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

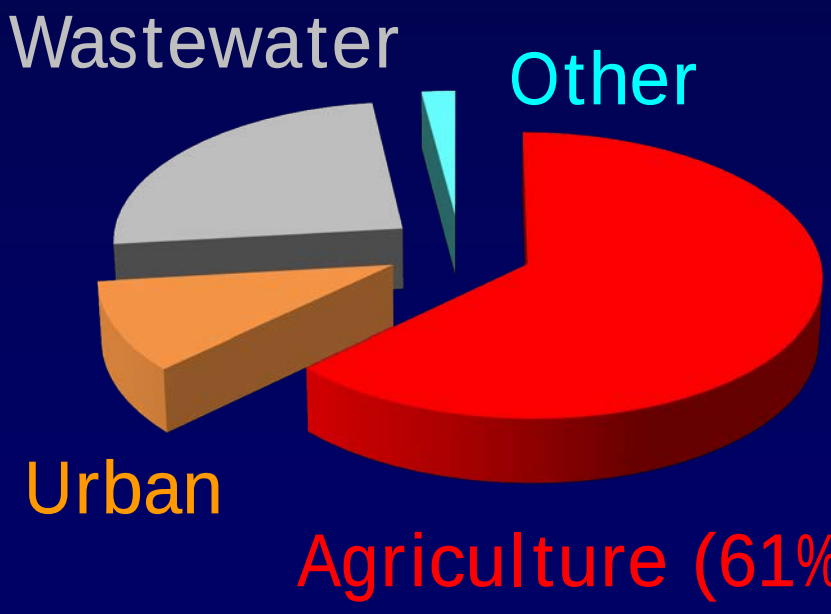
Lessons learned ….. and not learned

The Chesapeake Bay

