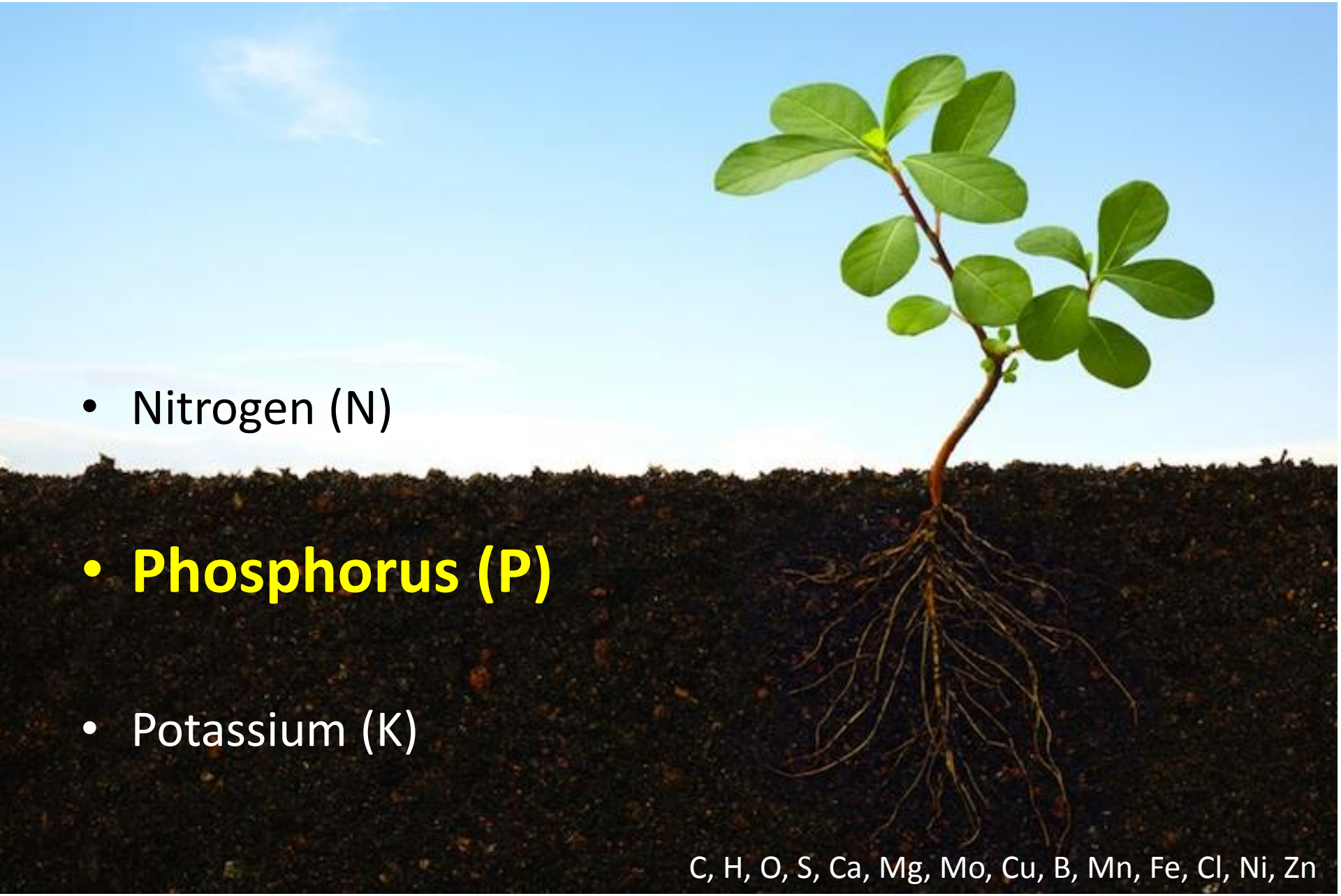
Lawn and Gardening our Way to Hell in a Vegetable Basket

Brad D. Lee, PhD, CPSS
Associate Professor and Extension Specialist
Department of Plant and Soil Sciences, University of Kentucky

