

Implementation of agricultural phosphorus practices

Lessons from the U.S., U.K. & Sweden

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Today's talk

- Case studies highlighting differences & commonalties across boundaries
- Detecting change
- Voluntary or regulated management
- Engaging farmers

Lessons learned and not learned

Swedish: *spreading regulations*

United Kingdom: *P surplus limit*

New York: *streambank fencing*

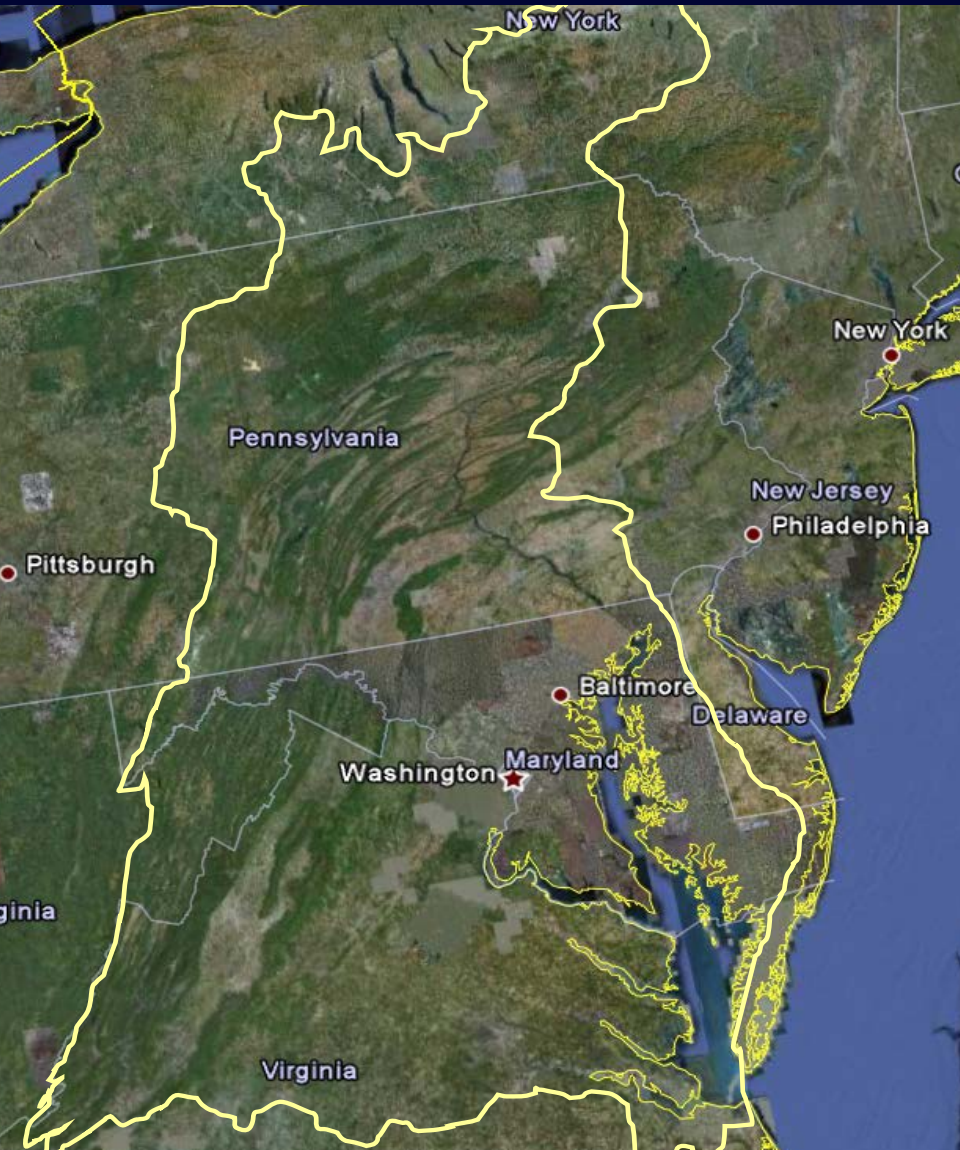
Chesapeake Bay: *manure application subsidies*