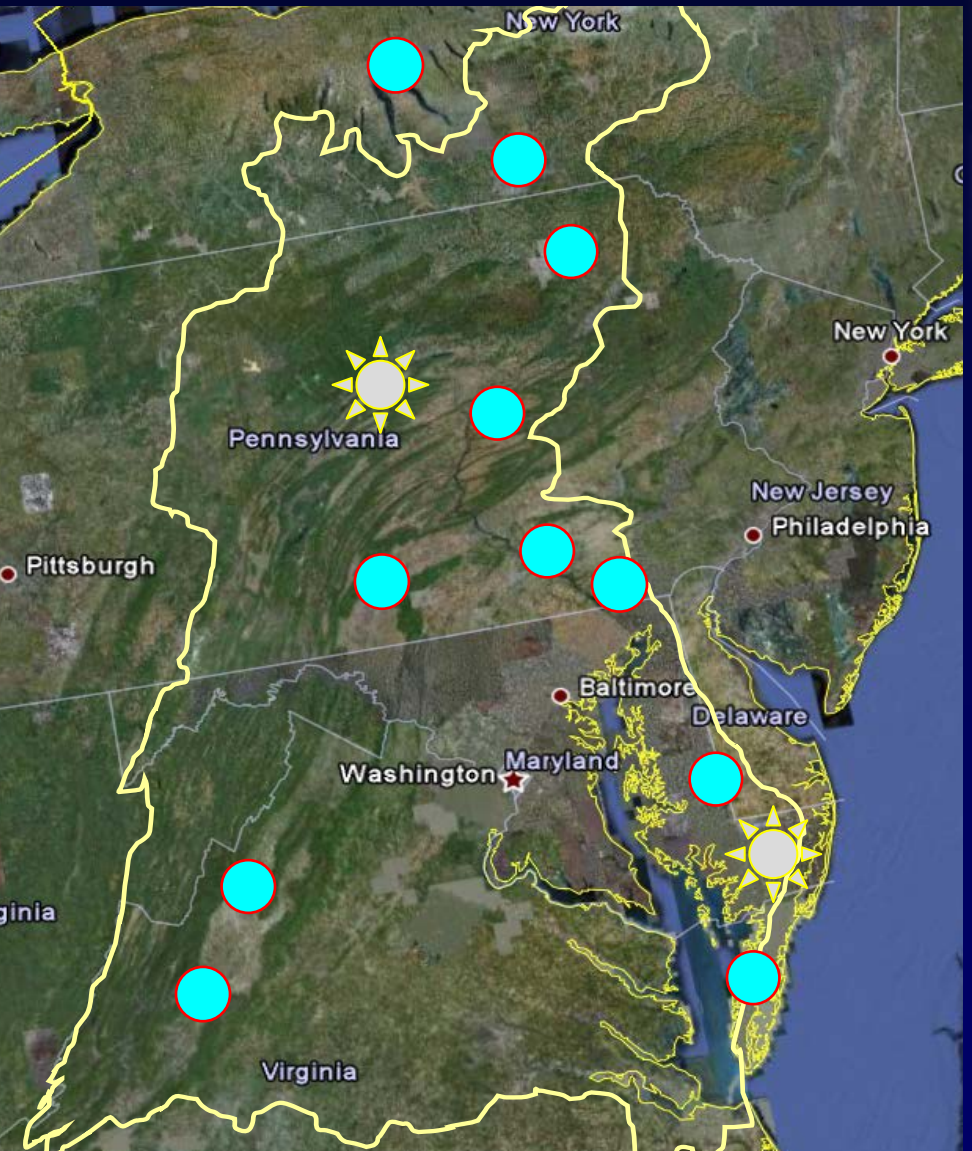
A long history of government agreements

To-date conservation has been voluntary

Expected nutrient reductions



Manure application technology



