A New Tool to Estimate Phosphorus Loss from Cattle Barnyards and Outdoor Lots

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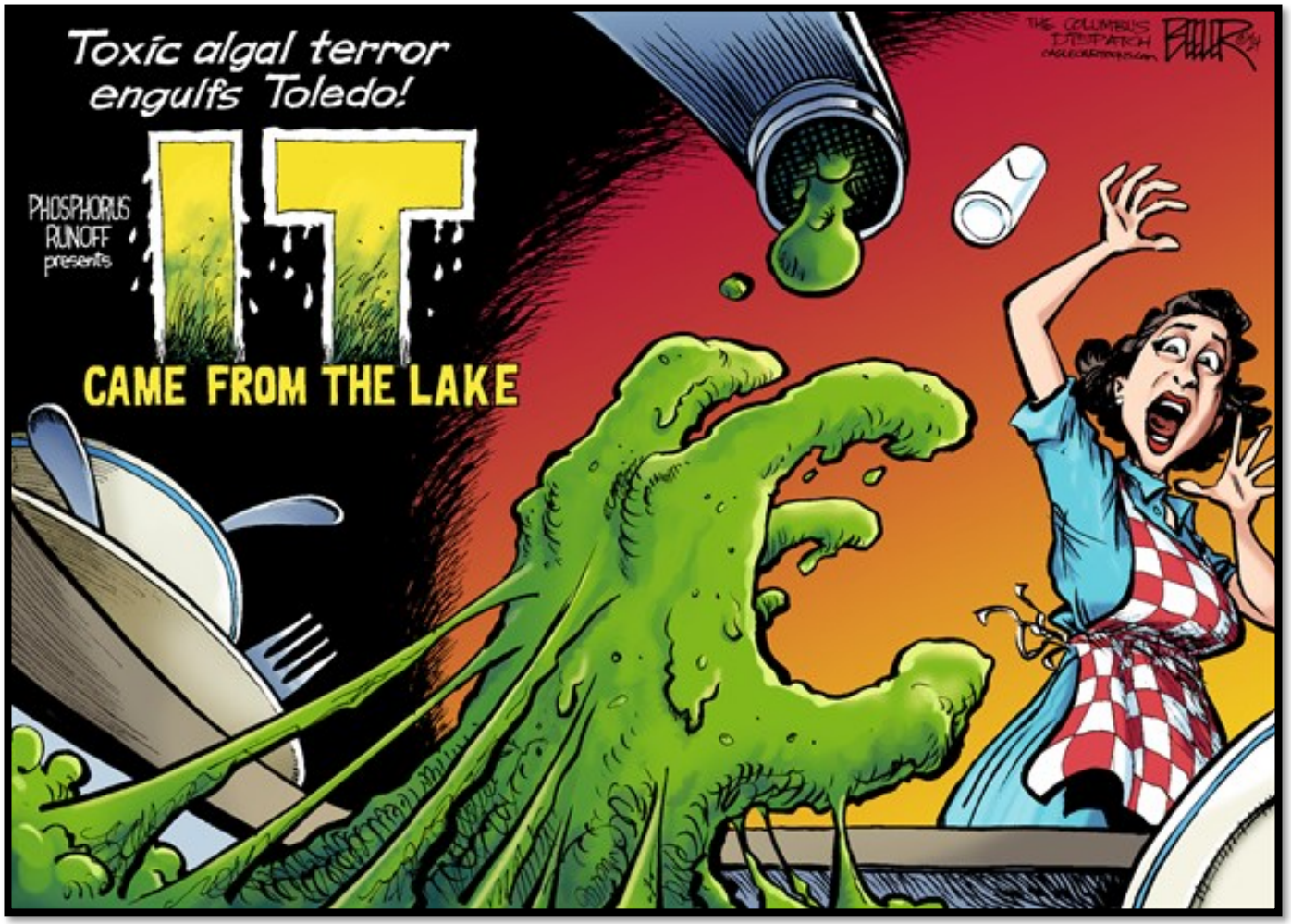
Phosphorus Loss from Farms Continues to be an Issue