Arkansas & Oklahoma: *law suits*

The Chesapeake Bay



A long history of government agreements

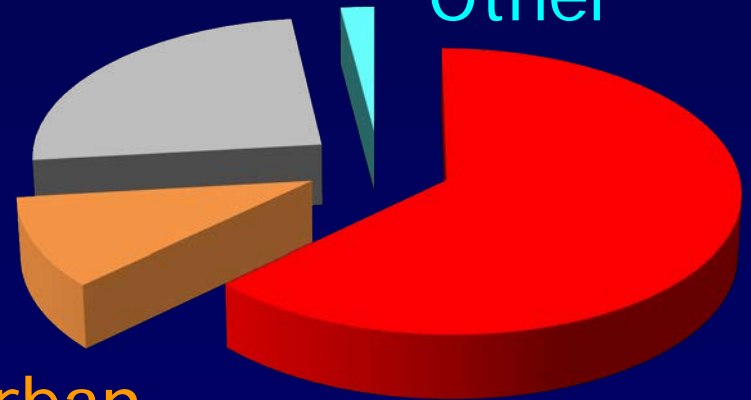


To-date conservation
has been voluntary

Expected nutrient
reductions

Wastewater

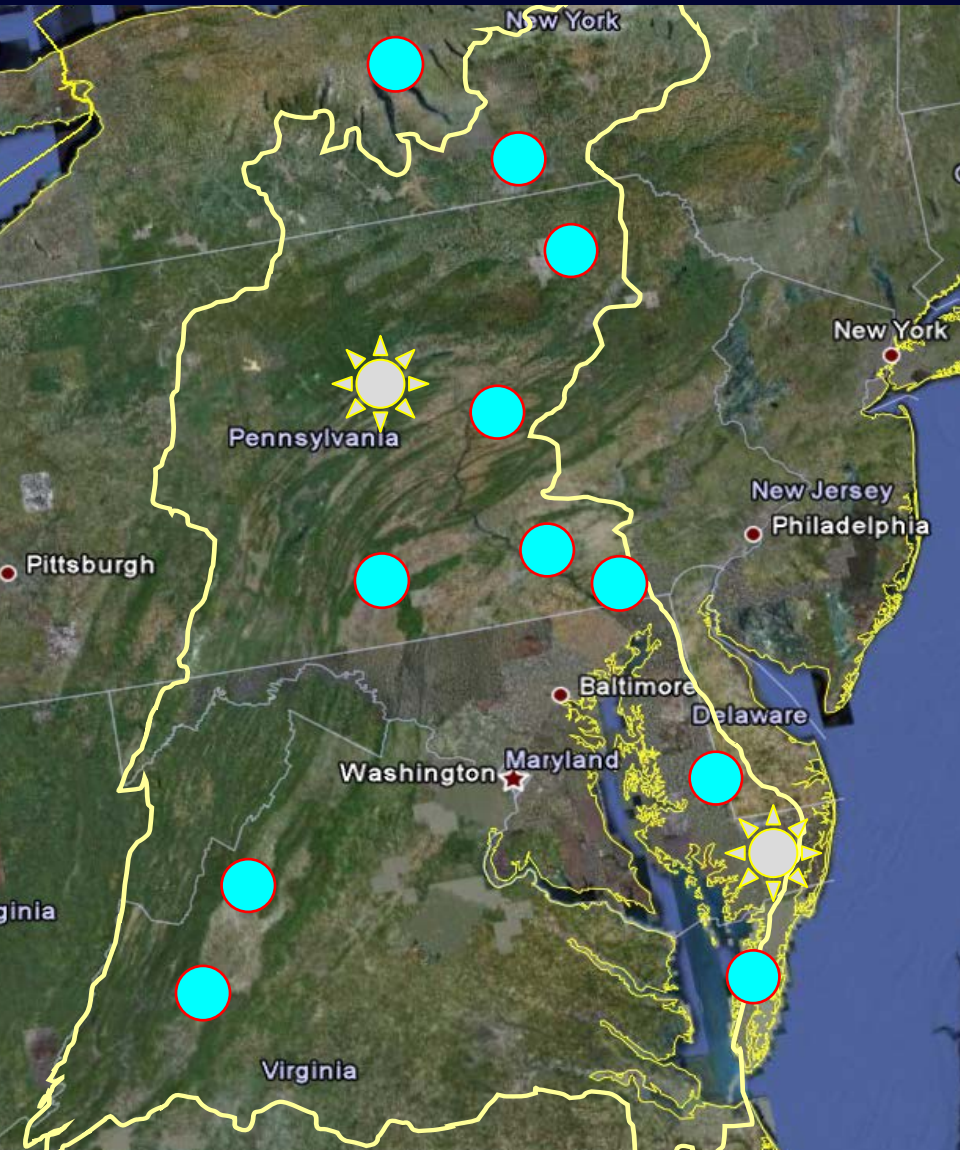
Other



Urban

Agriculture (61%)