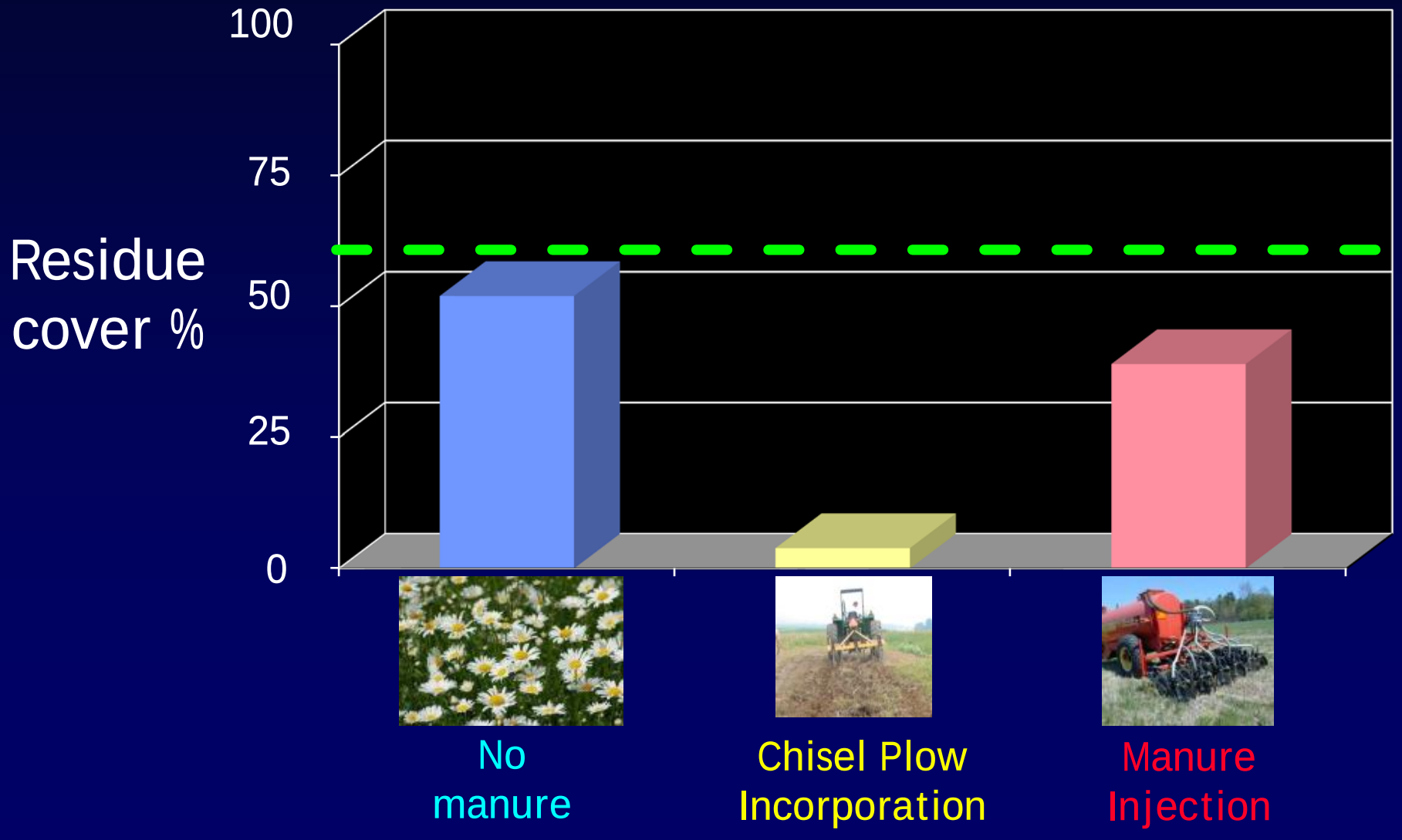
Shallow disk

High pressure

ARS Subsurfer

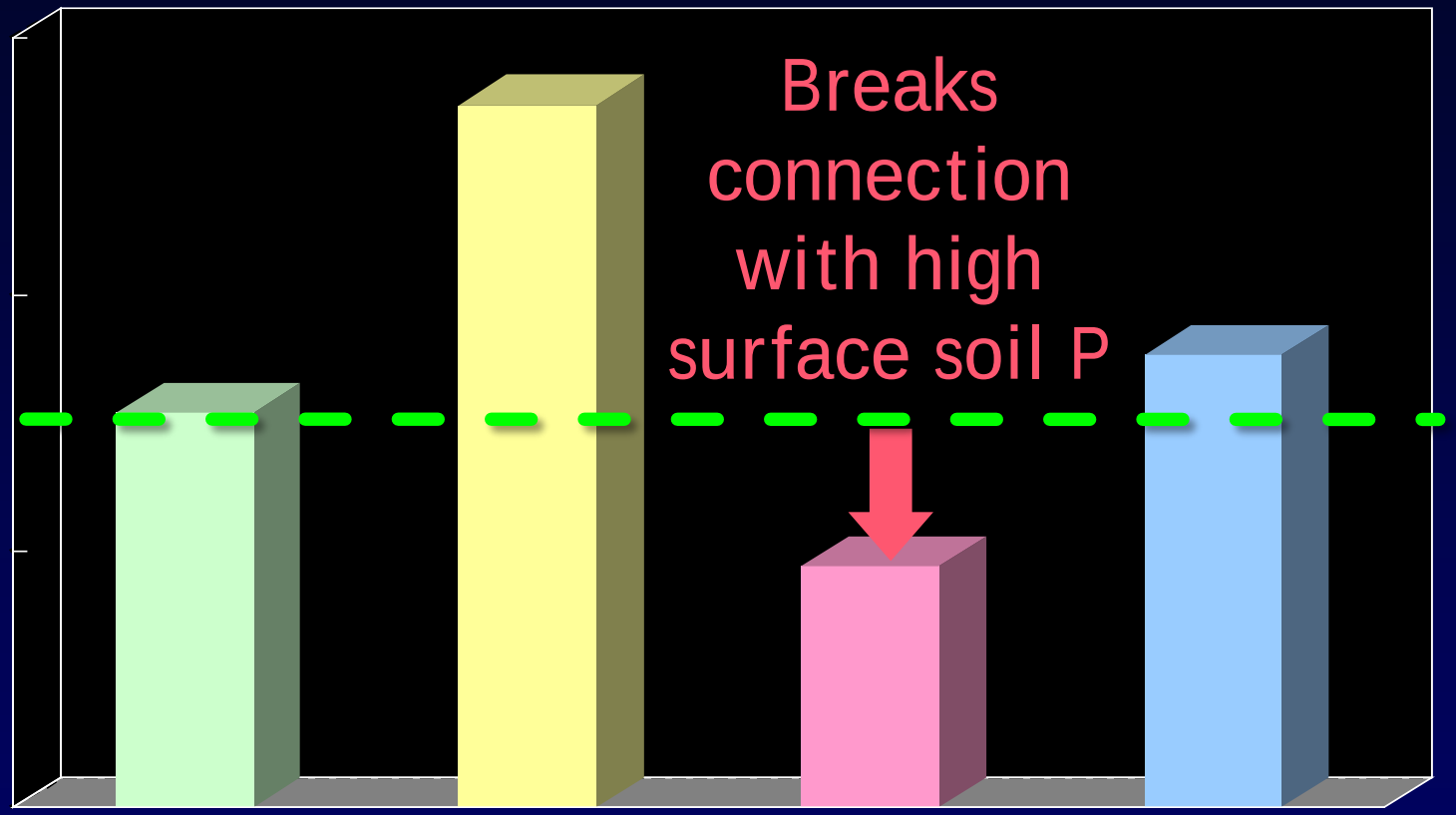
Low disturbance – preserves residue cover

