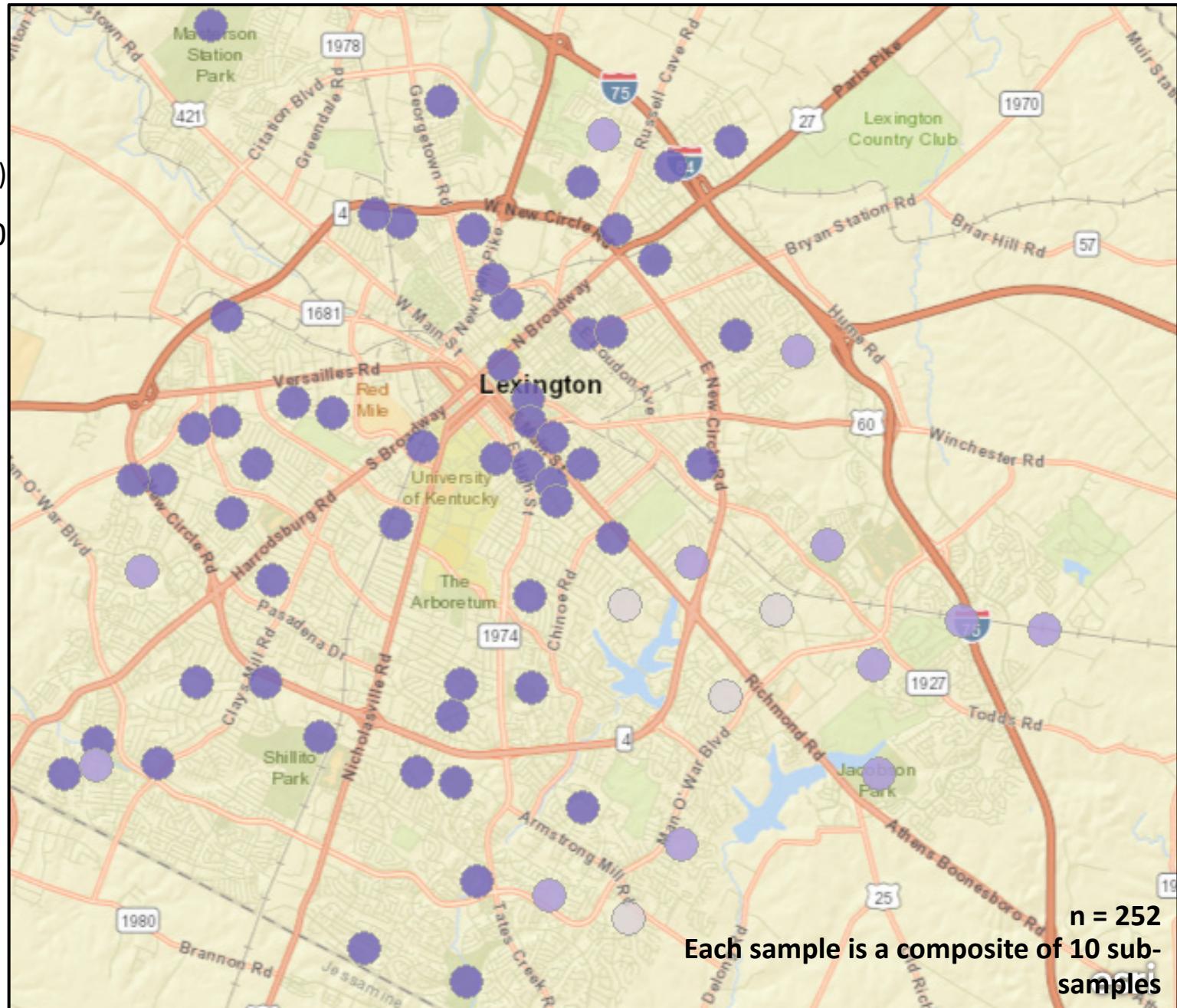


Water Quality Risk

Soil Test P in Lexington Parks and Medians

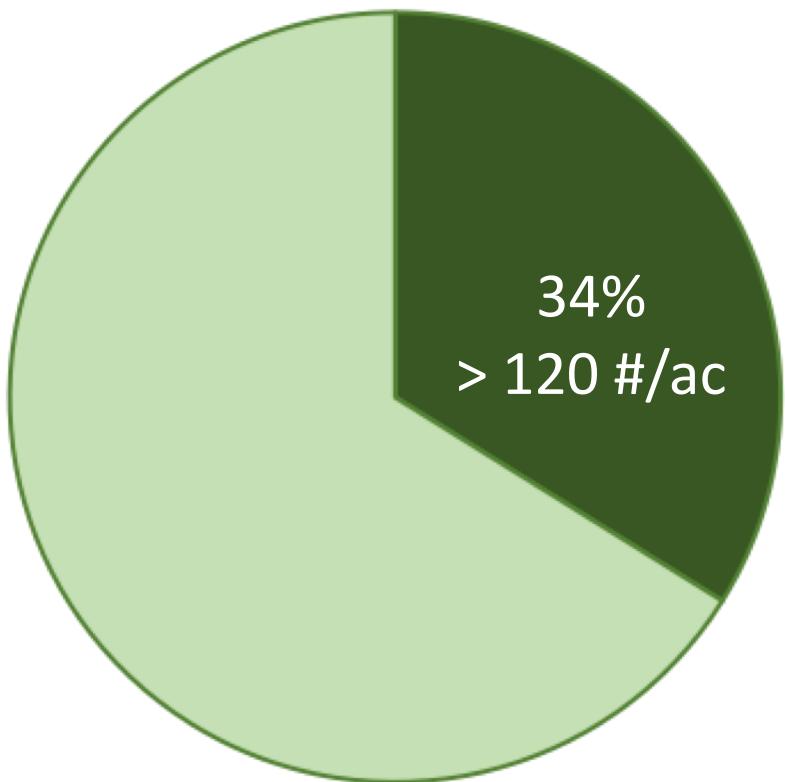
Average P (#/ac)