Manure application technology



Shallow disk



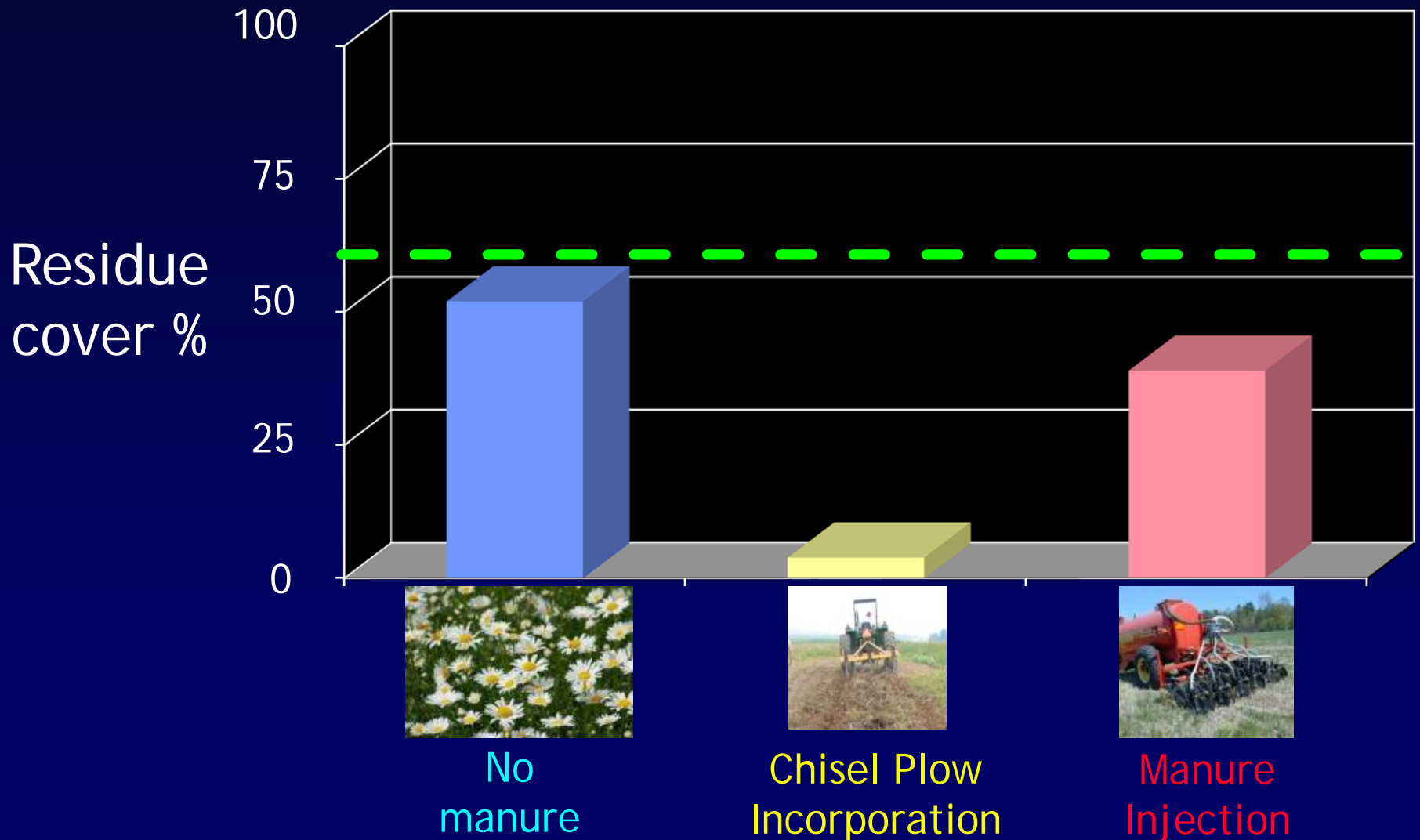
High pressure



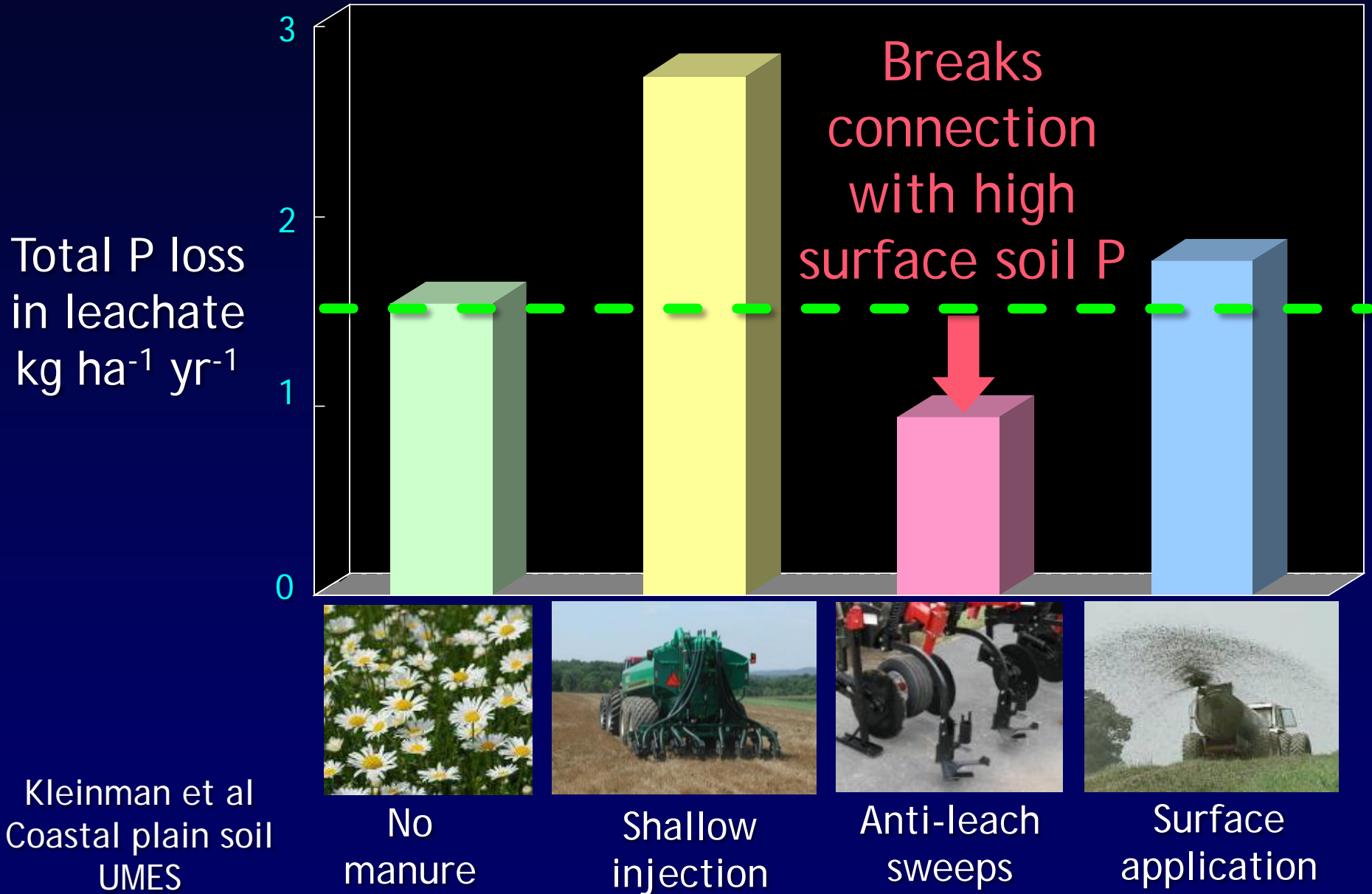
ARS Subsurfer

Low disturbance - preserves residue cover

Keeps the conservation community happy



Tillage and leaching losses



Despite Ch. Bay subsidy, adoption low

Except where there are “nosy” neighbors



Quantifying odor differences
inside a “manure ring”



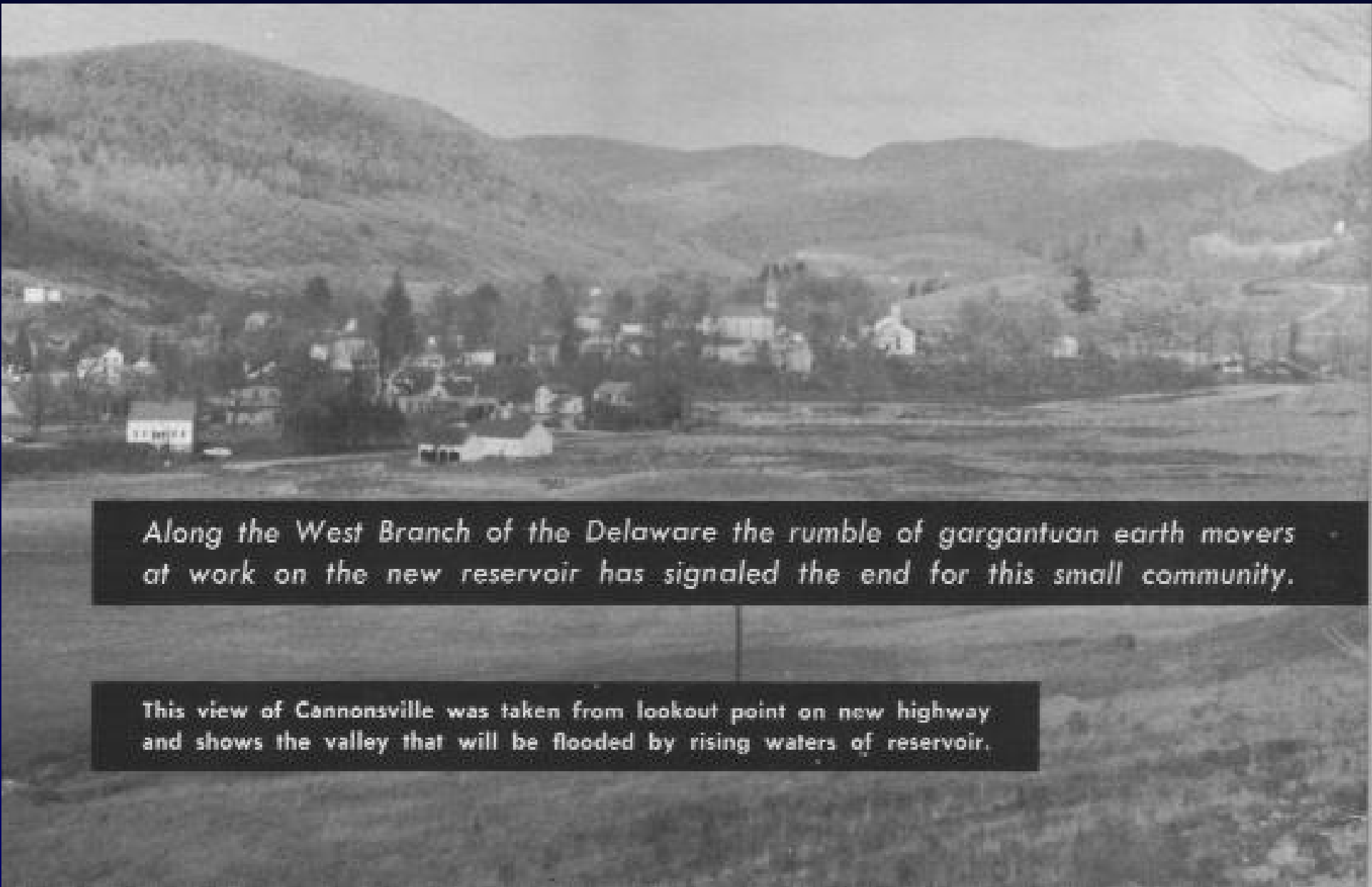
Penn State odor panel

- Odor control main reason for manure injection
- Adoption growing – contract spreaders

New York City Watershed



Village of Cannonsville (c. 1956)



Along the West Branch of the Delaware the rumble of gargantuan earth movers at work on the new reservoir has signaled the end for this small community.

This view of Cannonsville was taken from lookout point on new highway and shows the valley that will be flooded by rising waters of reservoir.