Cattle lots can be important source of P loss on farms

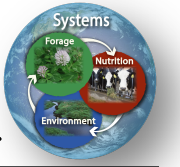
- High stocking density means manure and P accumulation
- Low vegetation means high runoff and erosion
- Anywhere from 10 to 600 lb P per acre loss annually

Cattle Lot Management Need

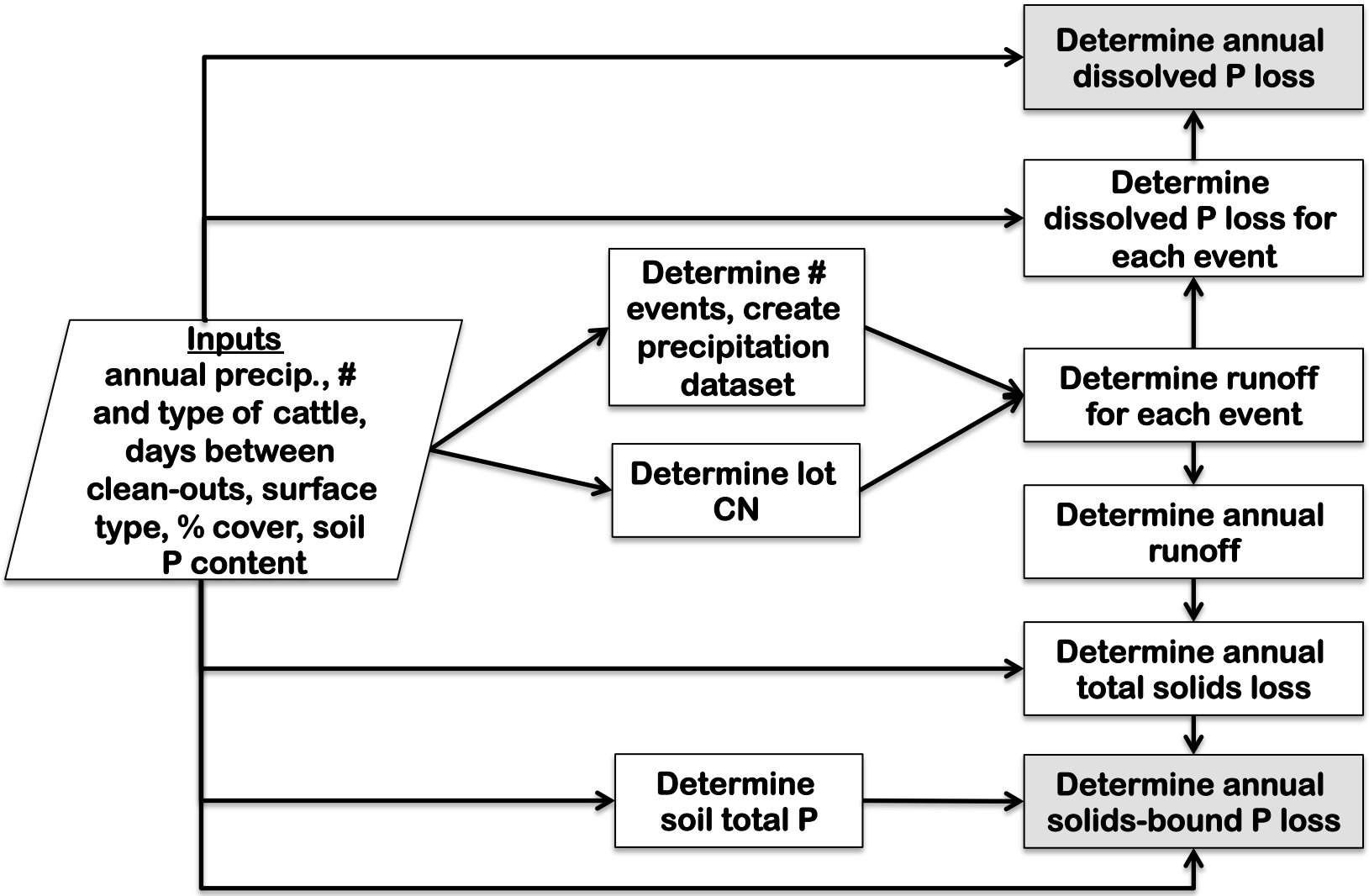
- Estimate P loss from outdoor lots
- Is P loss from lots excessive, especially relative to other land uses?
  - 100 acres of corn silage at 4 lb/ac P loss = 400 lbs P; 15% reduction = 60 lb P
  - 0.25 acre barnyard at 200 lb/ac P loss = 50 lb P; 100% reduction?
- How much can alternative management reduce P loss