Plant requirements



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

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

Farm Nutrient Supplements

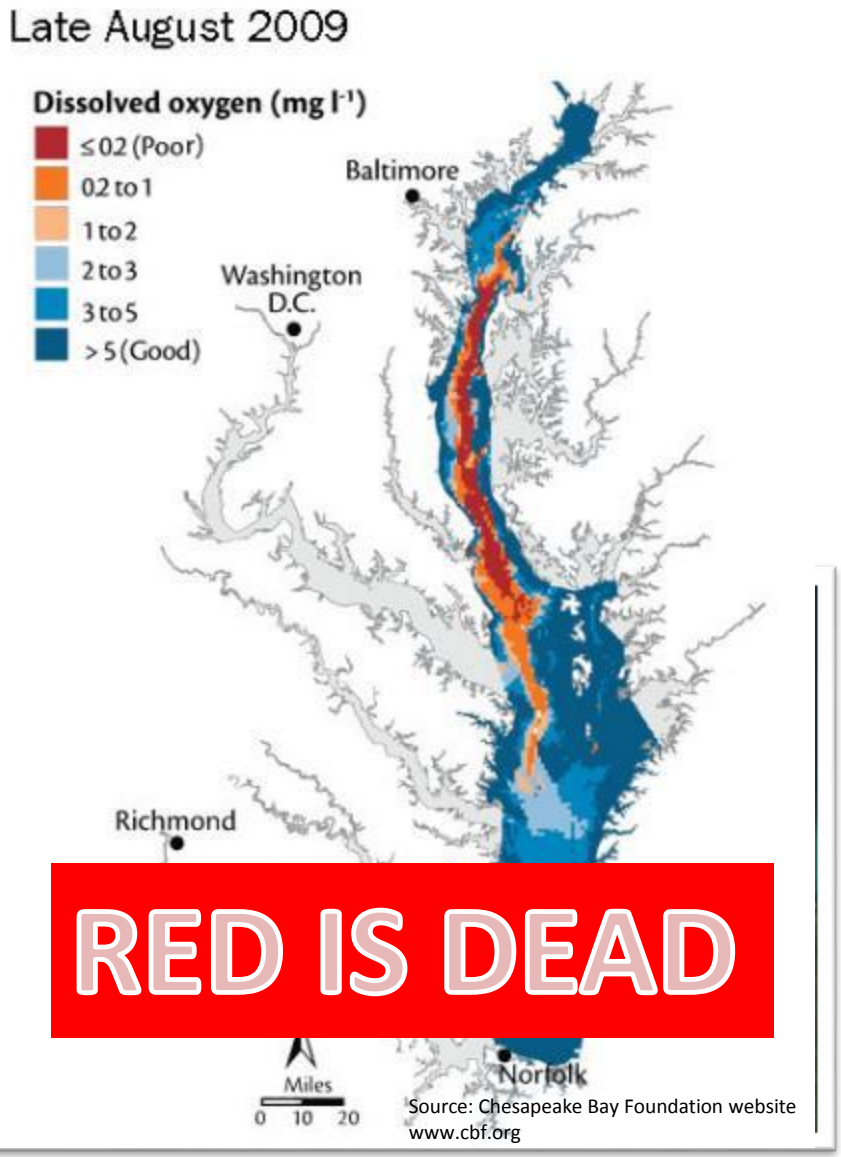
Home and Garden Nutrient Supplements

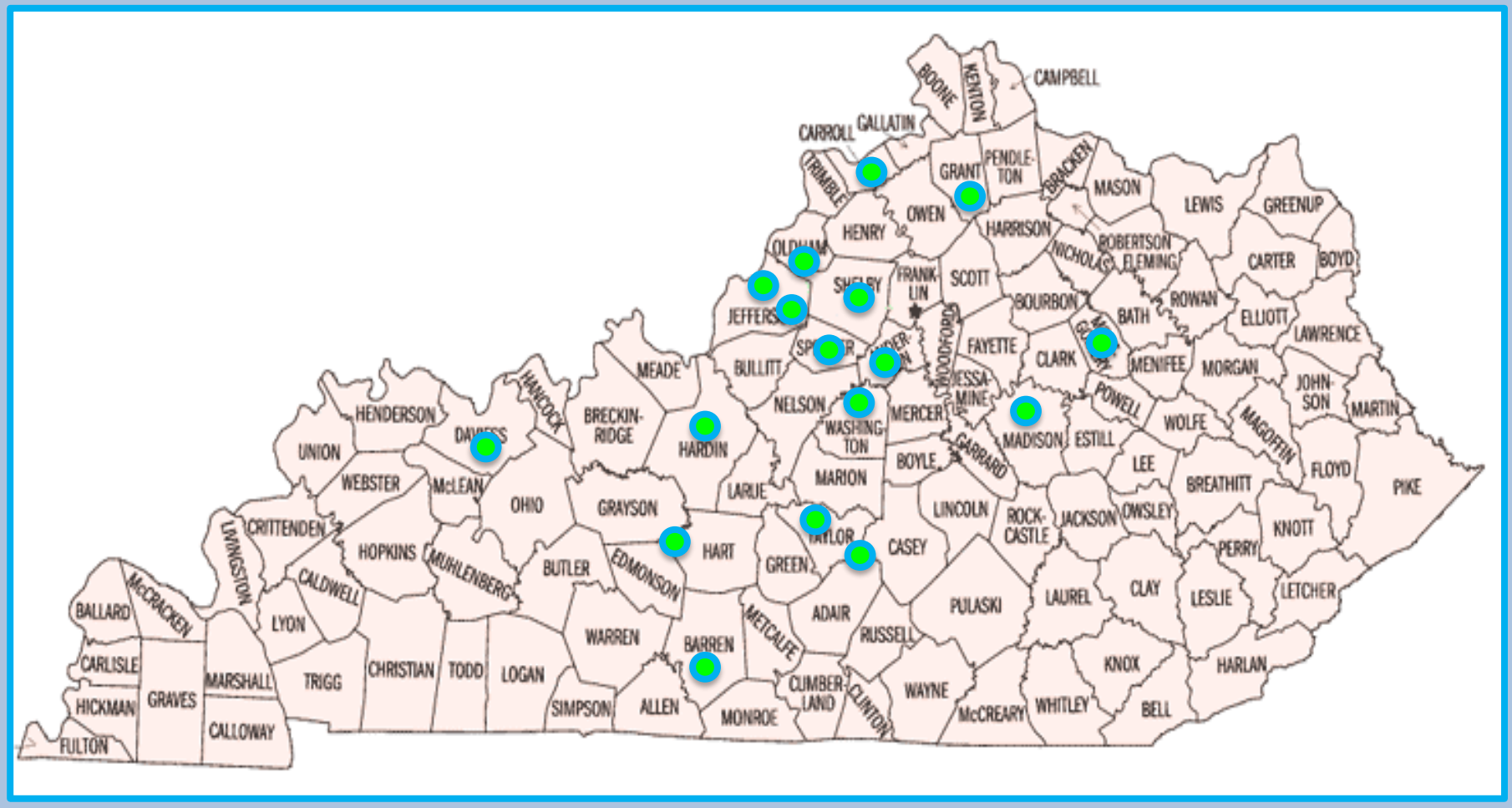
ALGAL

Block Sunlight

Produce Toxins

Decrease Oxygen





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

Urban

Agriculture

Global Developer

Corn Belt Senator

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

Water Quality Impairments

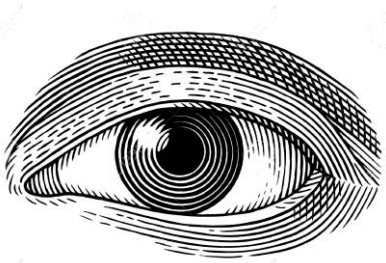
- In agricultural environments → agricultural runoff
  - Concerns about natural resource loss, nutrient loss and agricultural productivity loss (erosion)
  - *Concerns about impairment of nearby streams*

- In urban environments → stormwater
  - Increases with abundance of impervious surfaces
  - Increases with population density
  - *Concerns about impairment of nearby streams*

Urban

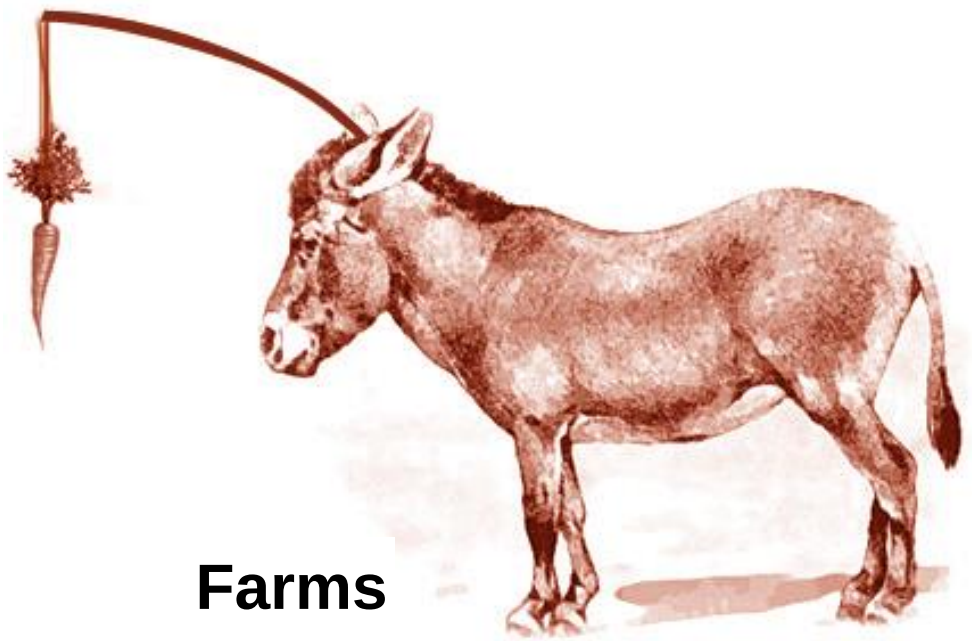
Agriculture

Aesthetics



Economics

Sticks and Carrots



URBAN
Regulations
EPA

AGRICULTURE
Incentives ($)
USDA NRCS

Kentucky Land Use

Number of farms, farmers and farm acres are decreasing.

	2002	2007	2012
Land in Farms (acres)	13,843,706	13,993,121	13,049,347
Principal operators	86,541	85,260	77,064

Fewer acres being farmed by fewer farmers

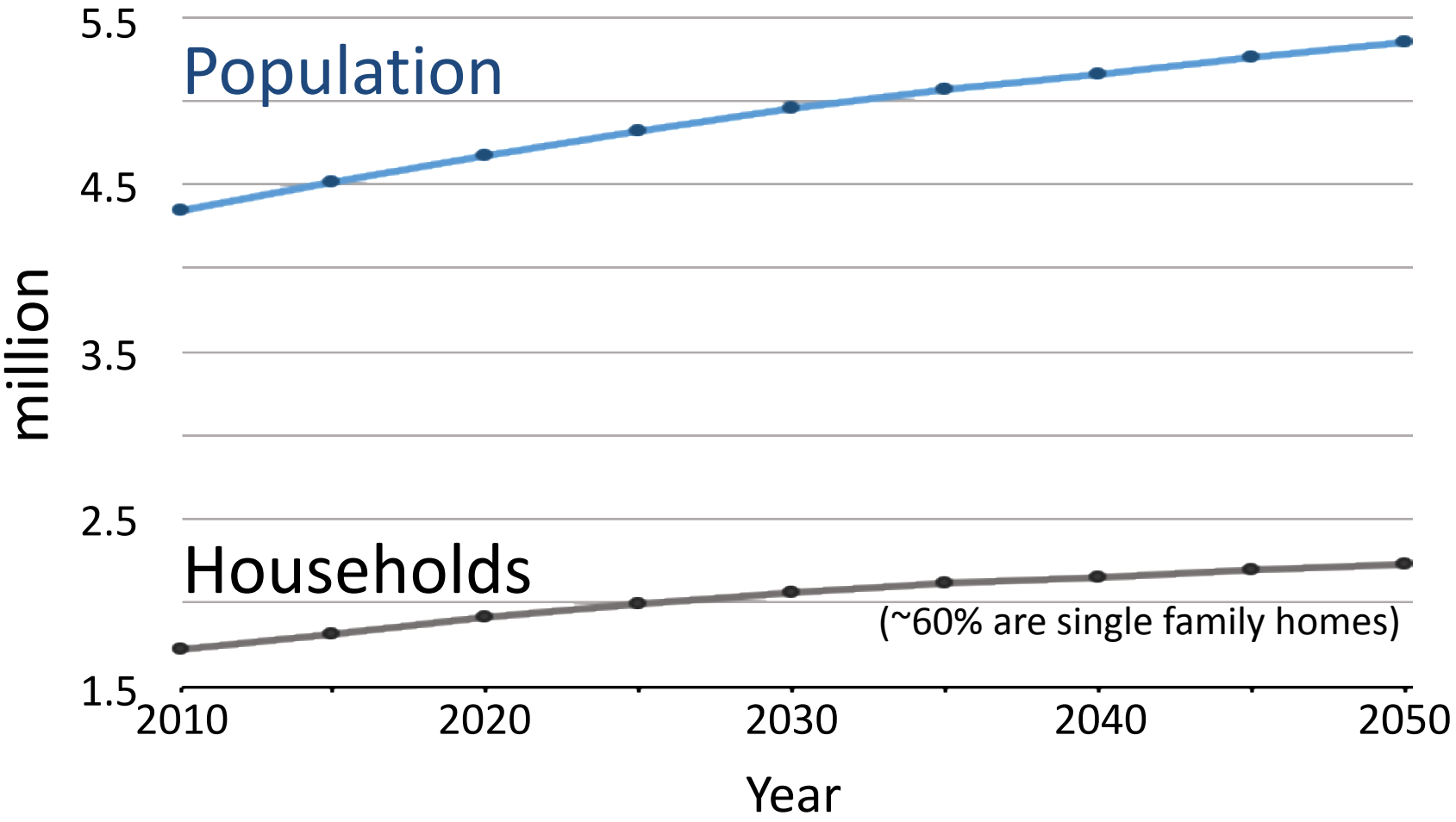
Kentucky Land Use

Developed land increases while agricultural, forest, and other rural lands are decreasing.

	1997-2002	2002-2007	2007-2012
Ag. land converted to development (acres)	125,300	55,700	30,400
Forest land converted to development (acres)	104,500	57,500	34,000
Other rural land converted to development (acres)	6500	4700	2400