- >120 - 530
- >30 - 120
- 0 - 30

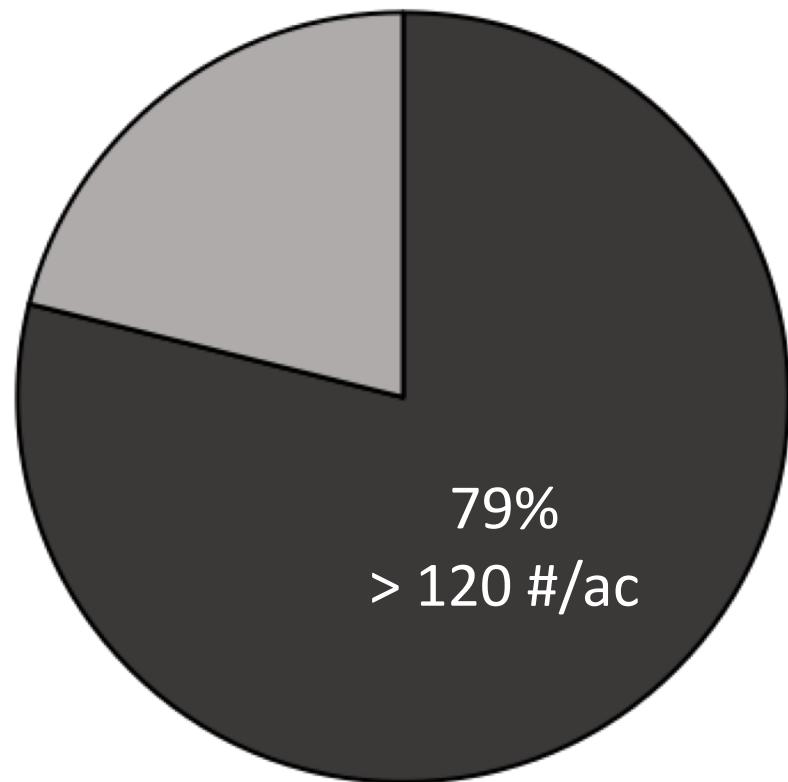


Water Quality Risk Soil Test P levels

Agriculture

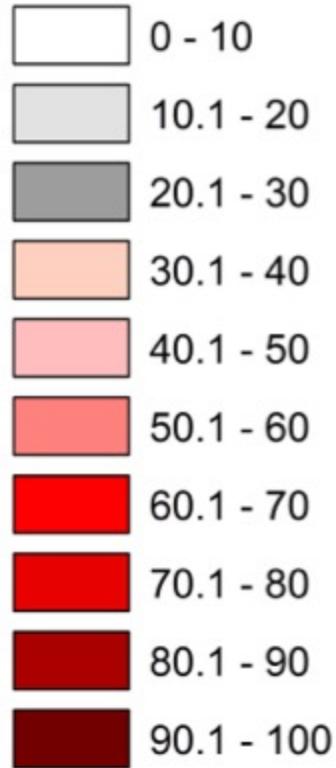


Urban

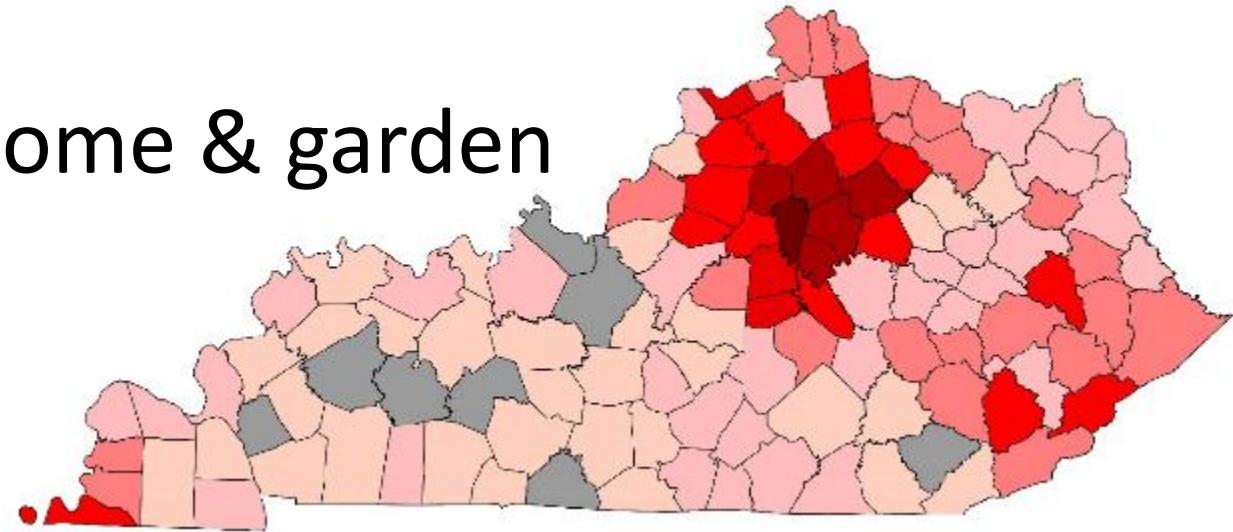


1990 – 2014 Soil Test Phosphorus Levels > 120 #/acre

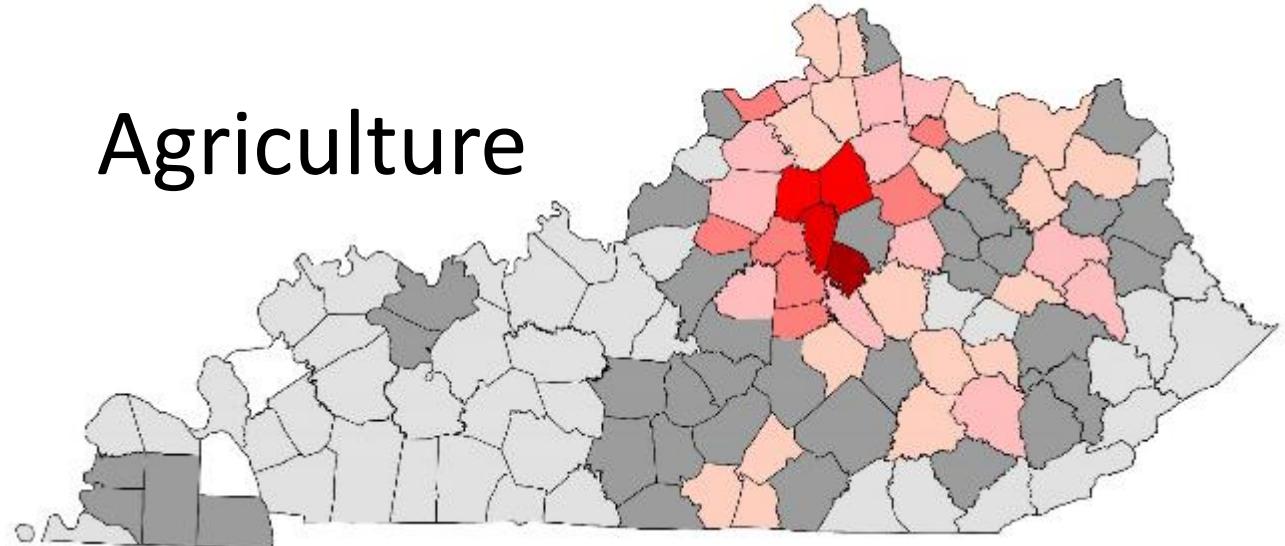
% Soil Tests with
High Risk P Levels



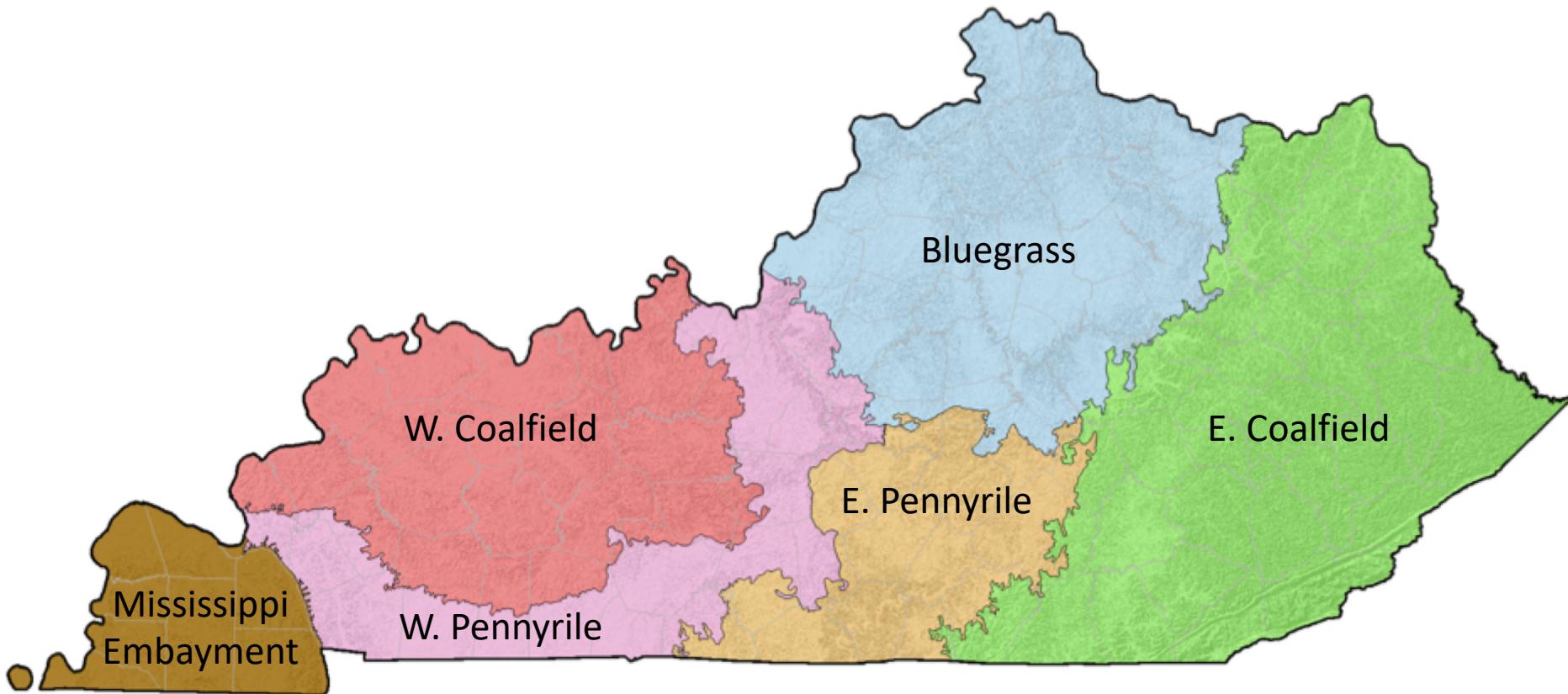
Home & garden



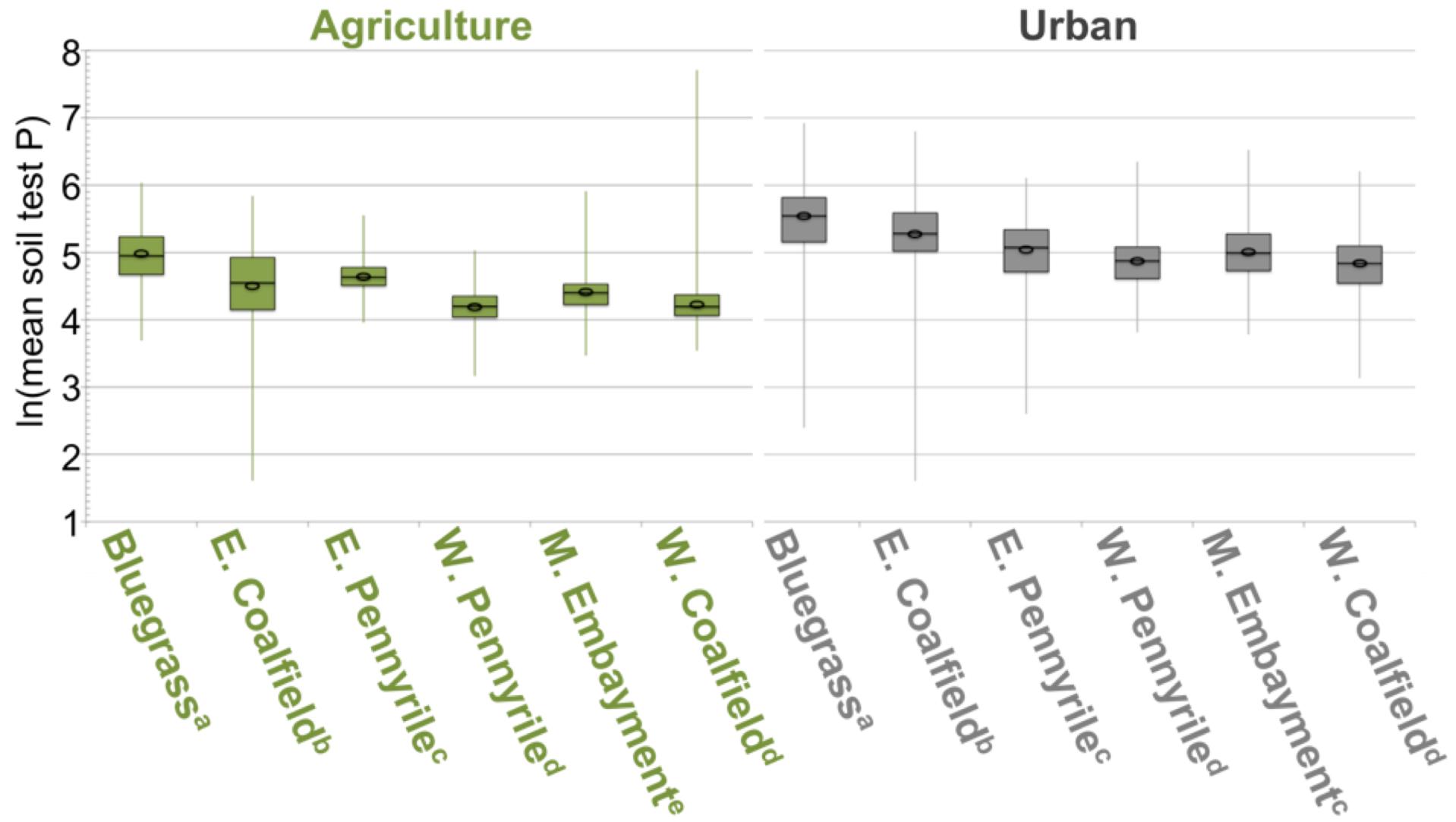
Agriculture



Physiographic Regions of Kentucky

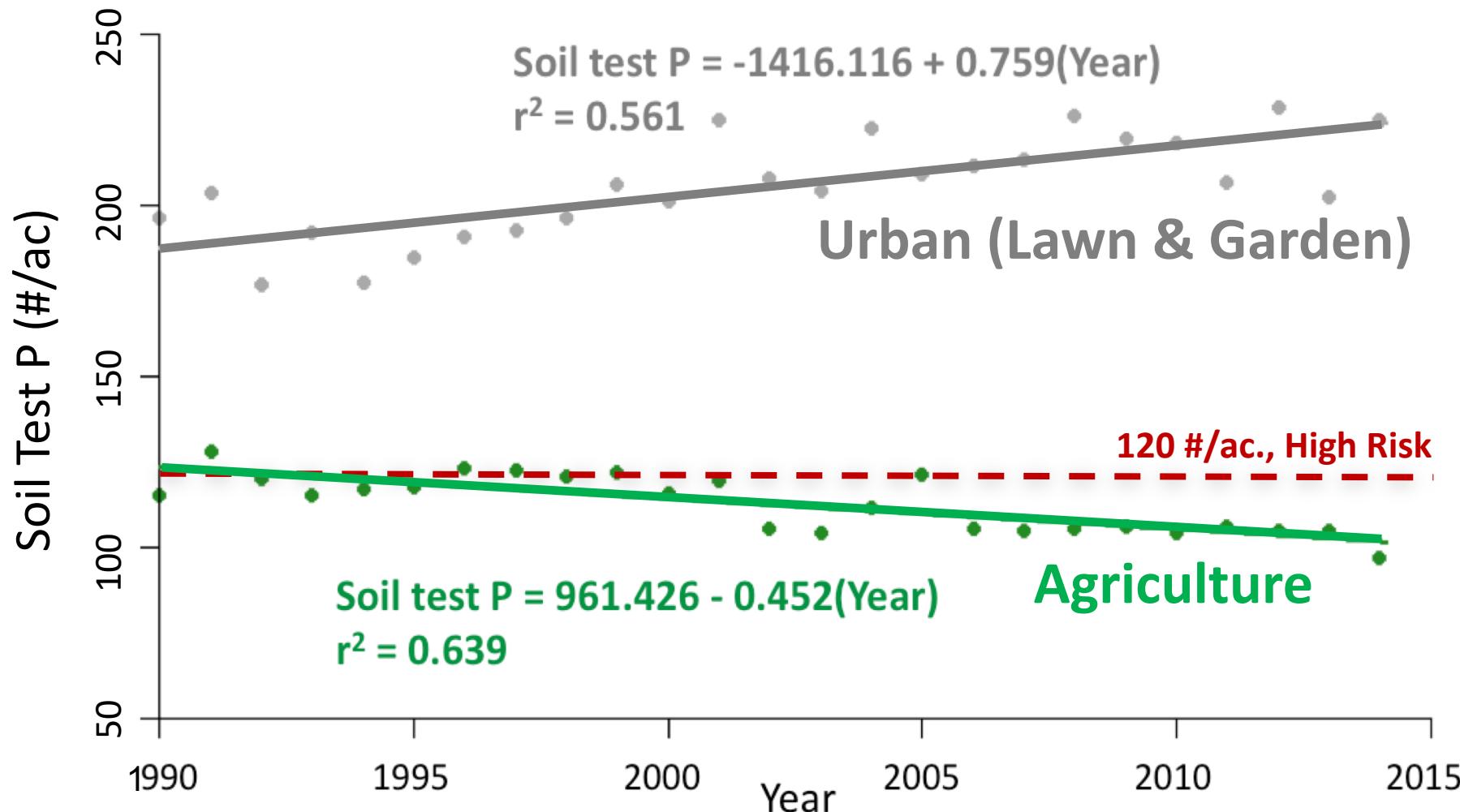


Regional Distribution of Soil Test P Levels



Kentucky Soil Test P

(~1 million tests analyzed 1990 – 2014)



Recommended Soil Test P in Lawns