CANNONSVILLE RESERVOIR
FORMER SITE OF
CANNONSVILLE



New York City Watershed Ag Program

- Voluntary participation
 - > 93% of Cannonsville watershed farms
- Strong link to local community
- 100% “cost-share” of BMPs

Stream bank fencing



- “Obvious” BMP with proven benefits
 - Stream bank stabilization (less erosion)
 - Improved stream health (less disturbance)



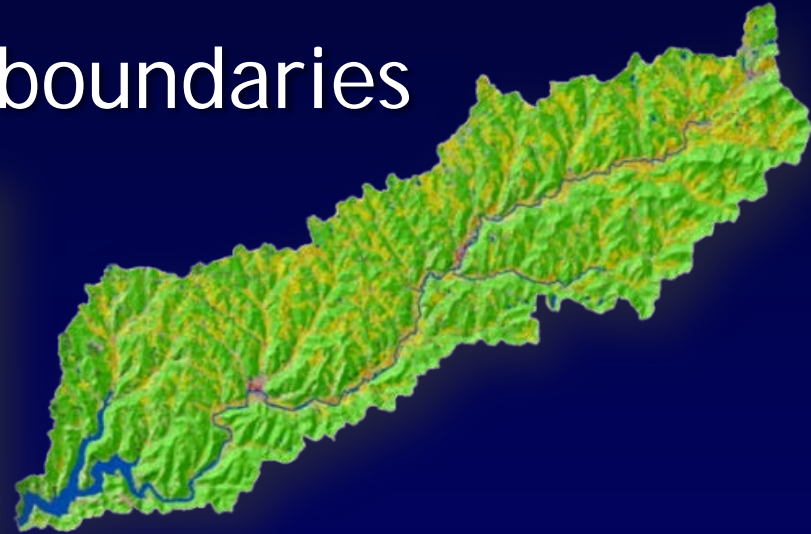
Stream exclusion

In-stream fecal P deposition
of 4,000 kg P yr⁻¹

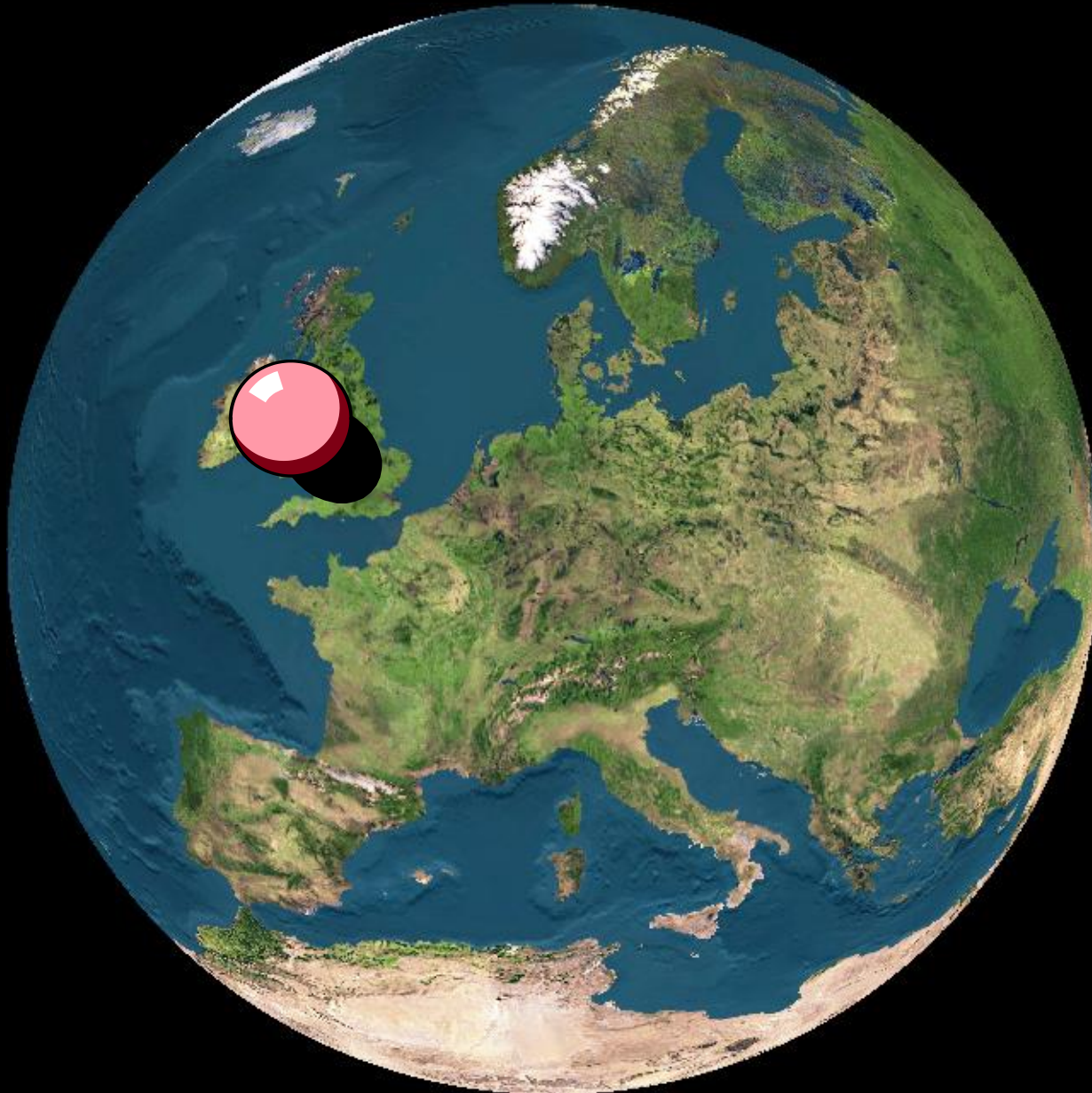
Equivalent to 12% of all
agricultural P loadings