1997 – 2012 developed land increased by 421,000 acres

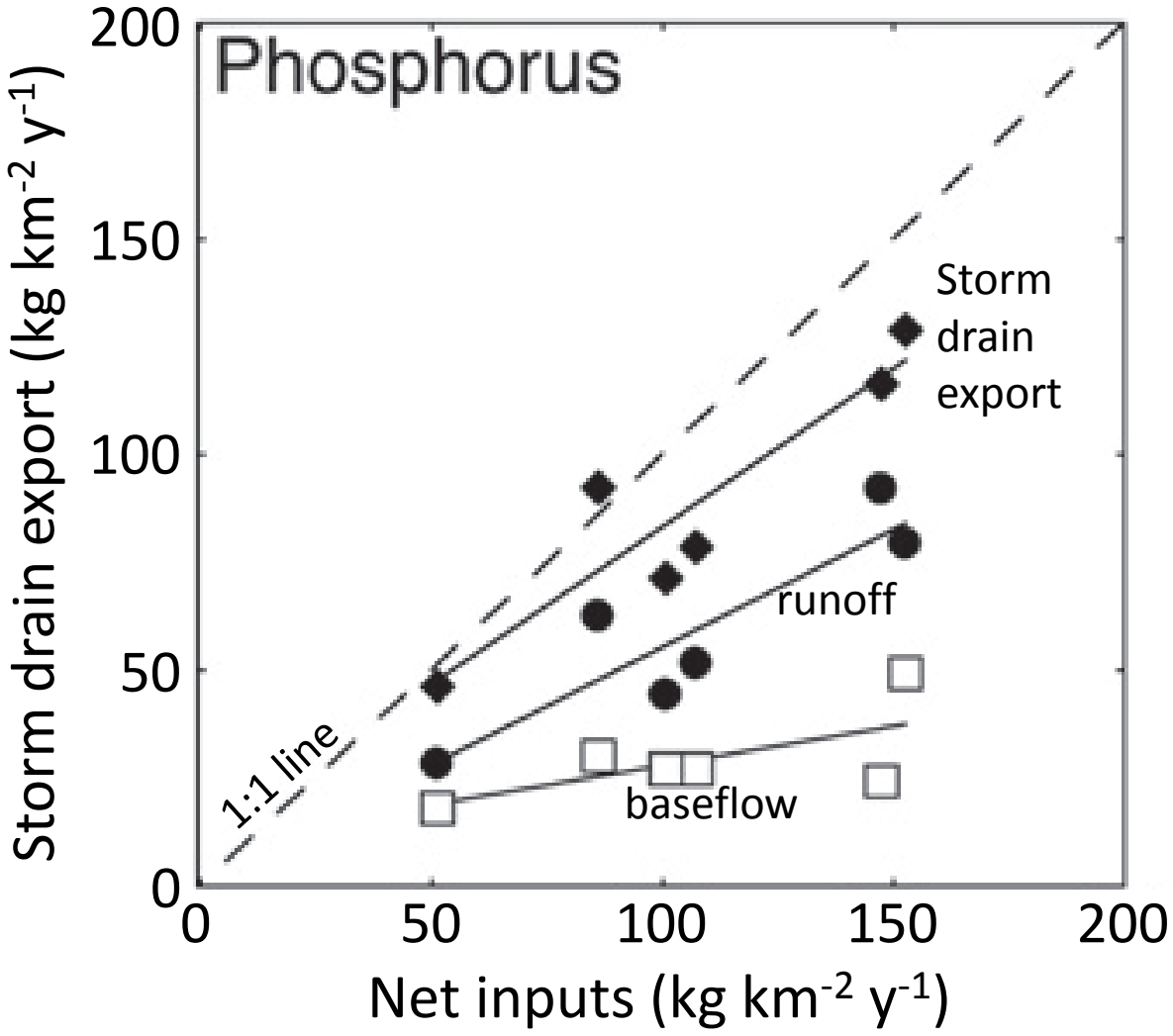
Kentucky Population & Household Growth Projections



National Trend

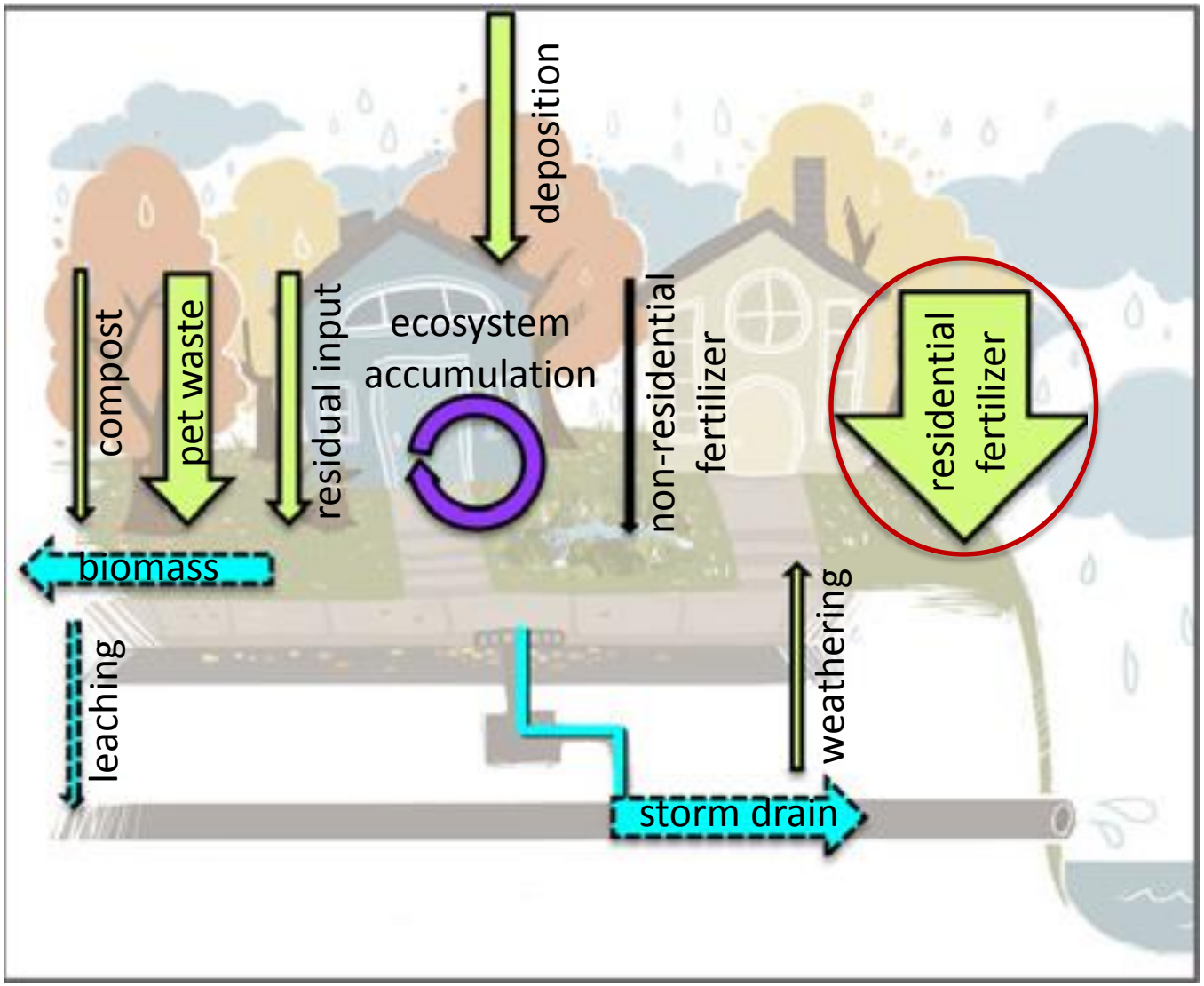
- Urban centers are growing in population and land area
- Rural populations are shrinking and the number of farms are shrinking
- ***With development we have more impervious surfaces***

Direct relationship between phosphorus (P) inputs and storm drain exports



Hobbie et al., 2017

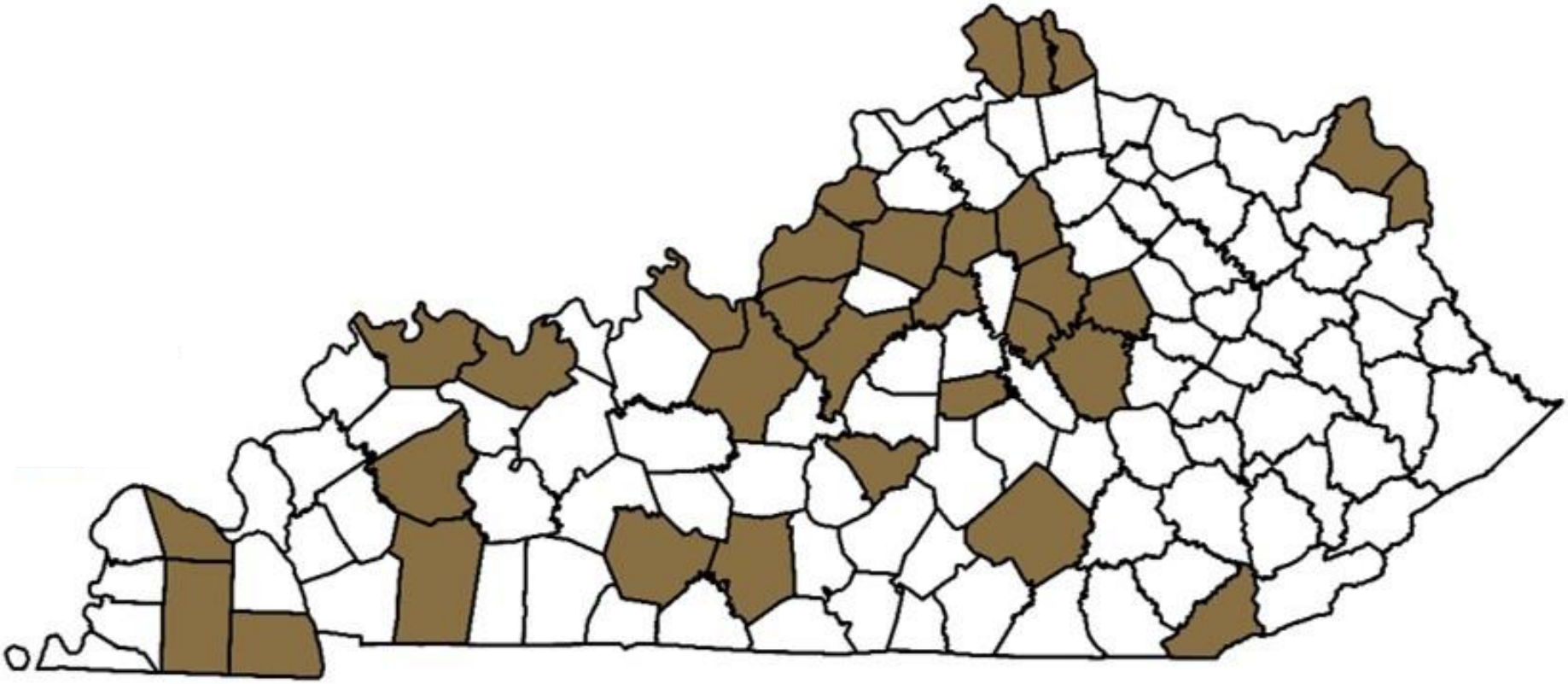
P inputs and outputs in urban watershed



Liberally modified (**in red**) from Hobbie et al., 2017

(MN does not allow P fertilizer)