Keeps the conservation community happy



Tillage and leaching losses

Total P loss in leachate kg ha^{-1} yr^{-1}



No manure

Shallow injection

Anti-leach sweeps

Surface application

Kleinman et al
Coastal plain soil
UMES

Despite Ch. Bay subsidy, adoption low

Except where there are “nosy” neighbors

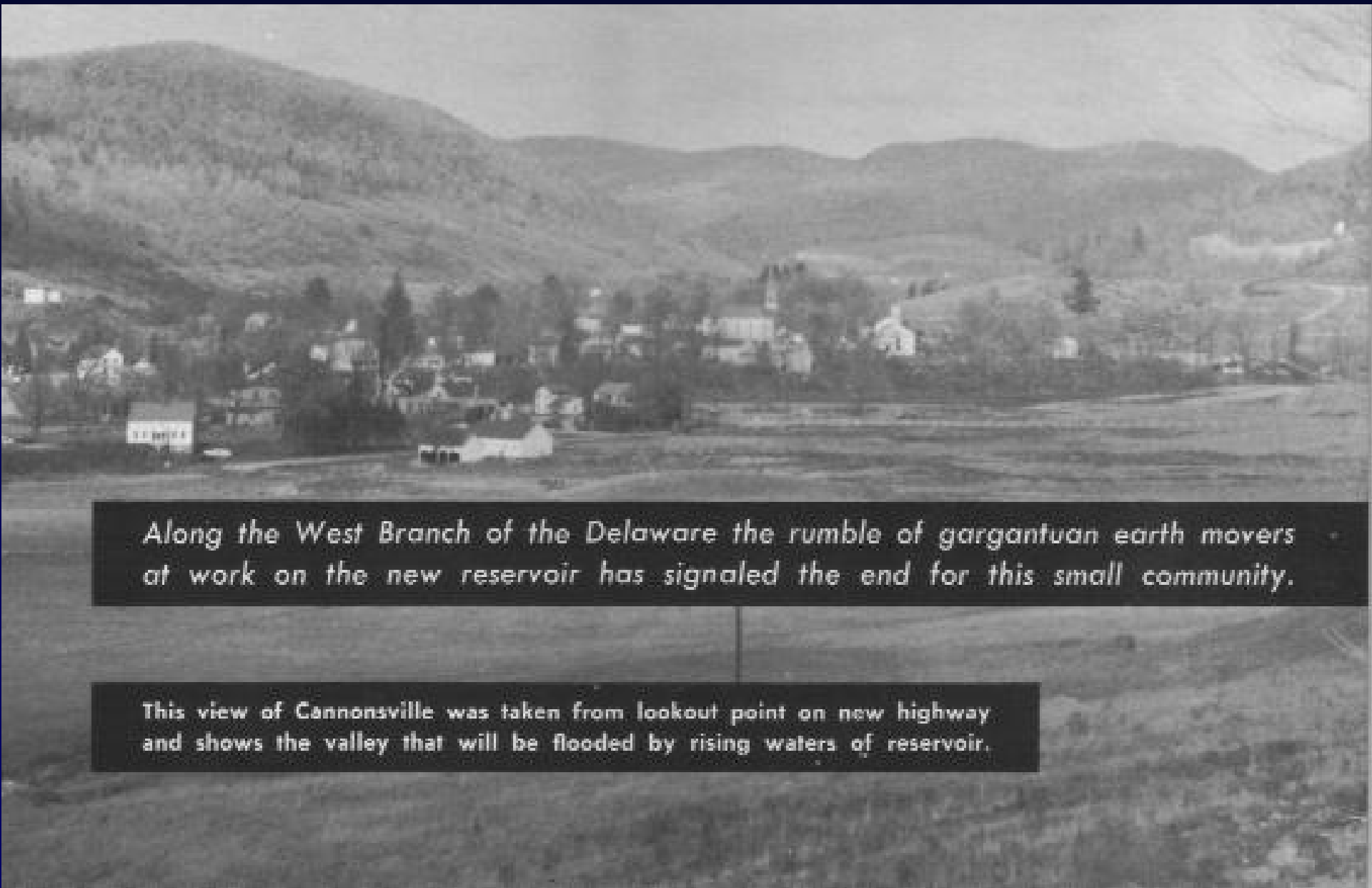
Quantifying odor differences inside a “manure ring”

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.