(~30 #/acre)

Who is applying fertilizer on lawns?

National homeowner survey 2017 (n ~ 3300)

- National Association of Landscape Professionals (NALP's) Industry Growth Initiative survey
 - 50% contracted mowing
 - 46% pest control
 - 42% weed control
- Why?
 - 52% wanted lawn/landscape to look better
 - 41% save time
 - 30% Save money

Who is applying fertilizer on lawns?

National homeowner survey 2013 (n = 675)

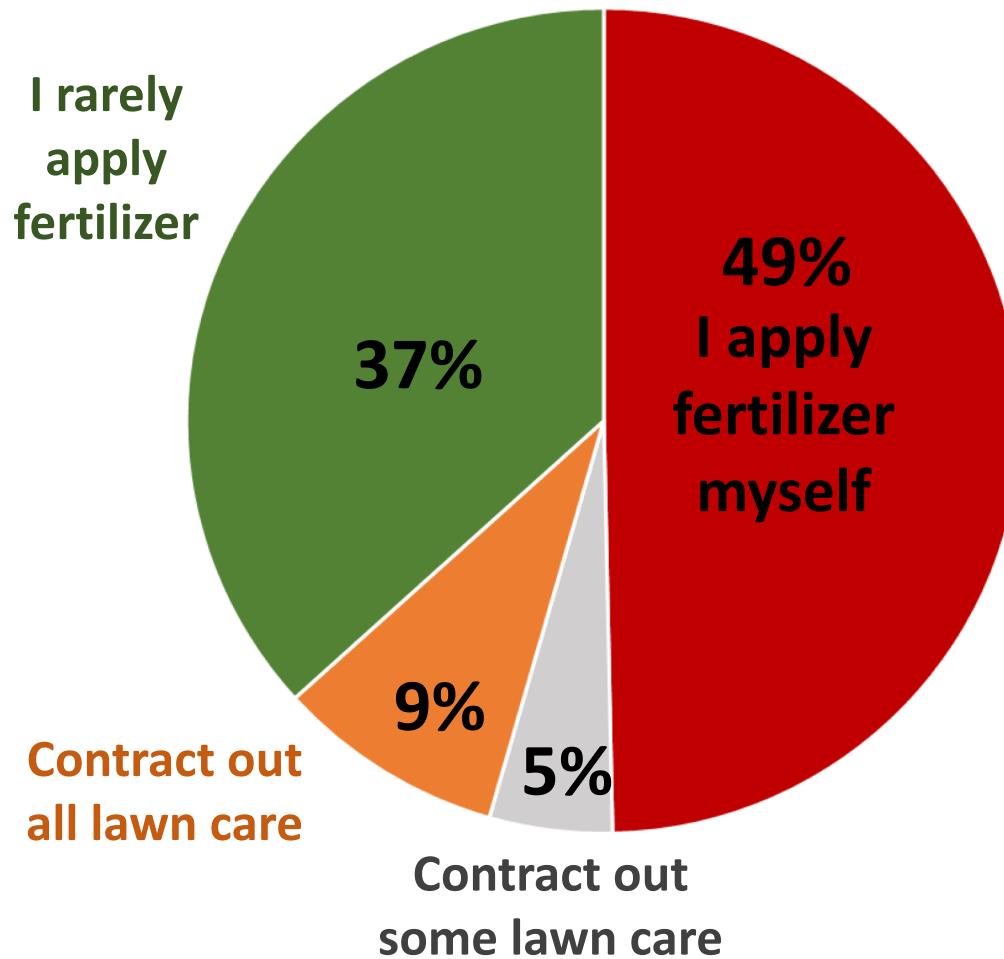
Do you treat your lawn, shrubs or trees with fertilizer, weed killer or insect control products?

- Yes, I do it myself
- Yes, I have a contractor do it
- No



Who is applying fertilizer on lawns?