MS4 Permits in 32 Counties



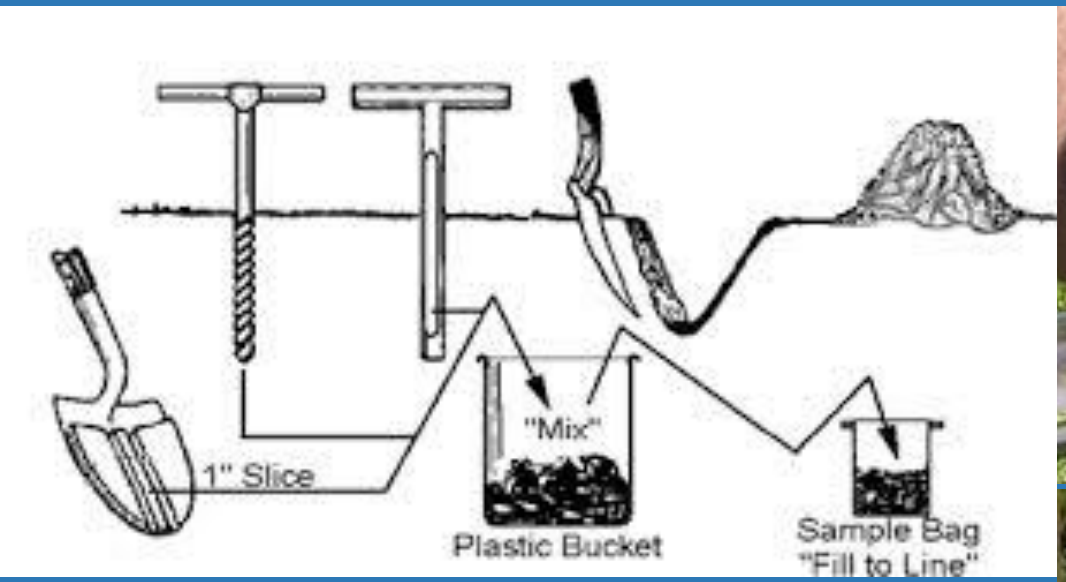
Each county has a CES office – Soil test P