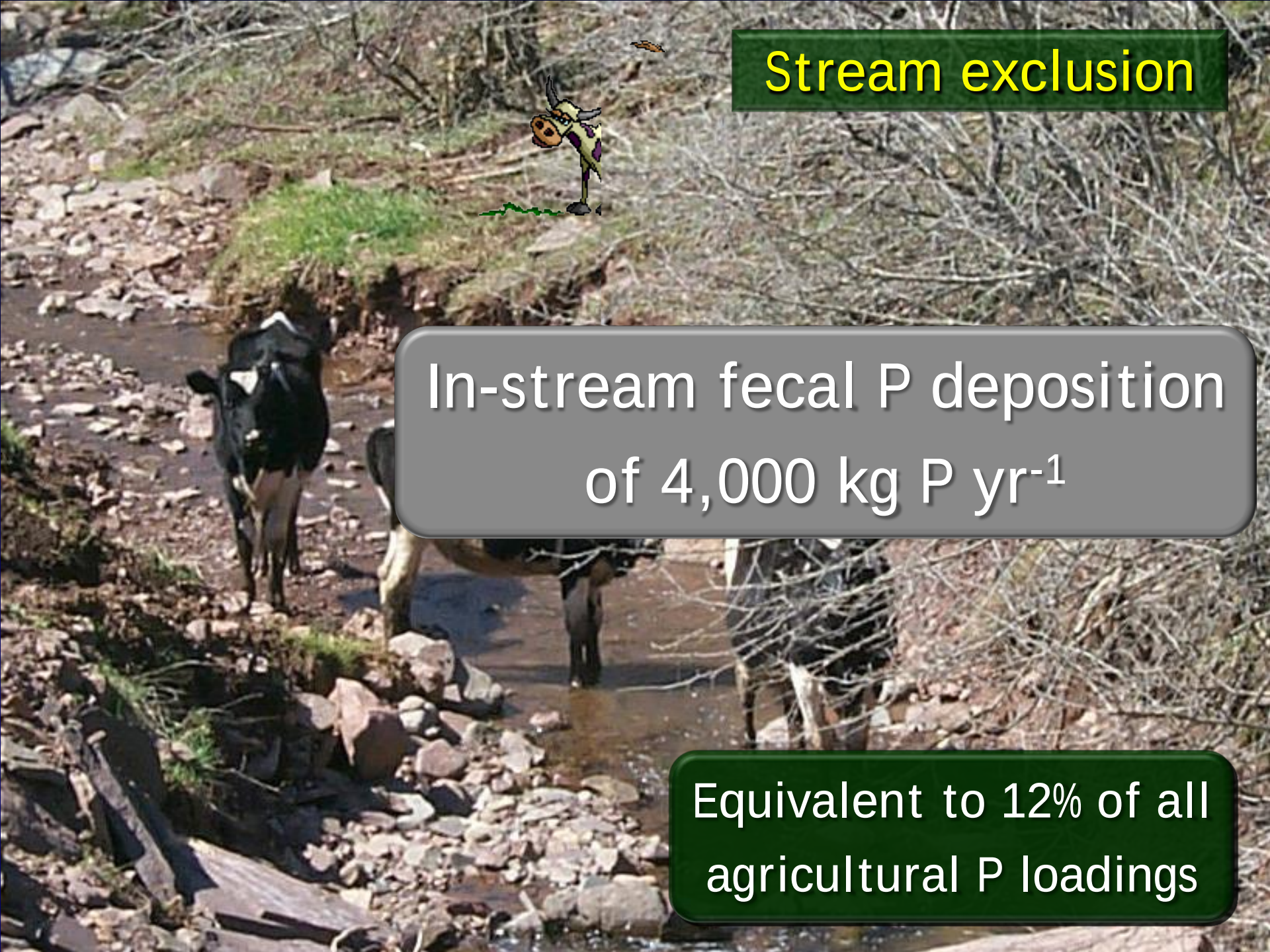

CANNONSVILLE RESERVOIR
FORMER SITE OF
CANNONSVILLE

New York City Watershed Ag Program

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

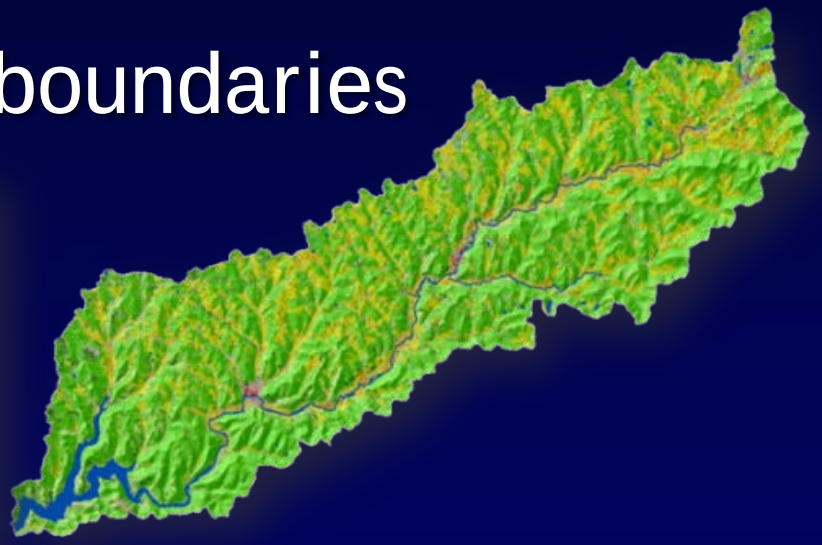
Stream bank fencing

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