Catchment modeling

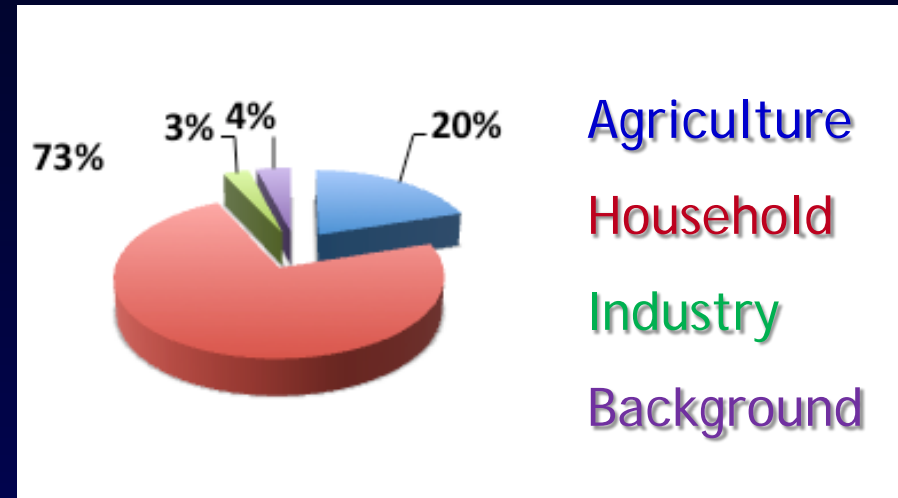
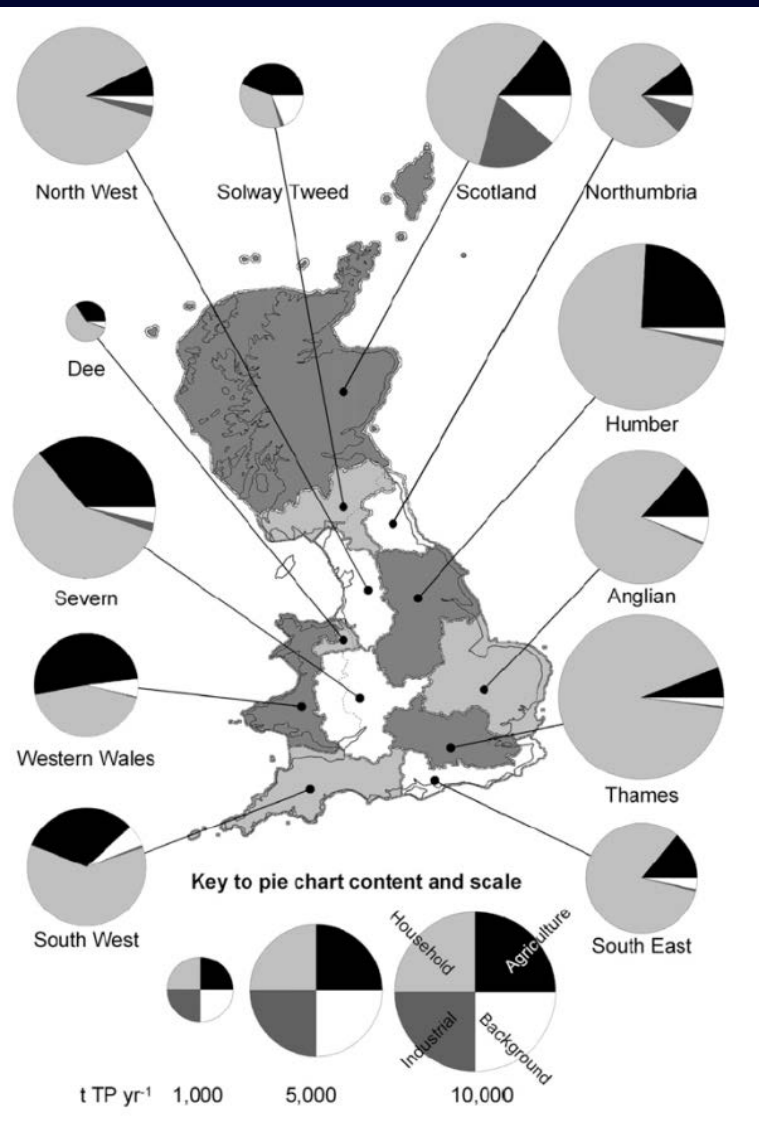
- Landscape design
 - Animal barns near the stream
 - Forests on catchment boundaries