Minimum **C**ontrol **M**easures

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

Soil Tests

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

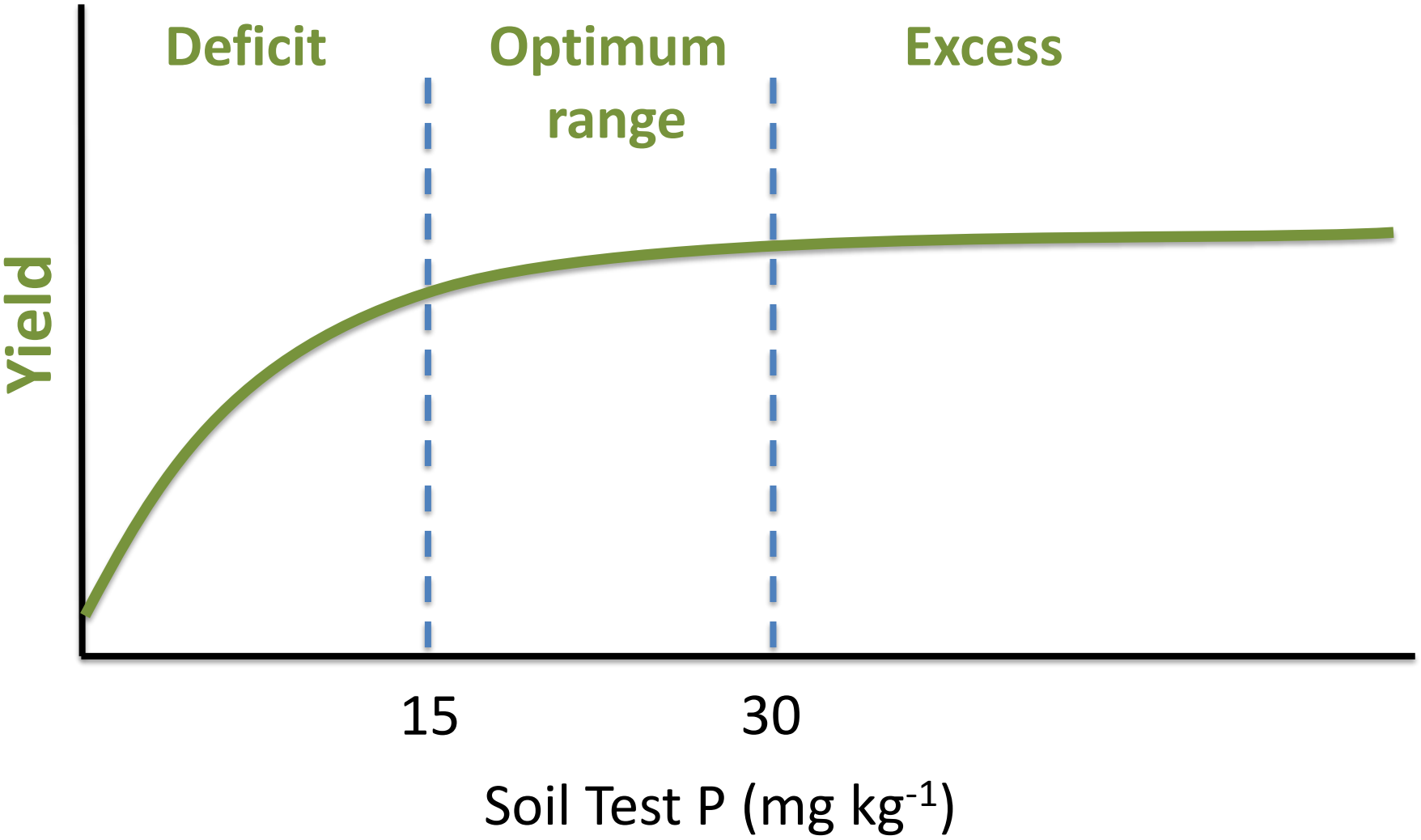


Cost varies by county

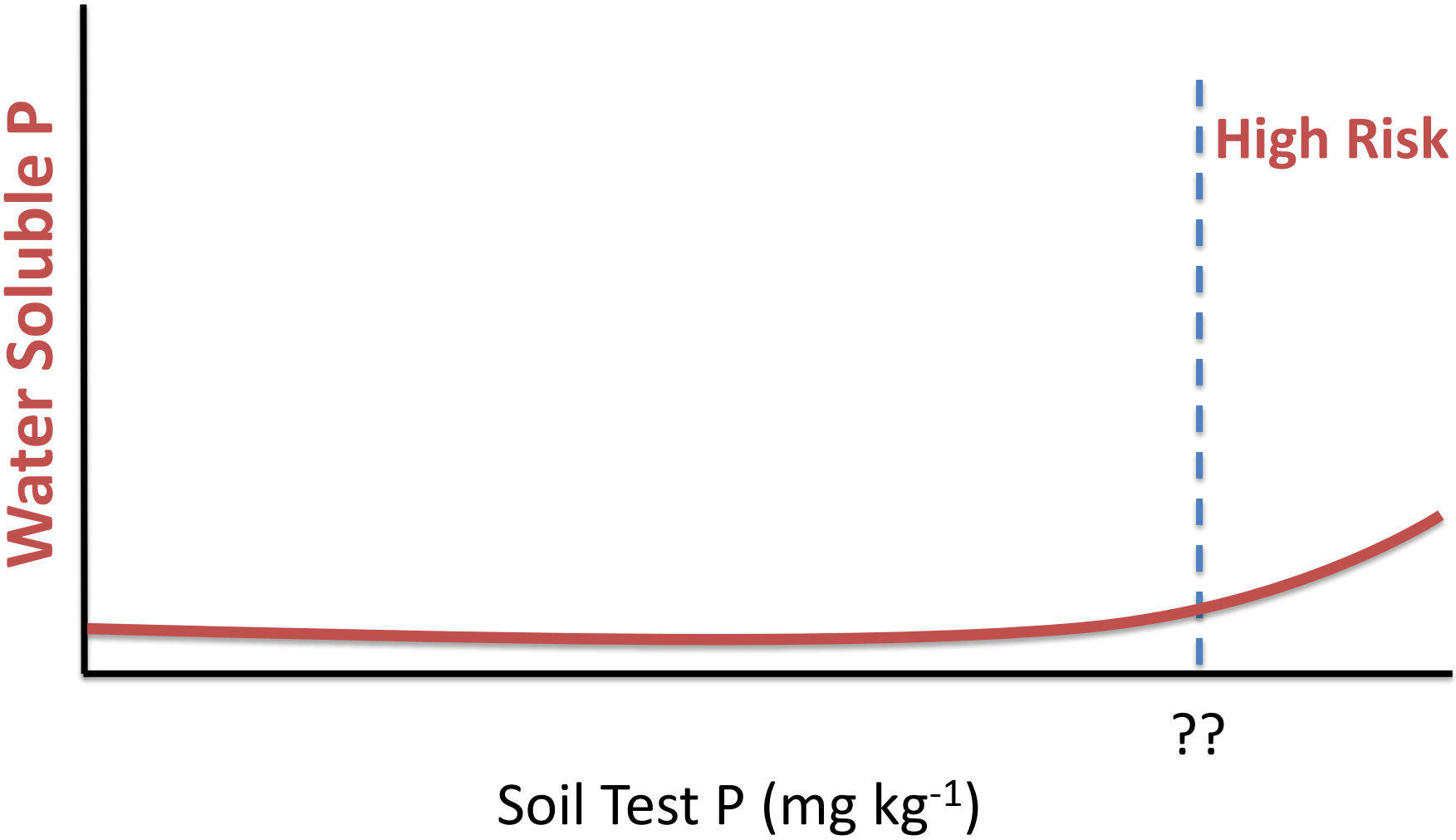
Free to ~ $10

UK Ag EXTENSION

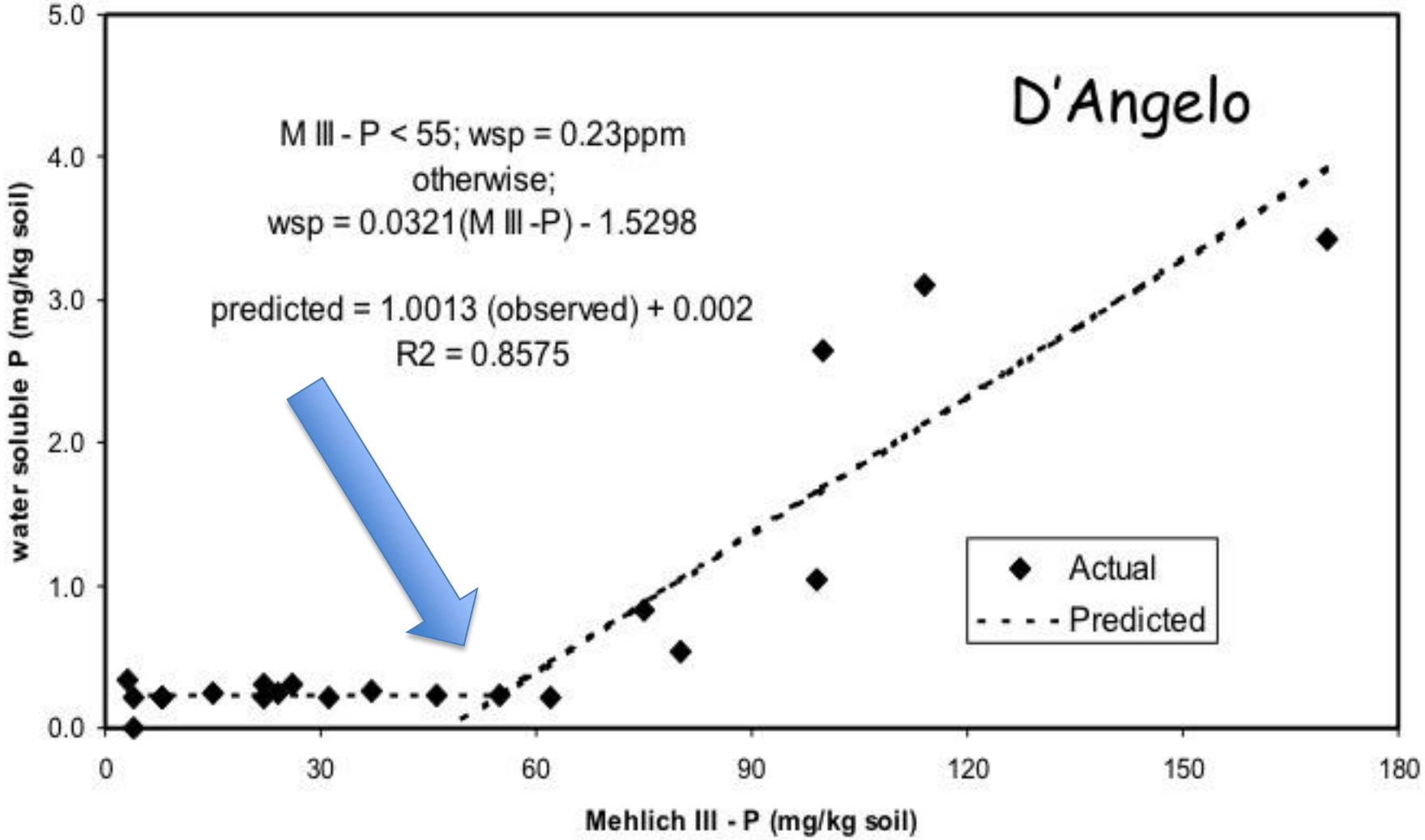
Soil Test P



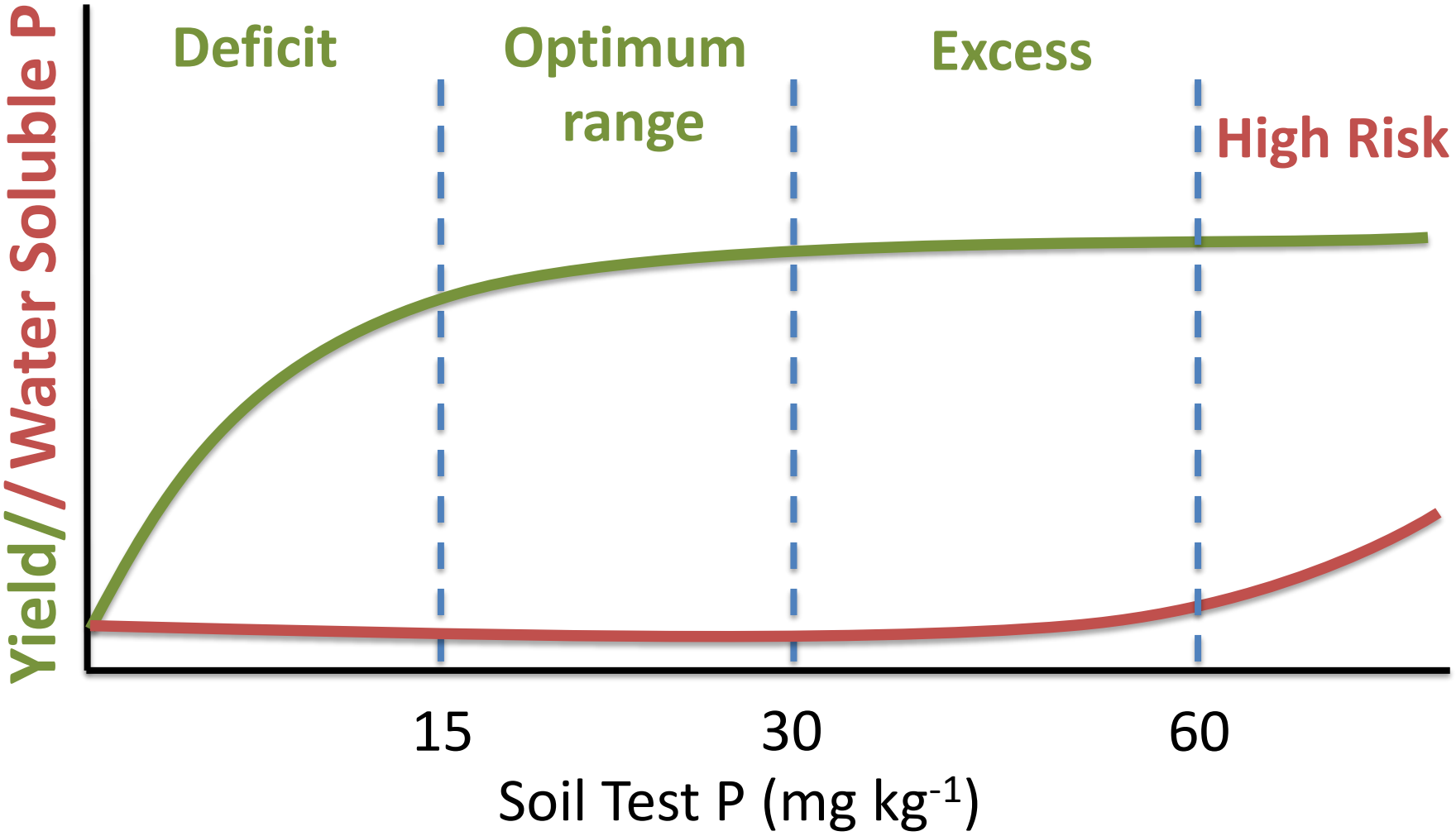
Soil Test P



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



Soil Test P


Deficit
Optimum range
Excess
High Risk
Yield// Water Soluble P
15
30
60
Soil Test P (mg kg-1)

Kentucky County Soil Tests 1990 – 2014 (n = 990,162)

Home and Garden (H code)

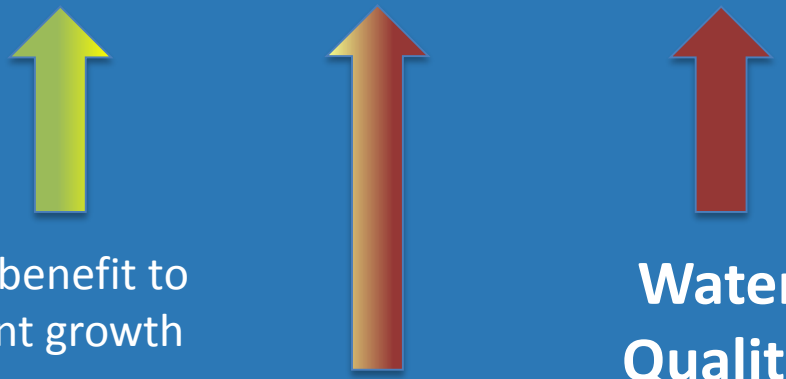
- Total = 179,184
- Max = 17,691
- Min = 52
- Mean = 1493
- Median = 747

Agriculture (A code)

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

25 year soil test summary for Boone County.

1990-2014	Samples (n)	Low (%) <15 mg/kg	Med (%) 15-30 mg/kg	High (%) 30-60 mg/kg	Very High > >60 mg/kg
Agriculture	9188	15	25	**28**	**32**
Lawn and Garden	6933	7	14	**26**	**53**

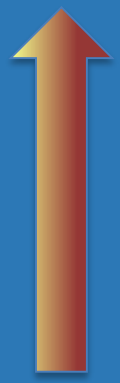


UKAg EXTENSION

25 year soil test summary for Taylor County.