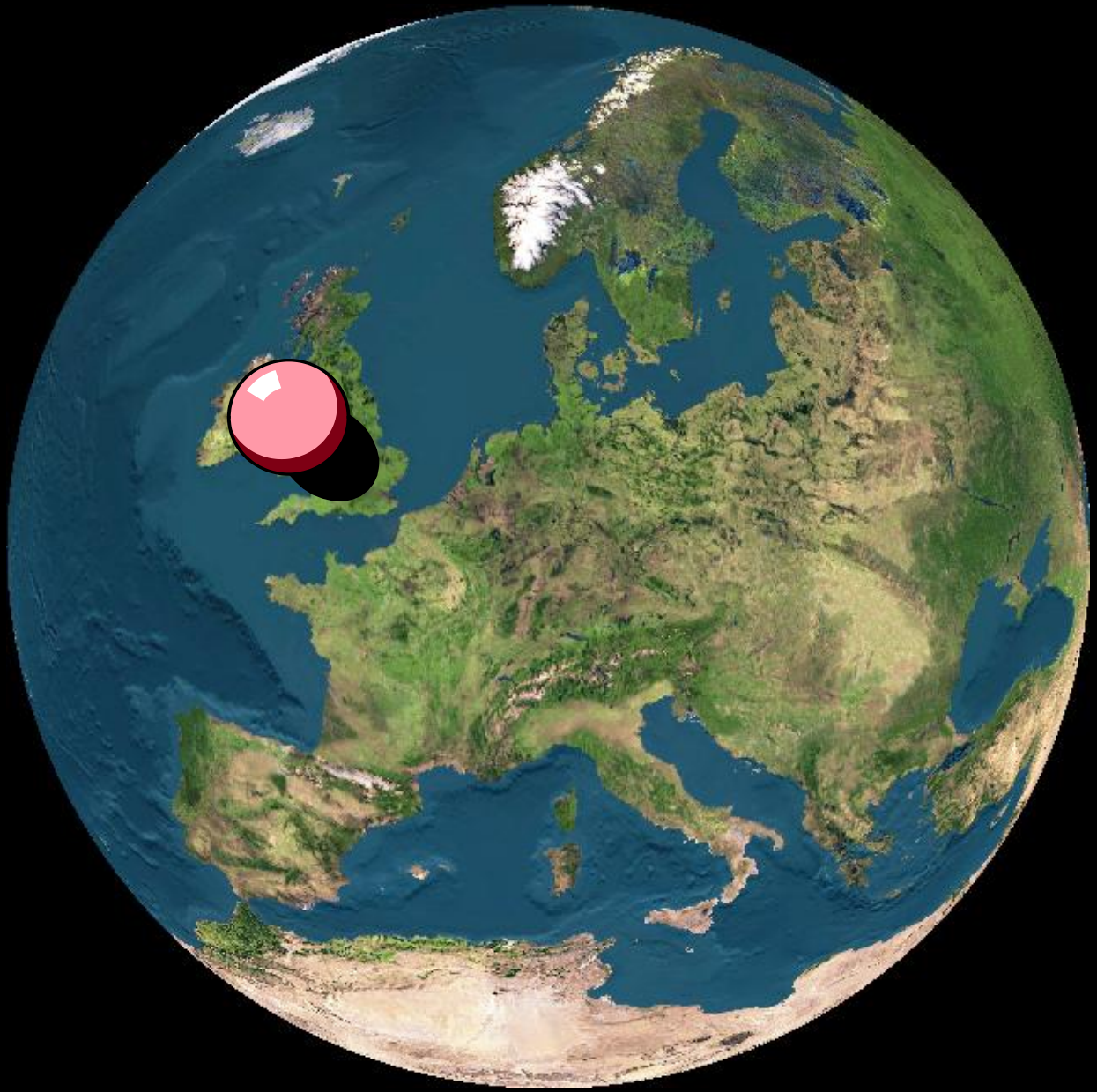

Stream exclusion
In-stream fecal P deposition of 4,000 kg P yr^{-1}
Equivalent to 12% of all agricultural P loadings

Catchment modeling

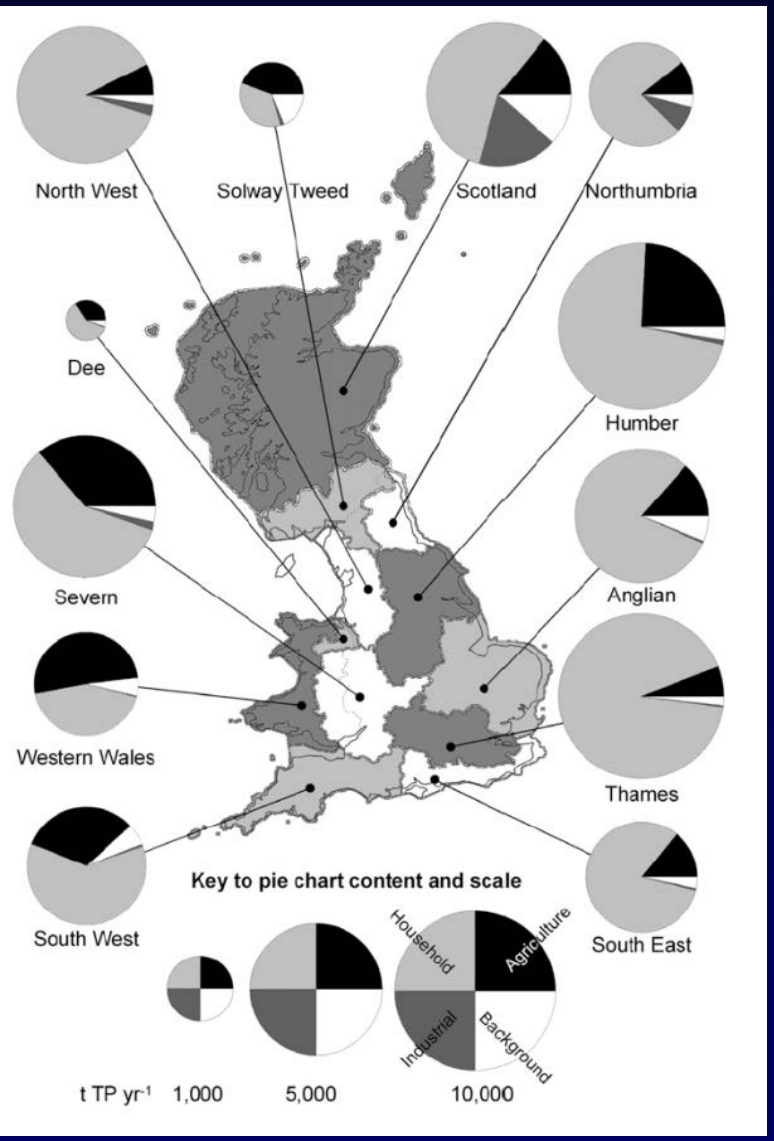
- Landscape design
  - Animal barns near the stream
  - Forests on catchment boundaries