United Kingdom



Phosphorus loads to UK waters



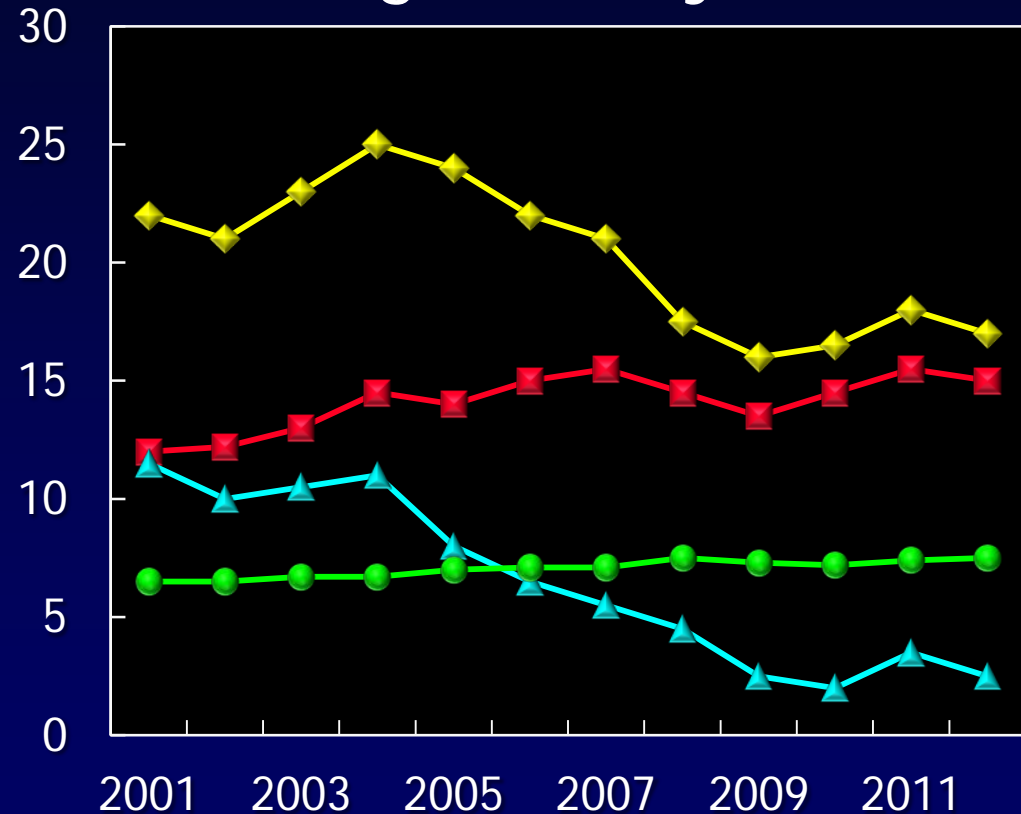
In UK, agriculture contributes between 6 & 50% of total P load

In NI, agriculture & small point sources contribute 50% of total P load

White and Hammond, 2007; EPA (2013)

Northern Ireland's surplus P limit

kg P ha⁻¹ yr⁻¹



Total P input

Feedstuff P input

Fertilizer P input

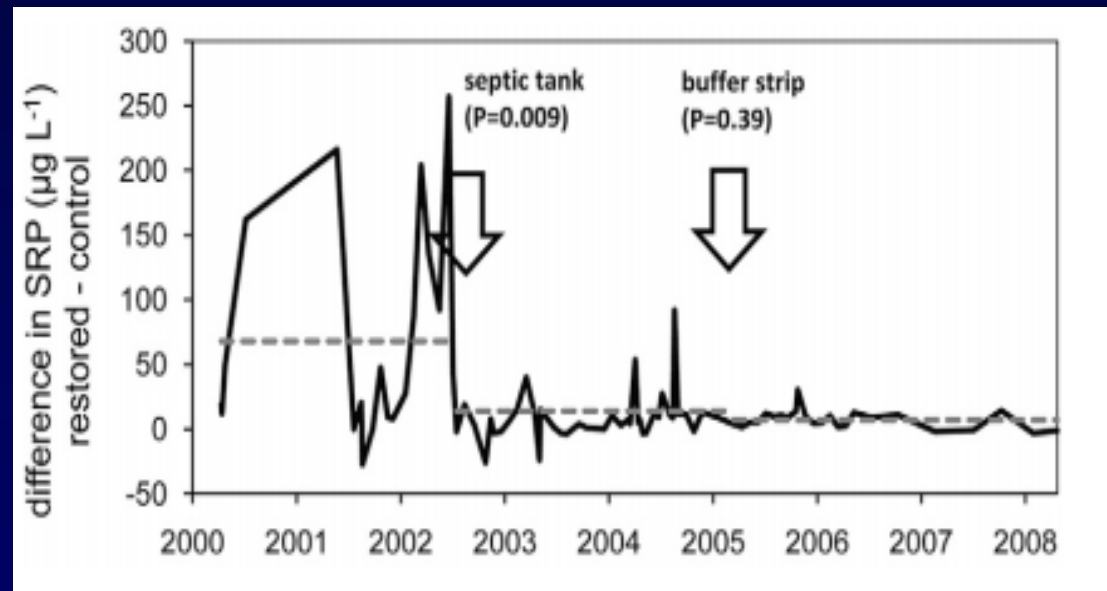
Total P output

- P surplus limit of 10 kg ha⁻¹ imposed in 2007 under Nitrates Directive
- Derogated farms only
- In NI, P input to land declining rapidly due to less fertilizer use
- Water quality is improving slightly but too early to tell!