1990-2014	Samples (n)	Low (%) <15 mg/kg	Med (%) 15-30 mg/kg	High (%) 30-60 mg/kg	Very High > >60 mg/kg
Agriculture	8646	20	28	**29**	**23**
Lawn and Garden	1035	23	17	**23**	**37**

No benefit to plant growth

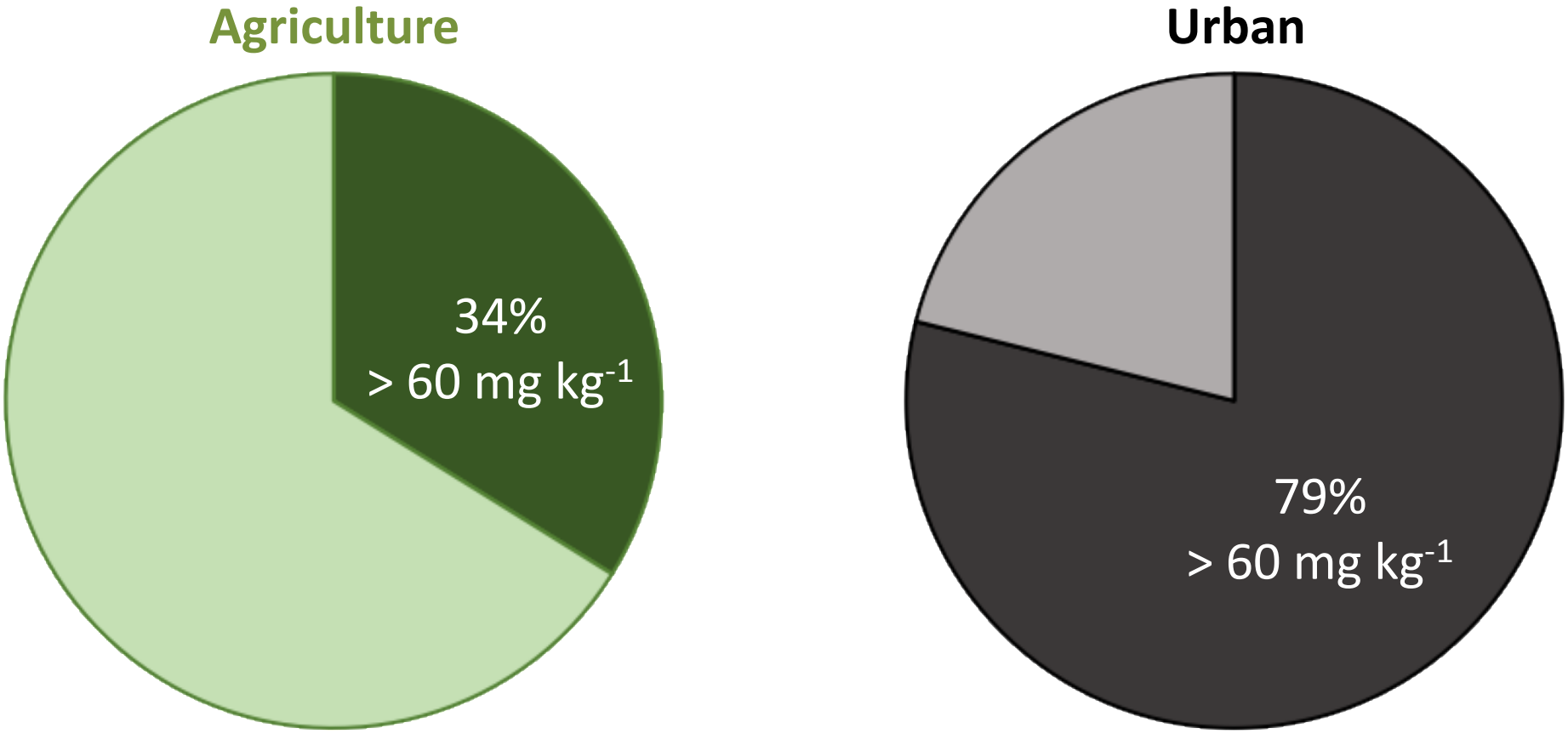


Maximum recommended soil P level

Water Quality Risk

UKAg EXTENSION

Water Quality Risk
Soil Test P levels

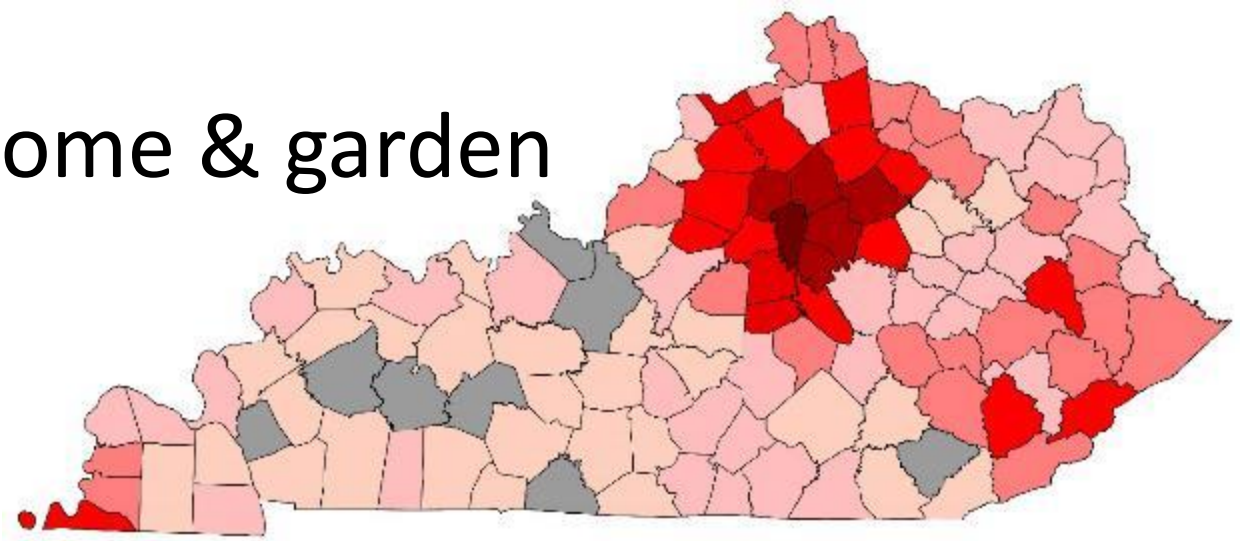


1990 – 2014 Soil Test Phosphorus > 60 mg kg^{-1}

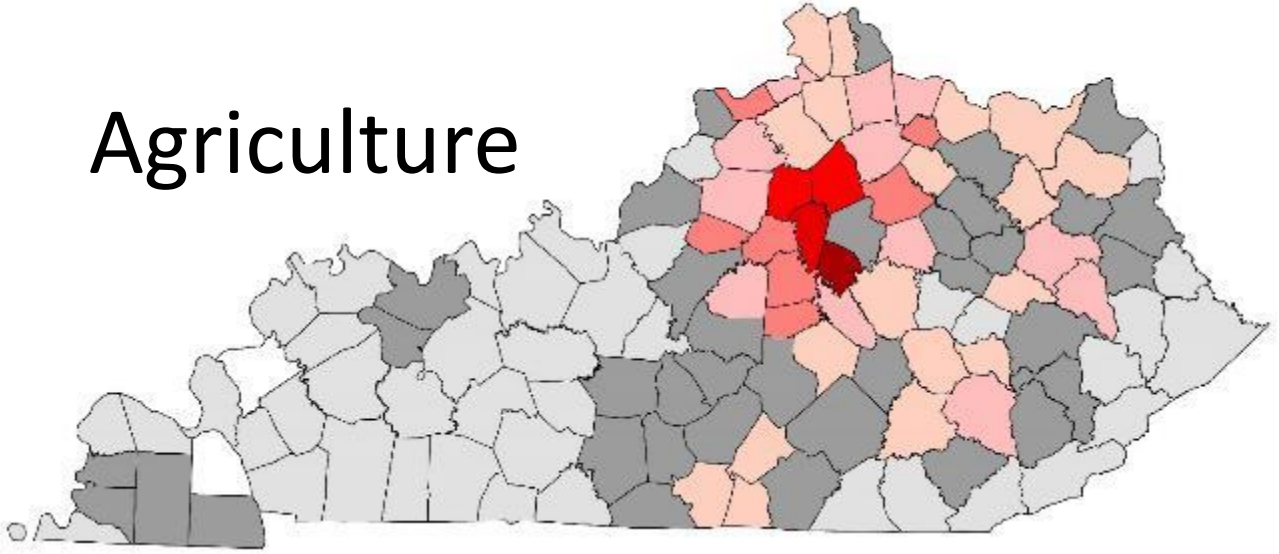
% Soil Tests with High Risk P Levels

- 0 - 10
- 10.1 - 20
- 20.1 - 30
- 30.1 - 40
- 40.1 - 50
- 50.1 - 60
- 60.1 - 70
- 70.1 - 80
- 80.1 - 90
- 90.1 - 100