Lexington homeowner survey 2018 (n = 147)



Lexington homeowner survey indicates most nutrient applications are DIY.

Homeowners' decisions are related to their attitudes, norms and values

Widespread idea that fertilizing will result in a healthier and greener lawn

(Nelson et al., 2008; Cheng et al., 2008)



Some states passed laws for lawn maintenance fertilizer applications



Nitrogen (N)

Phosphorus (P)

16-0-8

Potassium (K)

Availability of P-free fertilizer

Scotts drops phosphorus from lawn fertilizer

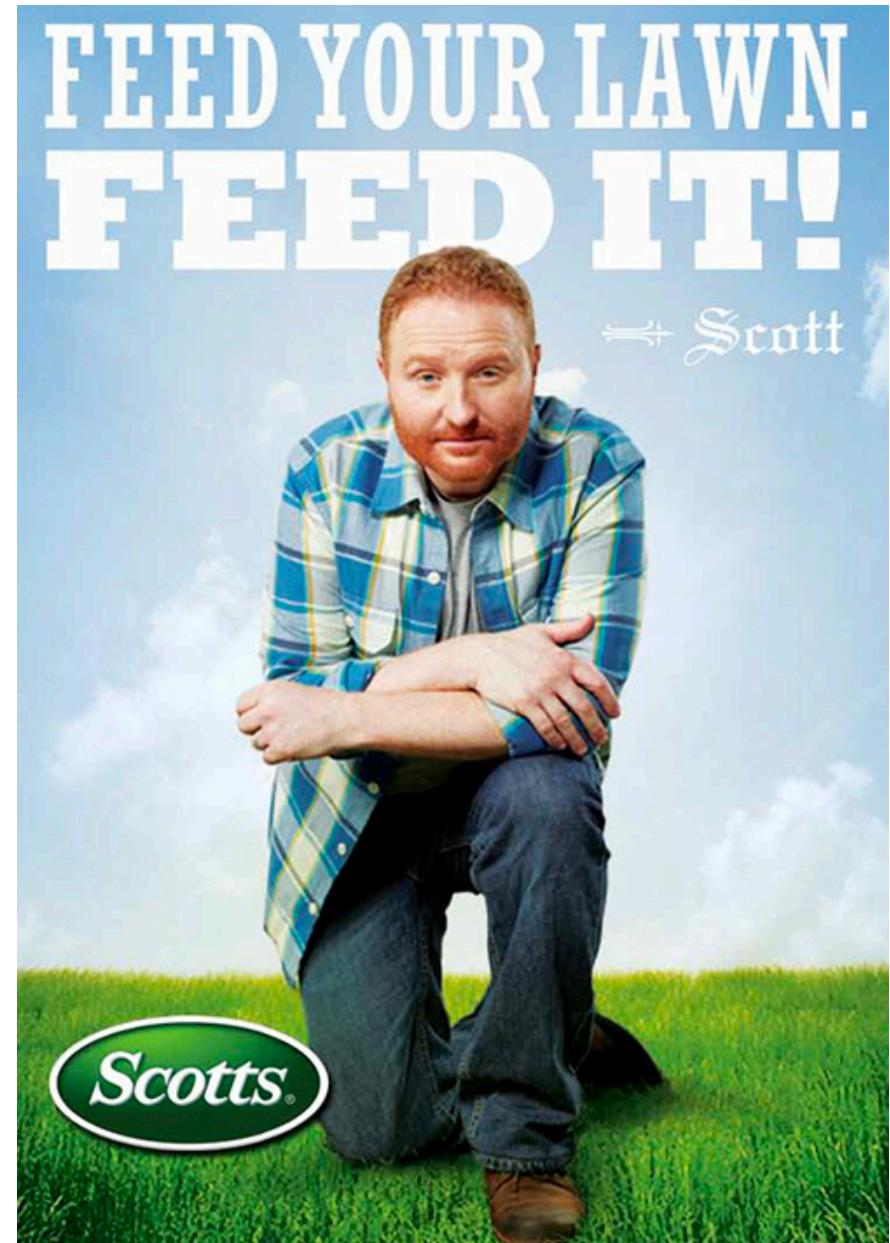
Marysville company acts to reduce risk of runoff feeding toxic-algae blooms in lakes; competitors likely to follow its lead