Tarlund (Scotland) Initiative

70 km² sub-catchment of the R. Dee, Scotland

- Impacted by point & nonpoint sources
- Upstream buffers & one large septic tank removed



Stream P decreased when septic tank removed
BUT no effect of buffer strips
No effect on macroinvertebrates

Sweden



Swedish regulation



No manure on frozen soil
All farms must store manure in winter

Swedish subsidies

Buffers maintained with no fertilizers & pesticides



Buffers strips are often not optimally placed

Arkansas & Oklahoma



Litigated nutrient management

- 1.2 billion broilers produced in AR last year
- Most are in NW AR
- Judge decided that
 - Manure applications based on risk of P runoff
 - Mehlich-3 soil P threshold of 300 mg L⁻¹
 - 33% of litter produced must be export out of the watershed
- Poultry litter exported out of watershed
 - Risen to 85% exported in 2012

Benefits and tradeoffs

- Economic impact on beef grazers
 - Reduction in N & forage production
 - Decreased herd size
- Potential water quality impacts



Response to management change

Mean annual concentration, mg L⁻¹

	Dissolved P	Total P
2000	0.224	0.377
2003	0.148	0.244
2011	0.070	0.130

Conclusions

- Farmers need convincing they are part of the problem
- Identify pollutant(s) of concern & source(s) before implementing conservation practices
- Identify critical source areas to prioritize conservation practices within the watershed
- Work with agency personnel to set reasonable & appropriate numeric water quality goals

Conclusions

- Locally derived solutions by engaged farmers must be part of the solution
- After conservation adopted, must work with farmers to maintain & sustain practices
- Slow implementation despite willingness to engage- even with cost-share / subsidies
- Understand & consider farmers' attitudes toward agriculture & conservation practices to promote adoption

Conclusions

- Technical assistance most effective when delivered by trusted local contact & is very person intensive
- BMP tracking & accountability needed
- Tenant farmers ?
- Adaptive management

It's time to treat environmental health like human health



- Get the diagnosis right
 - Assess each case individually & comprehensively
 - Aim for overall improvement



Drug Facts (continued)

Directions

- this product does not contain directions or complete warnings for adult use.
- shake well before using
- find right dose on chart below. If possible, use weight to dose; otherwise, use age.
- use only enclosed dosing cup designed for use with this product. Do not use any other dosing device.
- if needed, repeat dose every 4 hours while symptoms last
- do not give more than 5 times in 24 hours
- do not give more than 5 days, unless directed by a doctor

Weight (lb)	Age (yr)	Dose (tsp or mL)
under 24	under 2	ask a doctor
24-35	2-3	1 teaspoon or 5 mL
36-47	4-5	1 1/2 teaspoons or 7.5 mL
48-59	6-8	2 teaspoons or 10 mL
60-71	9-10	2 1/2 teaspoons or 12.5 mL
72-95	11	3 teaspoons or 15 mL

Other information • store at controlled room temperature

Inactive ingredients butyl paraben, carboxymethylcellulose sodium, cellulose, citric acid, flavors, glycerin, high fructose corn syrup, propylene glycol, purified water, red 40, sodium benzoate, sorbitol, sucralose, xanthan gum, yellow 6

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Children's PAIN RELIEF

SUSPENSION LIQUID

FEVER REDUCER / PAIN RELIEVER ACETAMINOPHEN

Tropical Punch Flavor

For ages 2 to 11

4 FL OZ (118 mL)

80 mg per 1/2 teaspoon (160 mg per 5 mL)

Drug Facts

Active ingredient (in each 5 mL, 1 teaspoon) Acetaminophen 160 mg **Purpose** Pain reliever/fever reducer

Uses temporarily reduces fever temporarily relieves minor aches and pains due to:
• the common cold • flu • headache • sore throat • toothache

Warnings
Liver warning: This product contains acetaminophen. Severe liver damage may occur if your child takes:
• with other drugs containing acetaminophen
• more than 5 doses in 24 hours, which is the maximum daily amount
Sore throat warning: If sore throat is severe, persists for more than 2 days, is accompanied or followed by fever, headache, rash, nausea, or vomiting, consult a doctor promptly.

Do not use • with any other drug containing acetaminophen (prescription or non-prescription). If you are not sure whether a drug contains acetaminophen, ask a doctor or pharmacist.

Ask a doctor before use if your child has liver disease

Ask a doctor or pharmacist before use if your child is taking the blood thinning drug warfarin

When using this product
• do not exceed recommended dose (see overdose warning)

Stop use and ask a doctor if • new symptoms occur • redness or swelling is present • pain gets worse or lasts more than 5 days • fever gets worse or lasts more than 3 days These could be signs of a serious condition.

Keep this and all drugs out of the reach of children.

Overdose Warning: Taking more than the recommended dose (overdose) may cause liver damage. In case of accidental overdose, seek professional assistance or contact a Poison Control Center immediately. Quick medical attention is critical even if you do not notice any signs or symptoms.

TAMPER EVIDENT: DO NOT USE IF PRINTED SECURITY SEAL ON THE BOTTLE IS BROKEN OR MISSING.

39-15064B

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It's time to treat environmental health like human health

- Get the treatment right



- Make sure the “remedy” works
- Consider all the benefits
- Consider the “side-effects”
- Treat with precision
- Adapt & fine tune the treatment

P policies can be a gamble



Balancing agricultural and production interests

An aerial photograph of a farm landscape. The foreground and middle ground are filled with large, irregular patches of green and yellow crops, likely corn, arranged in a winding, organic pattern. In the upper right, a white barn with a red roof and a tall, cylindrical silo are visible. The background shows more fields and a distant road or fence line.

**Thank you
Questions ??**