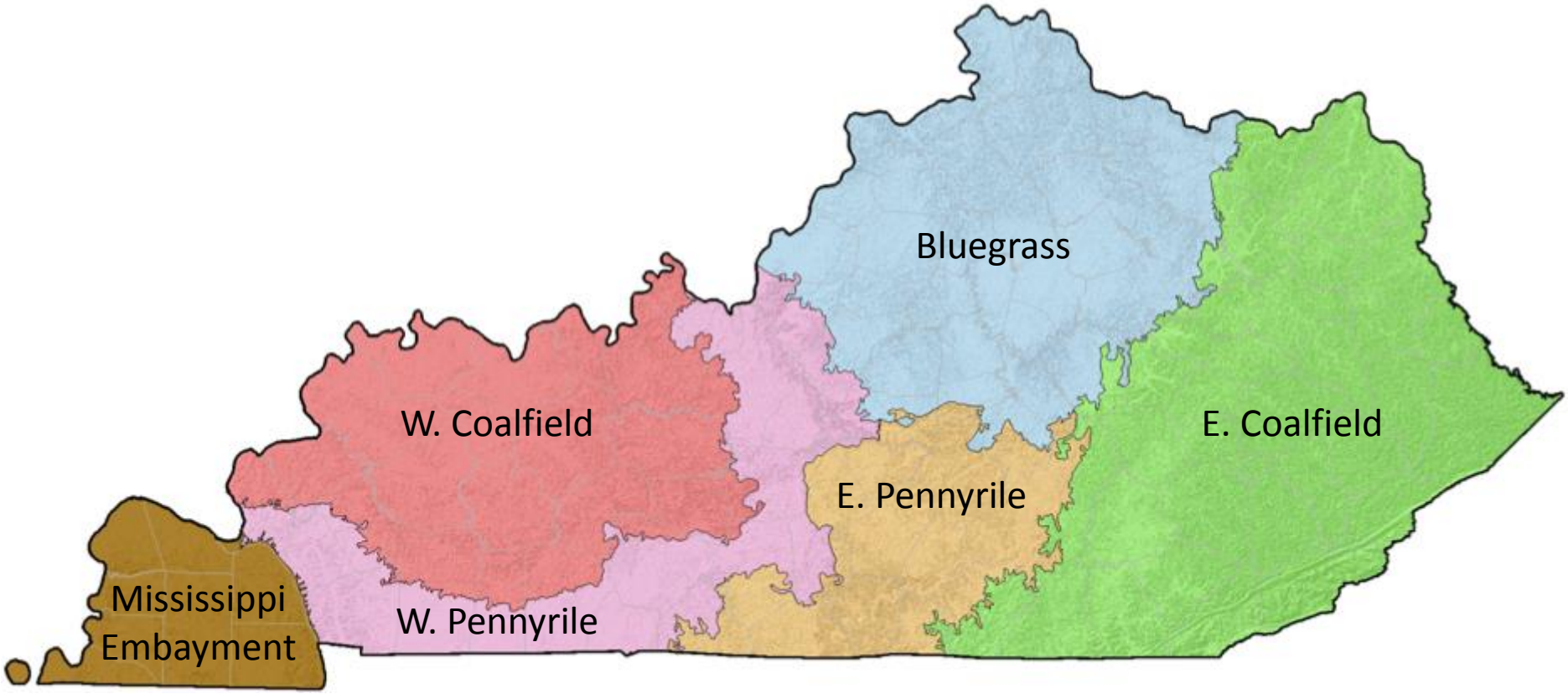
Home & garden



Agriculture

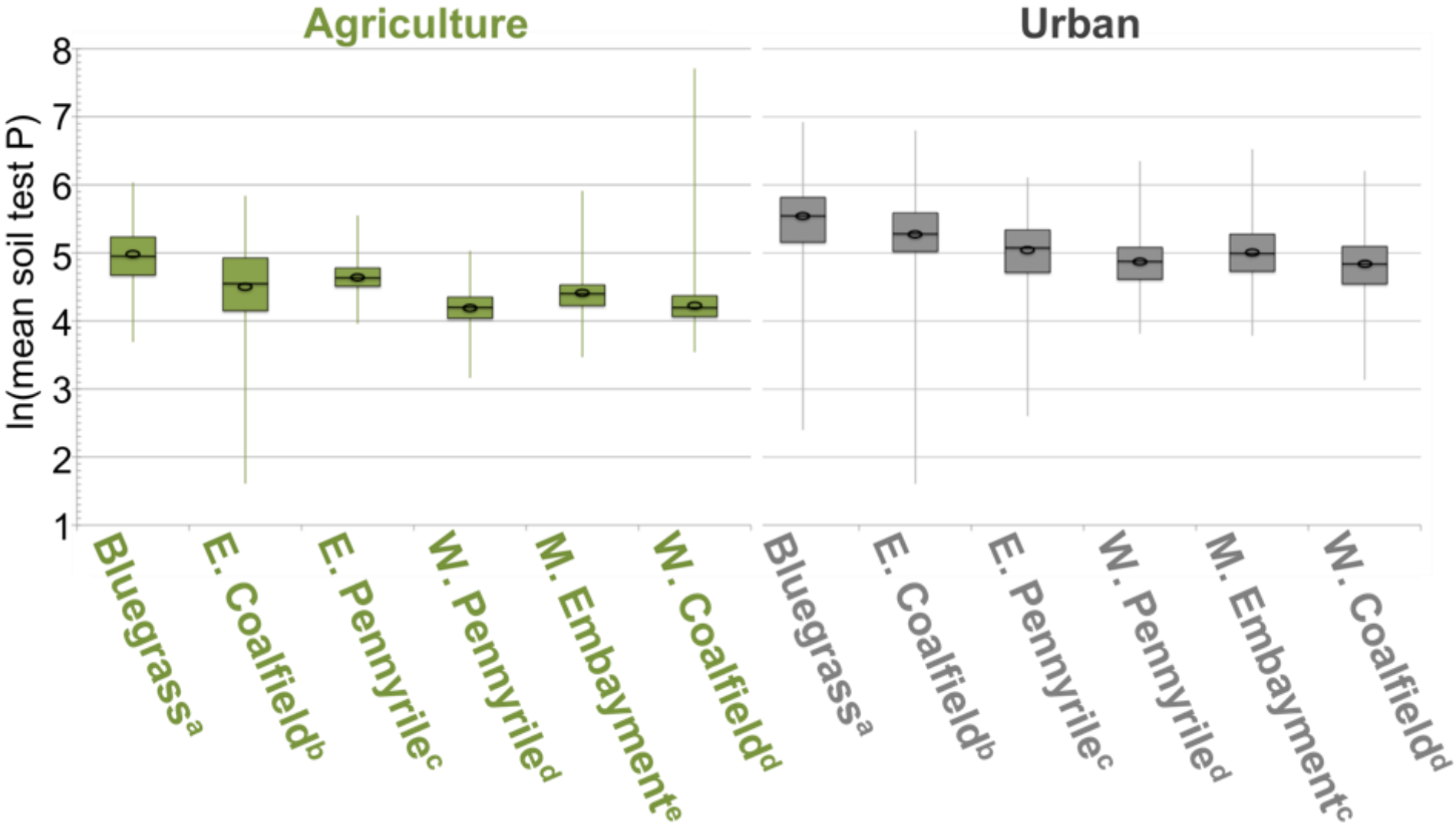


Physiographic / Soil Regions of Kentucky

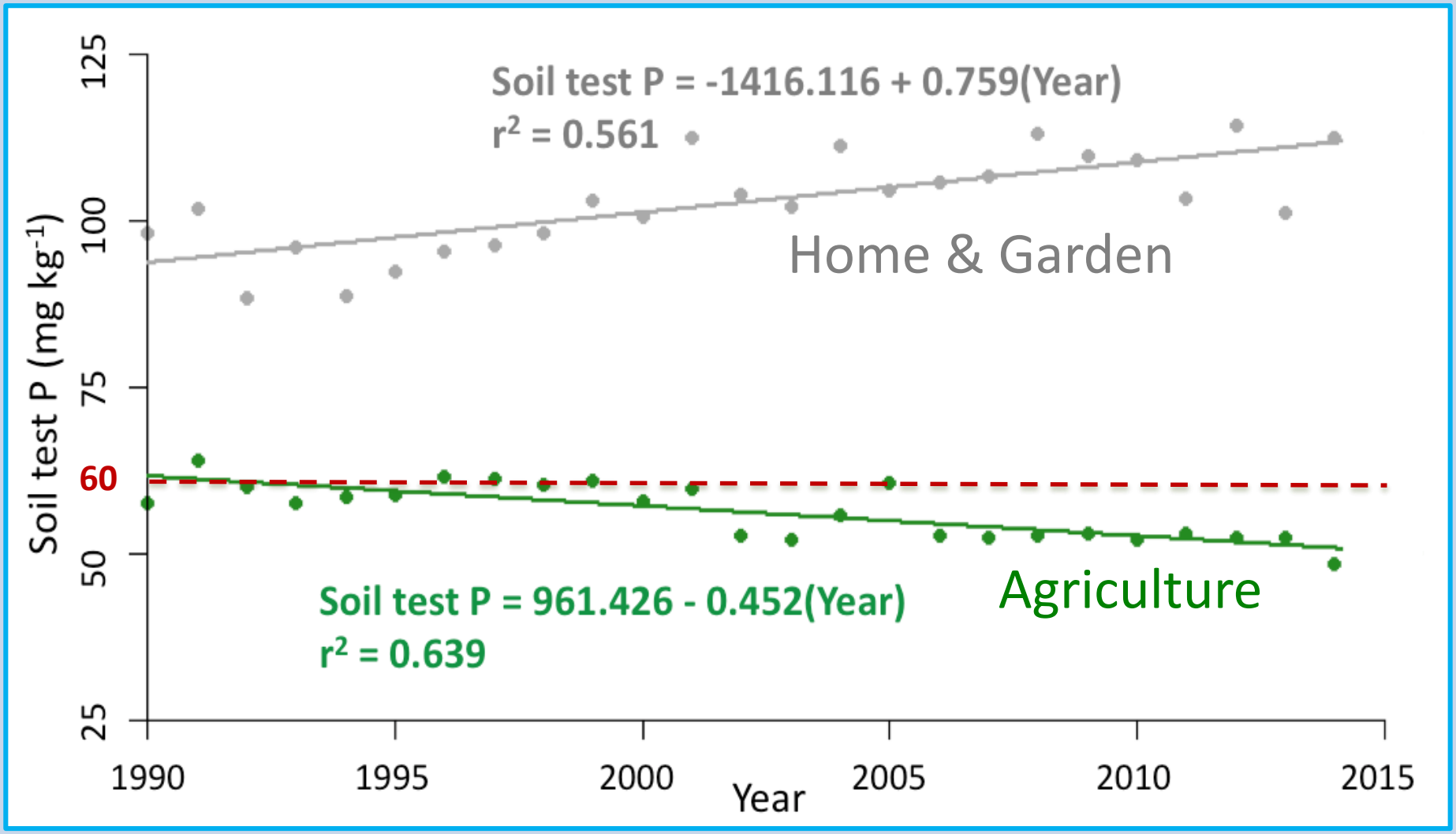


KY USDA NRCS

Regional Distribution of Soil Test P Levels



Kentucky Soil Test: Phosphorus over 25 years



How representative are KY results for the urban home and garden soil test P levels?