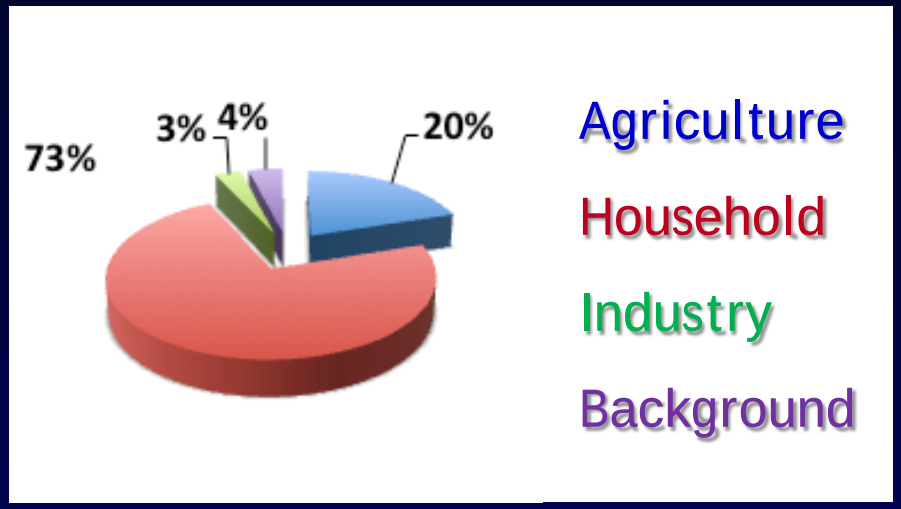


United Kingdom



Phosphorus loads to UK waters



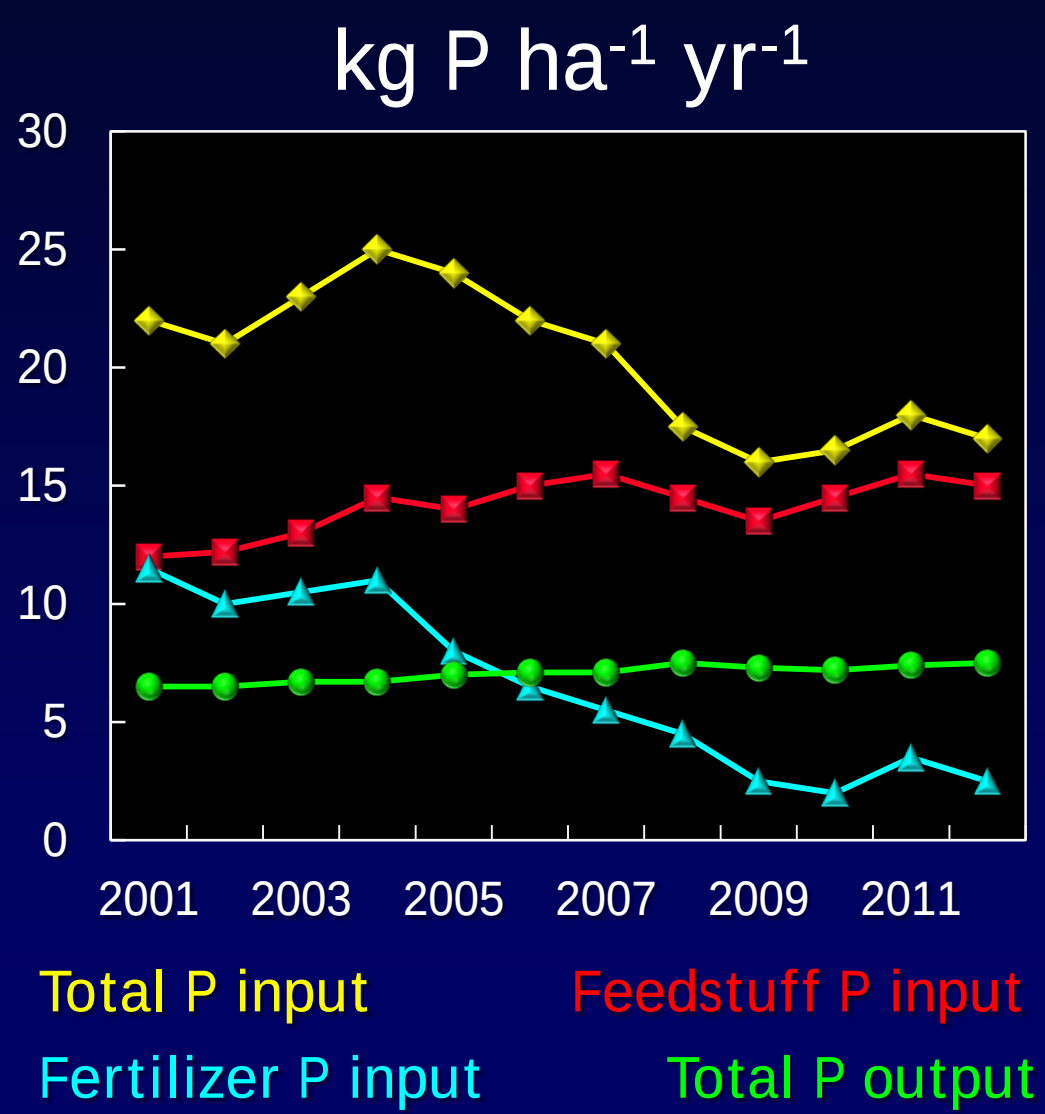


In UK, agriculture contributes between 6 & 50% of total P load

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

White and Hammond, 2007; EPA (2013)