Columbus Dispatch - May 10, 2013

States that Require Soil Test Prior to Sale of nonAg Phosphorus Fertilizer



Is phosphorus fertilizer
needed when we seed
new turfgrass?



Conversation with a fertilizer vendor

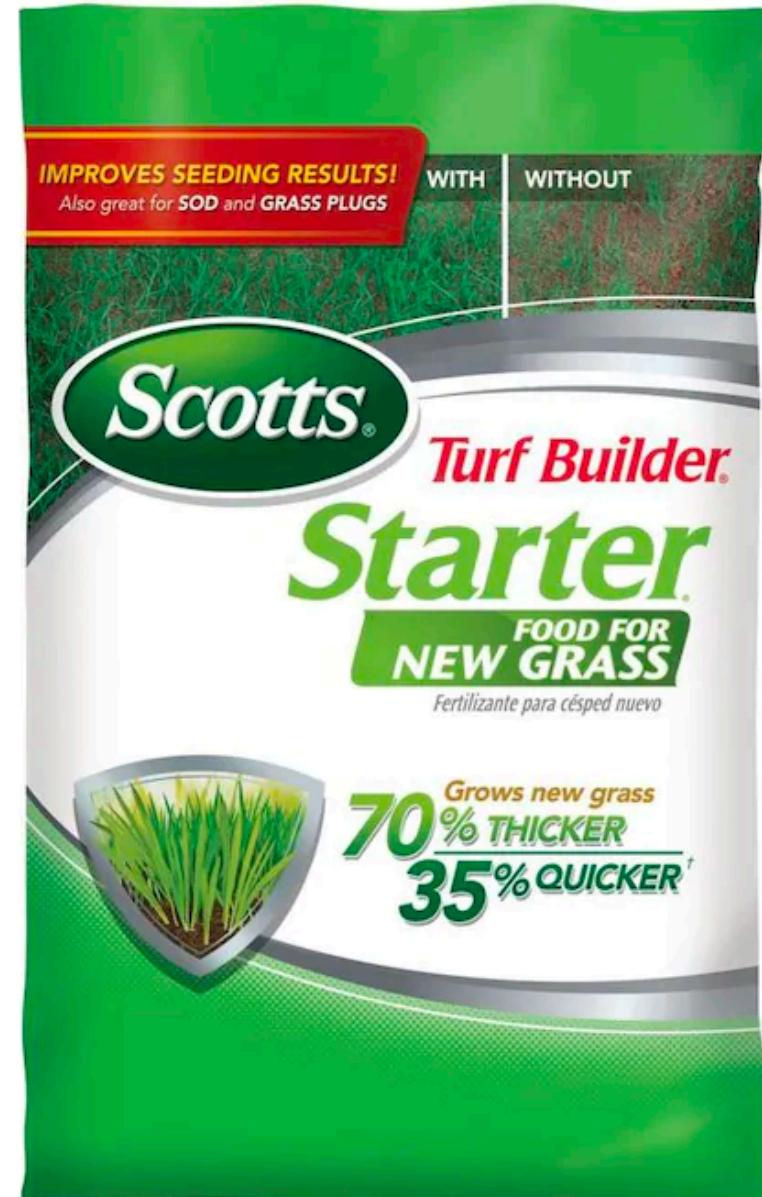
Vendor: 'When establishing lawn from seed, roots are short and cannot reach the soil P necessary for growth therefore you need to add phosphorus.'

ME: How much phosphorus?

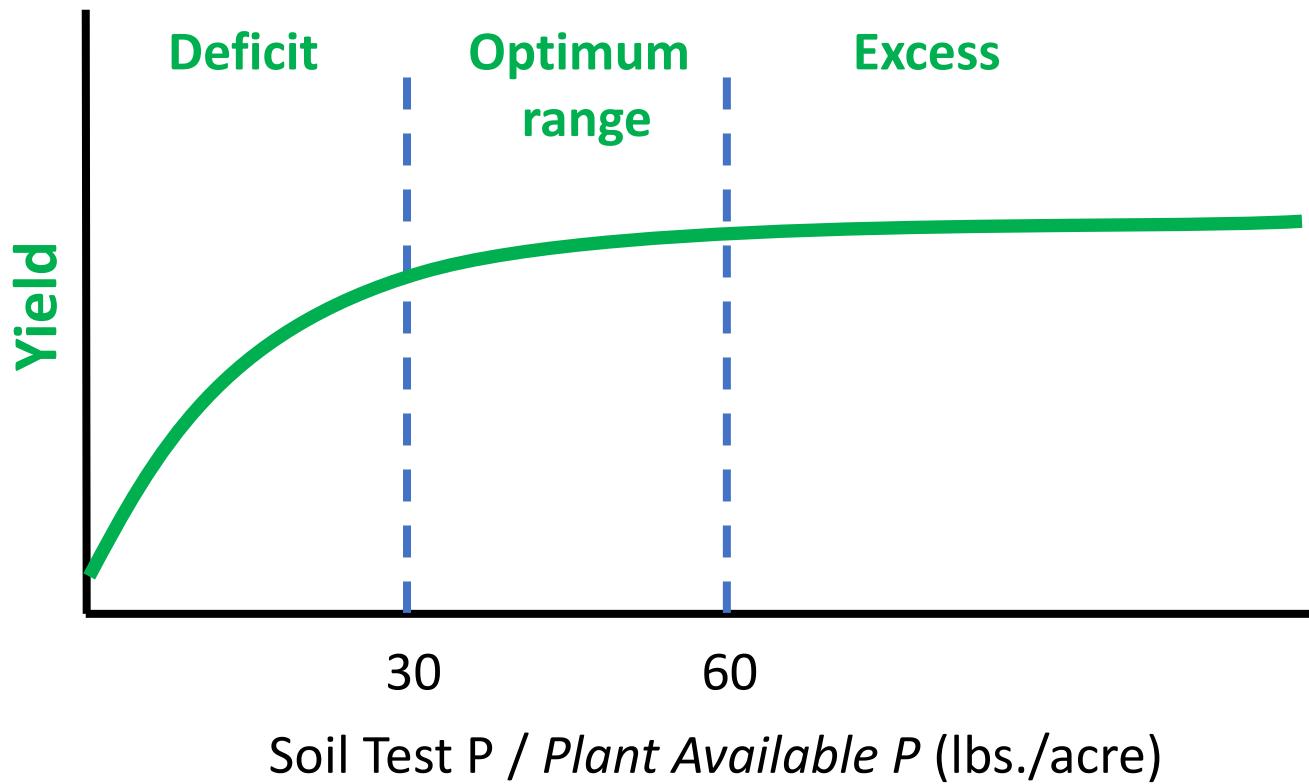
Vendor: 'I don't know, but you need to add it or the grass won't grow.'