Annual soil tests by county

(soil tests / single family homes in county[1])*100

- Max = 1.42%
- Min = 0.16%
- Mean = 0.45%
- Median = 0.38%

We need more soil tests

[1]2010 Census

Homeowner Habits

- 1/3 of homeowners do not apply fertilizer
- A few households contribute disproportionately to total nutrient load in runoff

Minnesota – Hobbie et al., 2017
North Carolina – Osmond and Hardy, 2004
Maryland – Law et al., 2004

Homeowner Habits

- Homeowners do not consider the removal of nutrients in leaves and lawn clippings when deciding whether and how much to fertilize
- Homeowners decisions are related to their attitudes, norms, and values (Nelson et al., 2008)
- Widespread idea that fertilizing will result in a healthier and greener lawns (Nelson et al., 2008; Cheng et al., 2008)

Fertilizer Marketing:

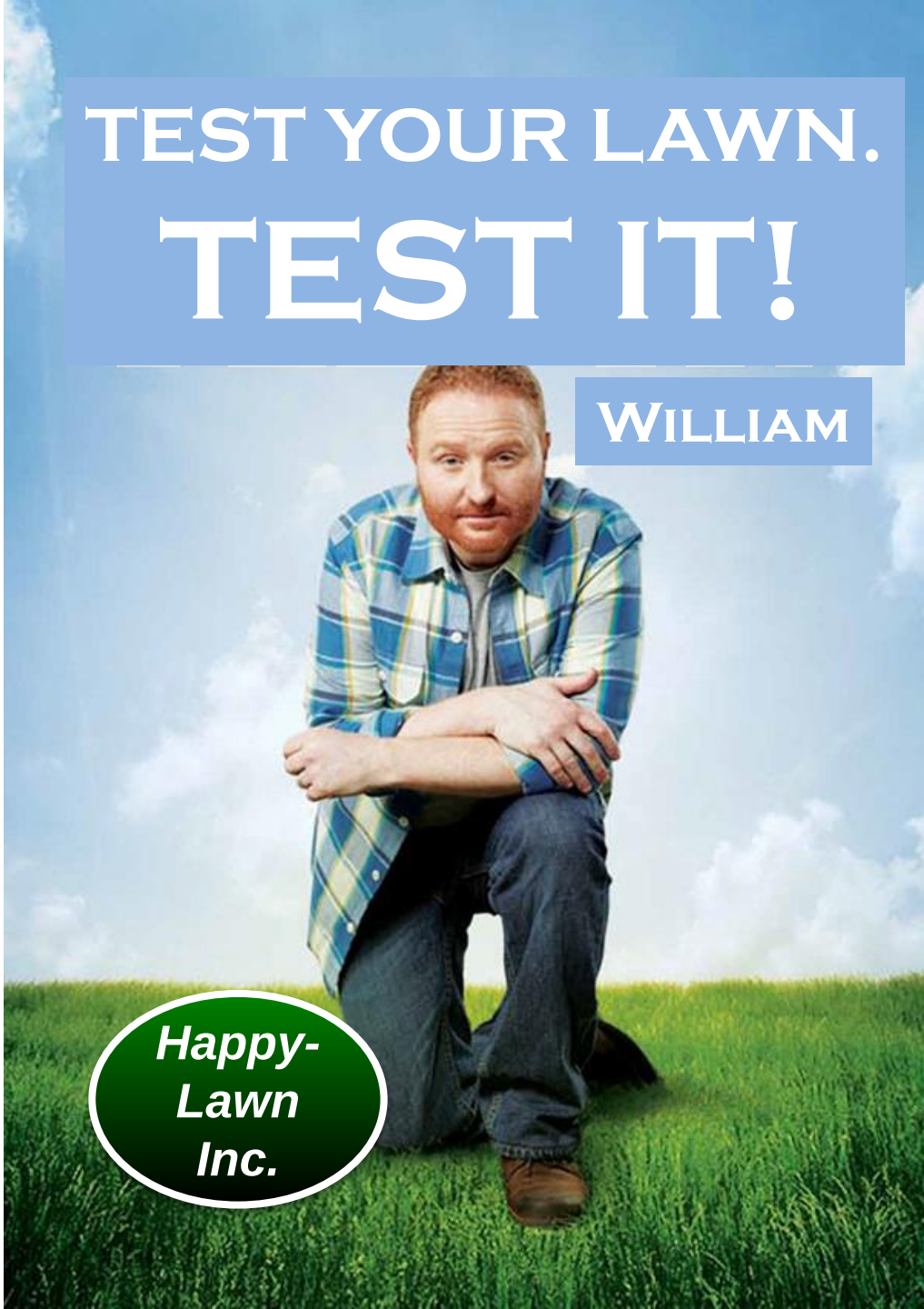
Personify your lawn

Assume that lawn is hungry

Assume that lawn is unhealthy unless you fertilize it.

Find out if your lawn is hungry or healthy

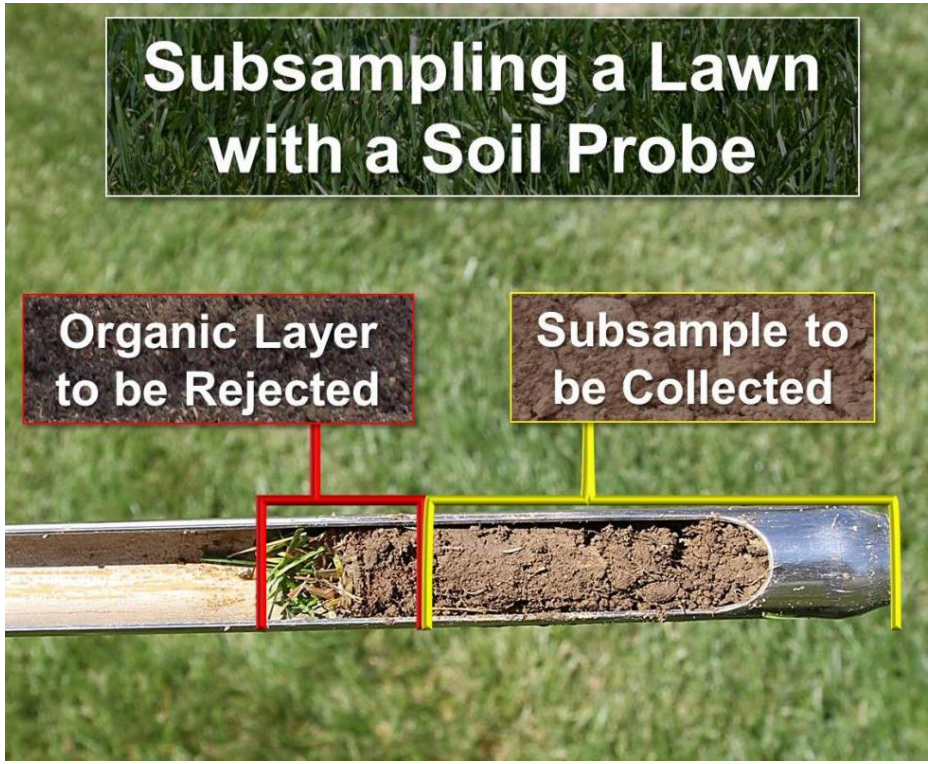
Get a soil test!



Soil Test at Warren County CES Office

- A routine or basic soil test measures the need for P, K and pH ($7)

Warren County Office
3132 Nashville Rd.
Bowling Green, KY 42101
Phone: (270) 842-1681
warren.ca.uky.edu



Front lawn composite
Back lawn composite
Garden composite

Total = $21

Some states passed laws for lawn maintenance

Nitrogen (N)

Phosphorus (P)

Potassium (K)

States that Require Soil Test Prior to Sale of Phosphorus Fertilizer

Is P – free fertilizer available?

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

Nutrient Management in KY

- Managed landscapes need N
- Most KY lawns will **not** require additional P or K
- Conduct a soil test for specific issues

Photo: grasshopperlawns.com

Green Lawns and Fertilizers

- Green lawns can be achieved by using less fertilizer if clippings are left on site instead of being removed (Guillard and Kopp, 2004; Heckman et al, 2000)

1 ton grass clippings has
15# N, 2# P, 10# K

4 – 1 – 3

Thelawninstitute.org

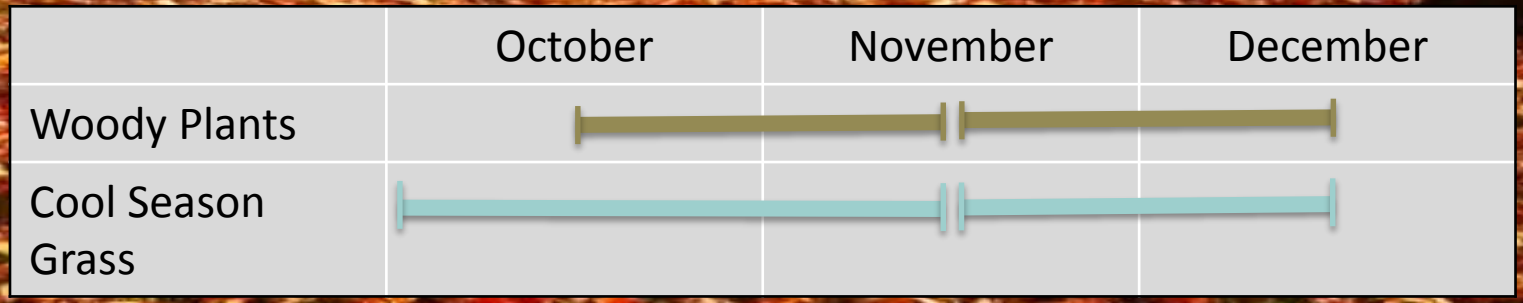
Annual Nitrogen Application Rates

lbs N per 1000 ft^2	Plant Response
0	Minimal turf growth; some growth of older woody plants, immature plants may be delayed
2	**Optimum for most turfgrass; healthy growth of mature woody plants, may stimulate additional growth on younger plants**
4	Produces high maintenance turfgrass; pushes unneeded growth on older woody plants, produces desirable rapid growth on younger plants
6	usually excessive – increased susceptibility to disease in turf and woody plants

Nutrient Management: N Timing

	Plant Type	N Application Time
●	Woody plants	Fall – after dormant
●	Cool season grasses (bluegrass, fescue)	Fall – promotes root and tiller growth

- **Ideally no more than 1 lb N/1000 ft^2 in a single application.**
- **Plants can absorb N until soil is frozen.**



Questions?

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University of Kentucky
Brad.lee@uky.edu