Northern Ireland's surplus P limit



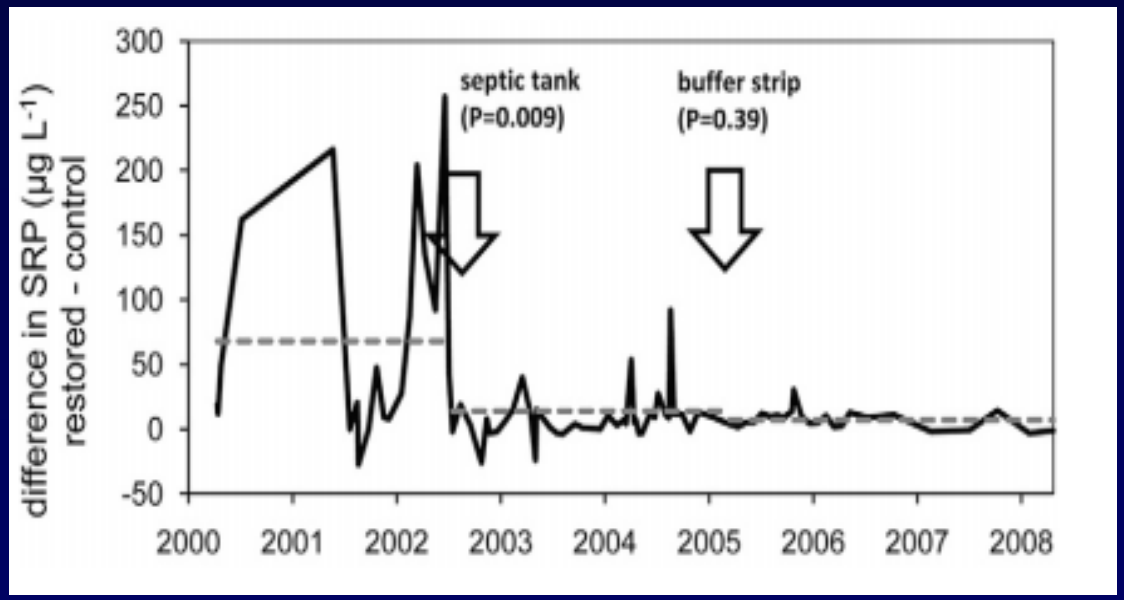
- P surplus limit of 10 kg ha^{-1} imposed in 2007 under Nitrates Directive
- Derogated farms only
- In NI, P input to land declining rapidly due to less fertilizer use
- Water quality is improving slightly but too early to tell!

Tarlund (Scotland) Initiative

70 km^2 sub-catchment of the R. Dee, Scotland

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

Bergfur et al. 2012



Stream P decreased when septic tank removed

BUT no effect of buffer strips

No effect on macroinvertebrates

Sweden

Swedish regulation

Swedish subsidies

Buffers maintained with no fertilizers & pesticides

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

AR Water Resources Center, 2012

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

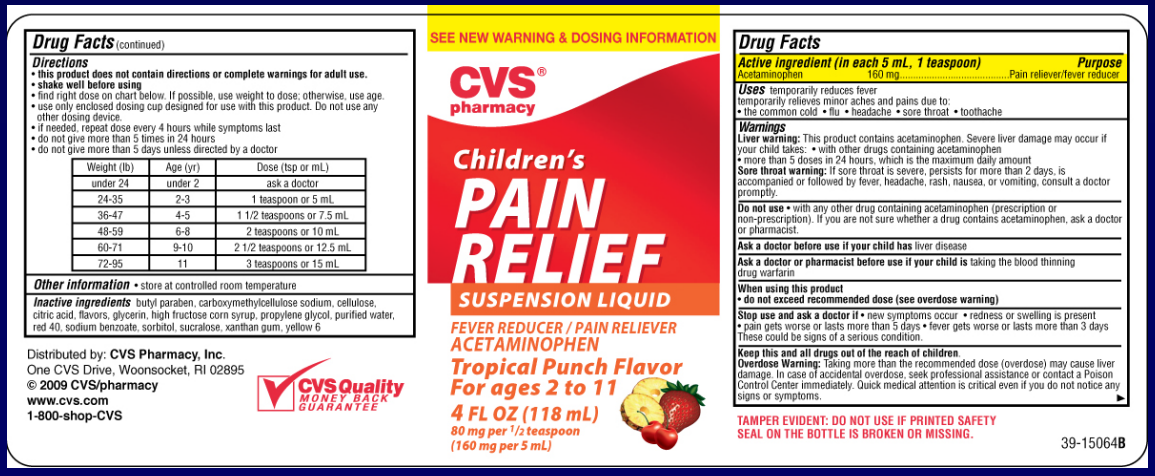
- Locally derived solutions by engaged farmers must be part of the solution
- After conservation adopted, must work with farmers to maintain & sustain practices
- Slow implementation despite willingness to engage- even with cost-share / subsidies
- Understand & consider farmers' attitudes toward agriculture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

Conclusions

- Technical assistance most effective when delivered by trusted local contact & is very person intensive
- BMP tracking & accountability needed
- Tennant 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



Health diagnosis courtesy of Don Flaten, Univ. Manitoba, Winnipeg, Canada

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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.

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


Thank you
Questions ??