ME: Even if the soil test P level is high?

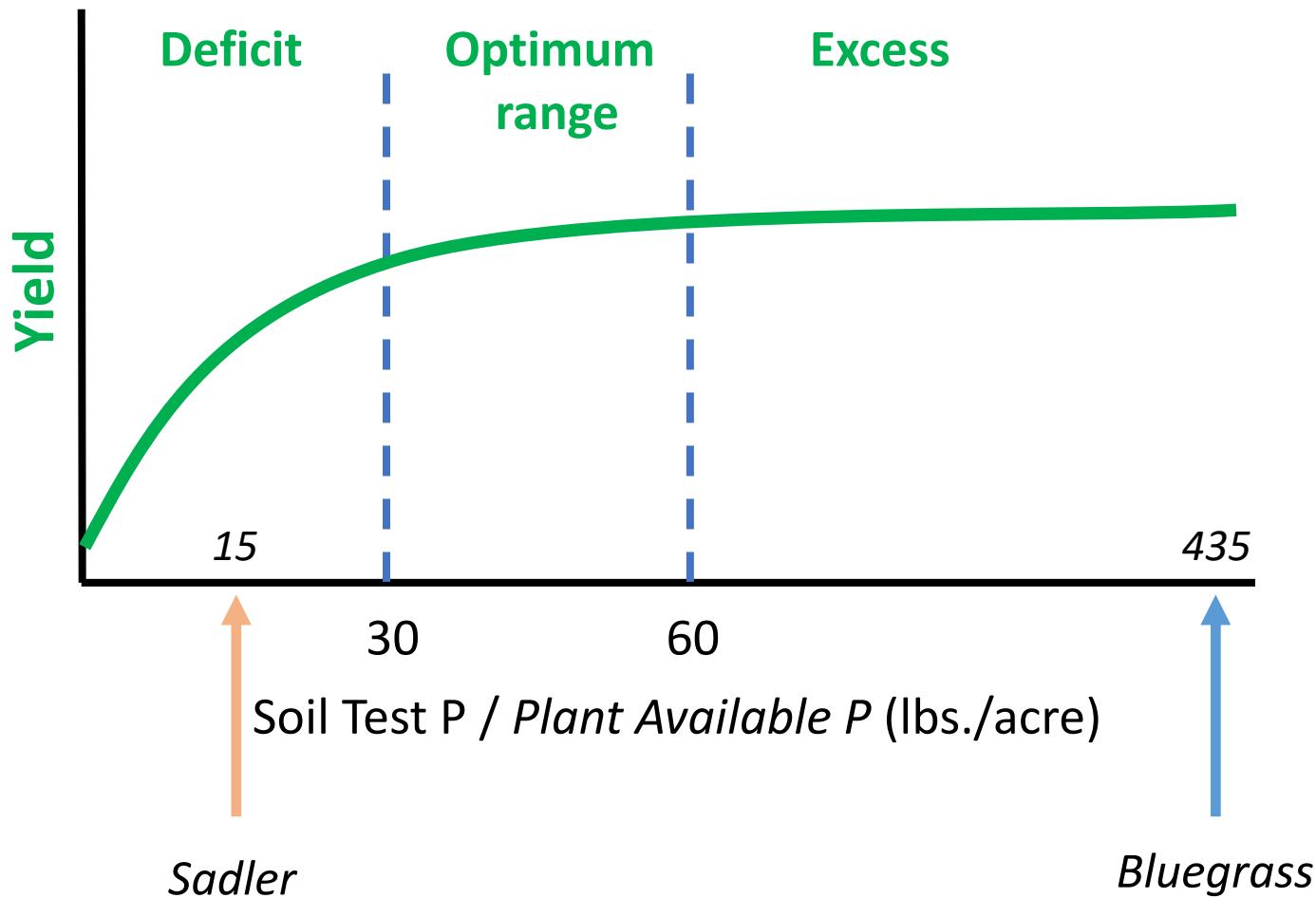
Vendor: 'Yes'

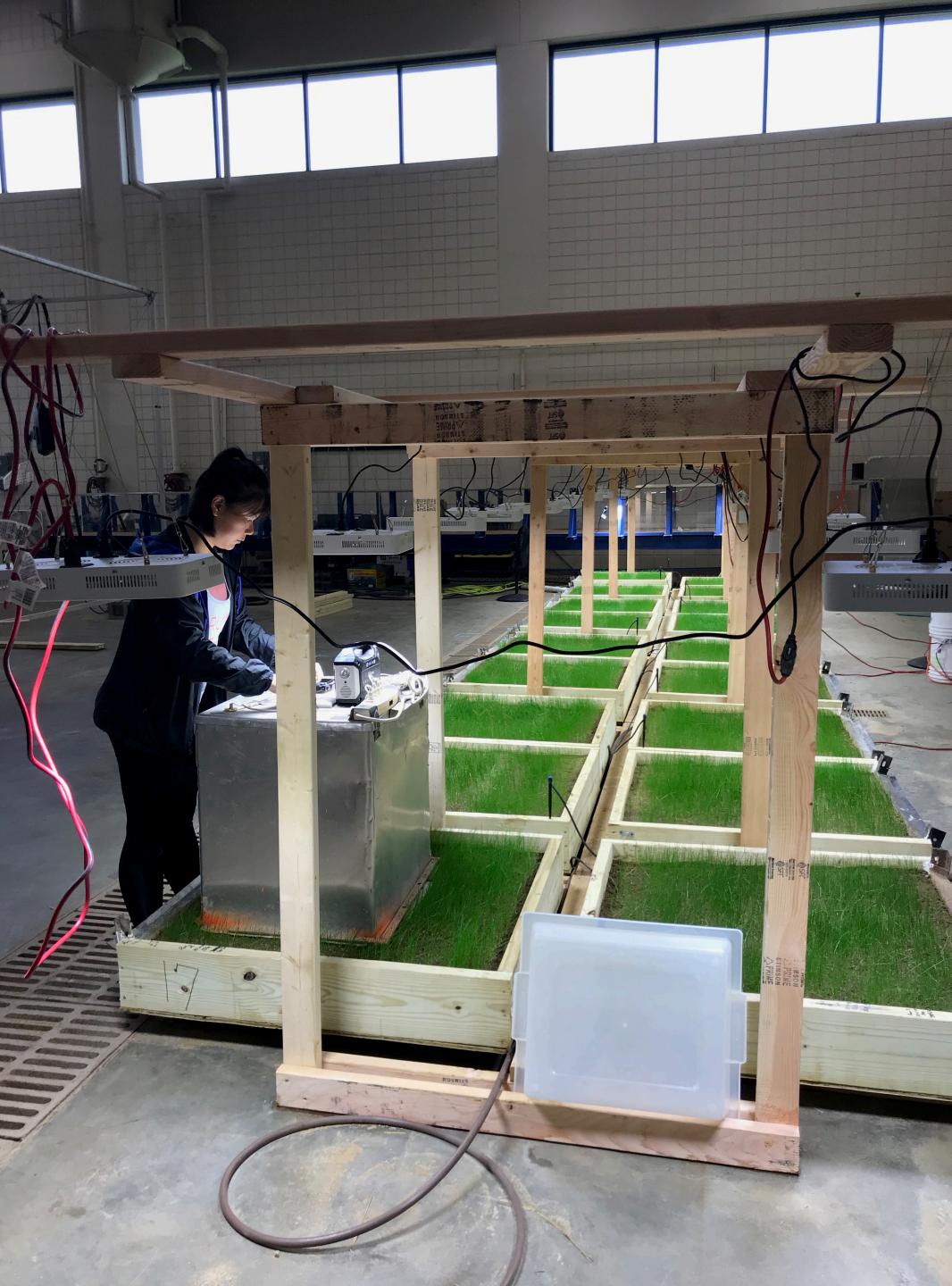


Soil Test P and Agronomics



Soil Test P and Agronomics





Starter Fertilizer (24-25-4)

Manufacturers Recommended
Rate Starter Fertilizer
(3#/1000ft²)

No Starter Fertilizer

Bluegrass – Soil with high P

No P

No P

No P

+ P

+ P

+ P

Sadler – Soil with low P

No P

No P

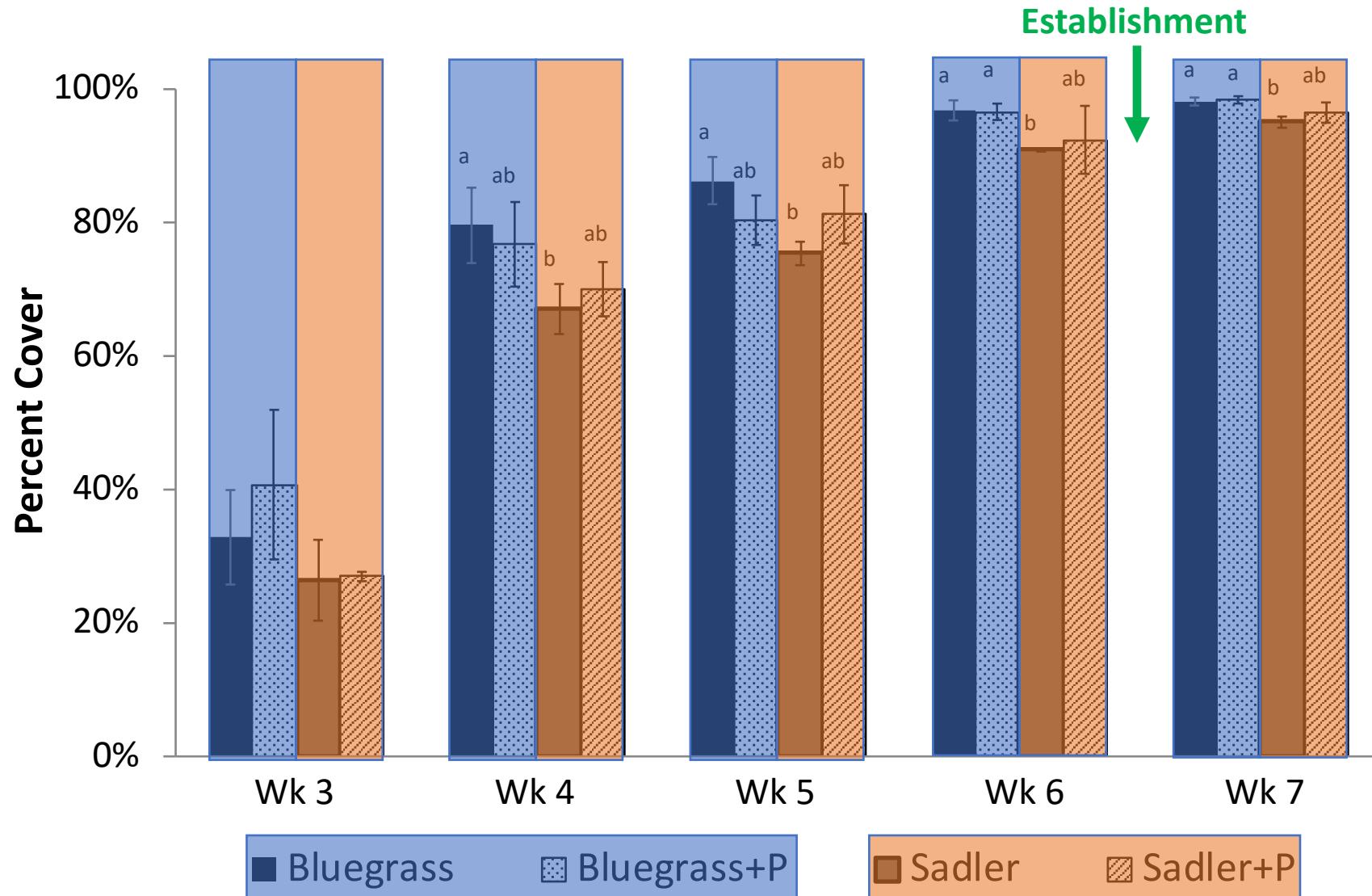
No P

+ P

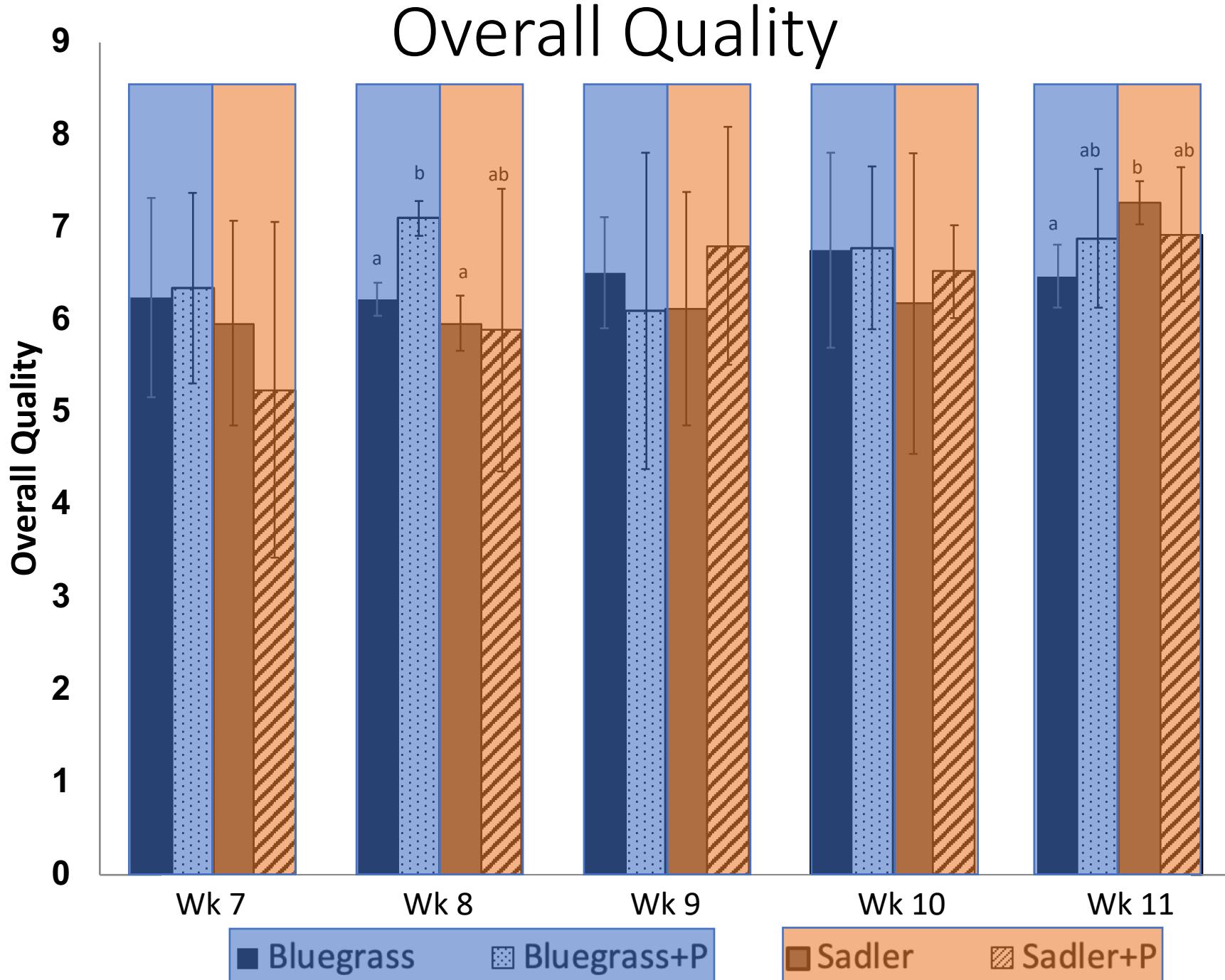
+ P

+ P

Percent Cover Until Establishment



Overall Quality



Plant available P depends on pH

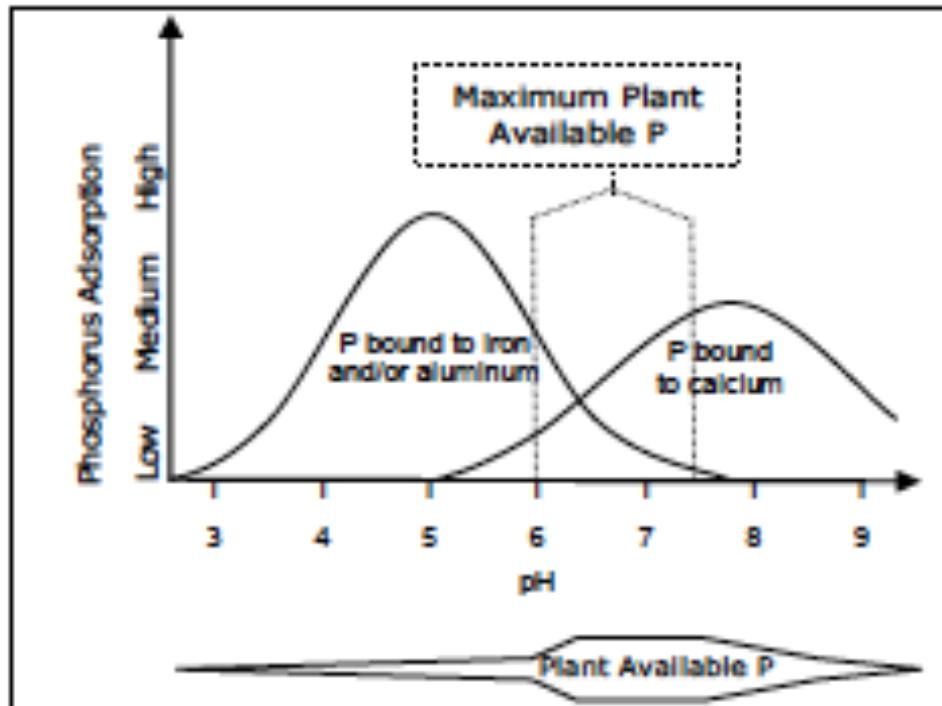


Figure 2: Soil pH impacts P availability.

Get a soil test. Check the pH. If the soil needs lime, add it according University of Kentucky's lime recommendations in AGR-1 Ext. Bulletin.
<http://www2.ca.uky.edu/agcomm/pubs/agr/agr1/agr1.pdf>

Kentucky

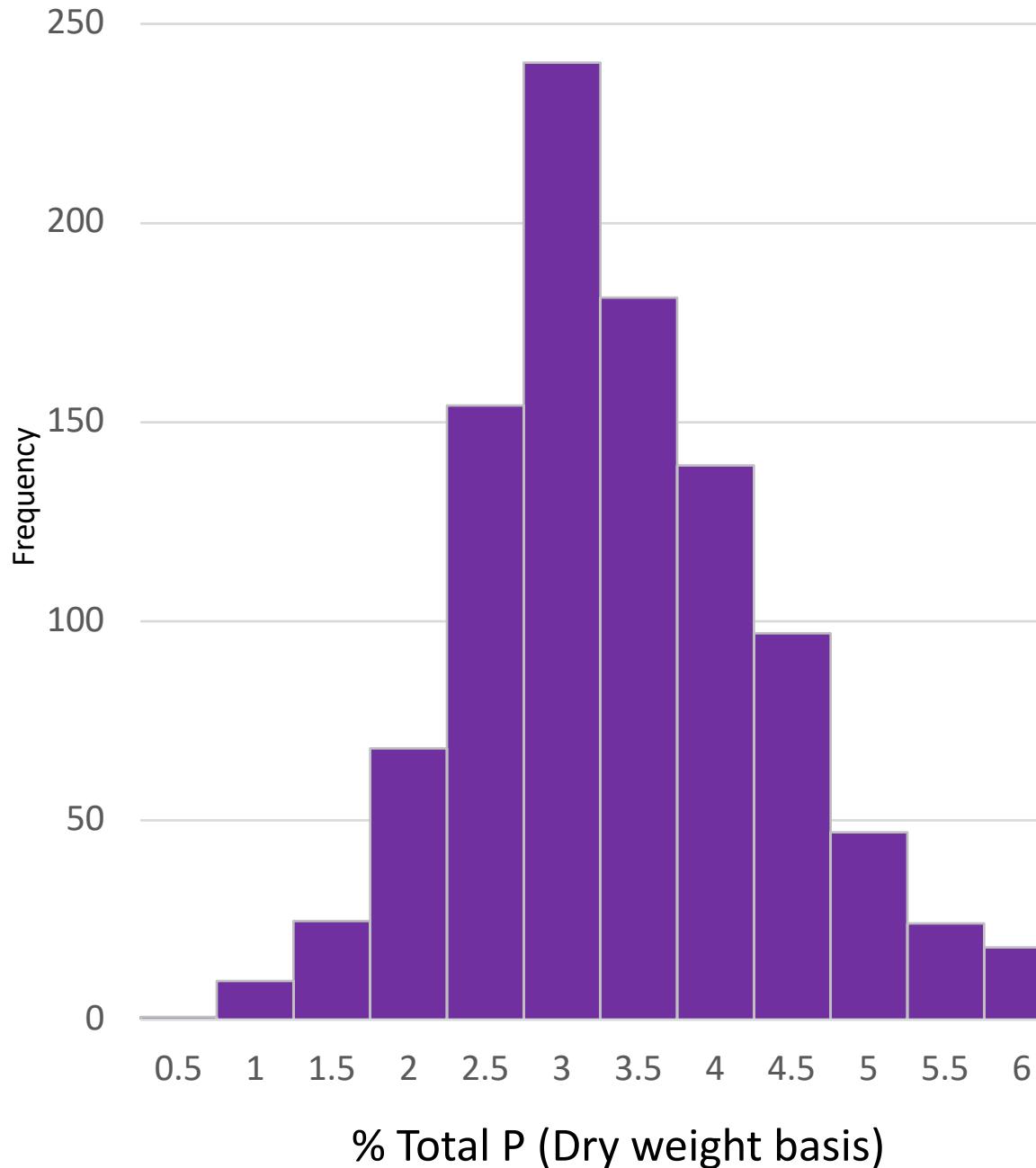
- **1.874 million households**
- **45.9% of households have dogs**
- **1.9 dogs per household**



HOW MUCH P FROM DOG WASTE?

% P in Dog Waste

n	1005
mean	3.14%
median	3.01%
Standard dev.	1.00%
Min. value	0.43%
Max. value	7.99%



Dog (solid) Waste

Estimated that 275# “solid” waste annually per dog (EPA)

2.6# P/yr

For reference: one 10-10-10 application at 1# N / 1000 ft² rate ~ 0.5# P



Urban Kentucky P (imports)

1°



2°



Does your business add P to lawns that do not need it?

Managed landscapes need N

2 # N/1000 ft² of lawn – split application in fall

MAJORITY of Kentucky lawns WILL NOT require additional P or K

Solution is simple...



Implementation is challenging

Questions?



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