Research Need

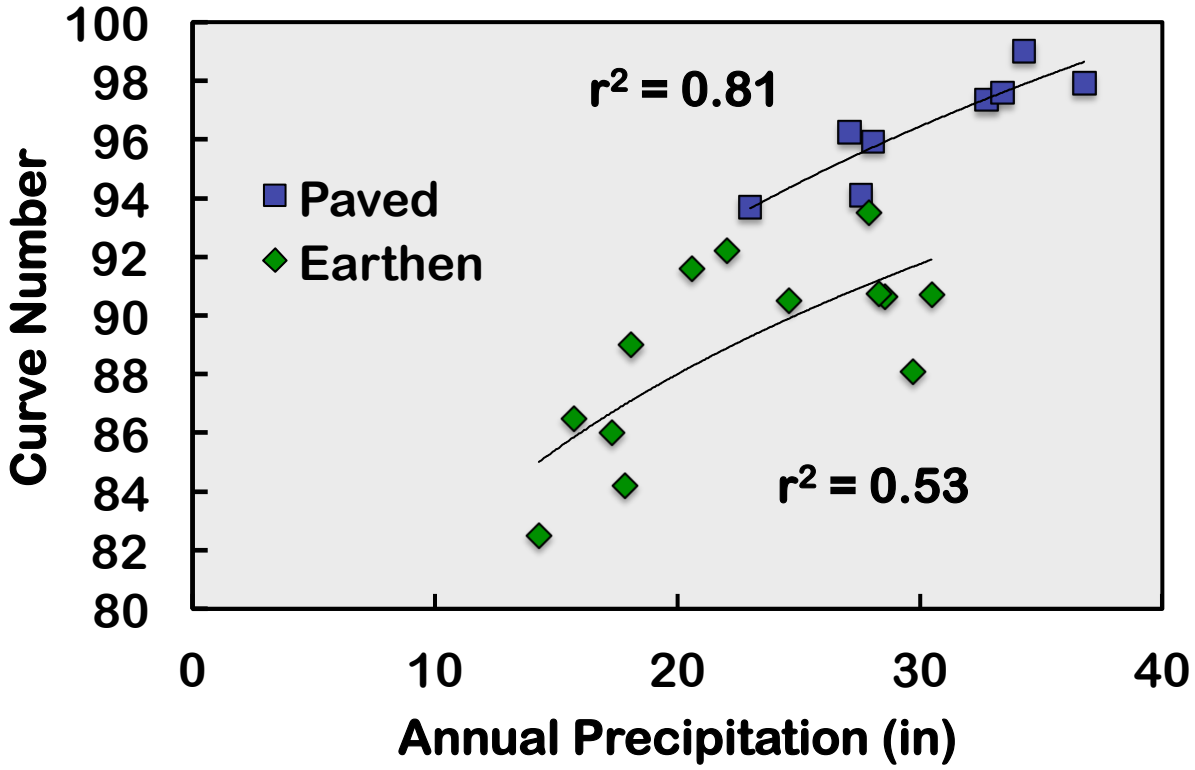
- Develop new tool to estimate P loss from barnyards and lots
- Test tool with data from studies monitoring P loss from lots
- Compare new tool with current WI lot P loss estimator (BARNY)



New Cattle Lot P Runoff Model



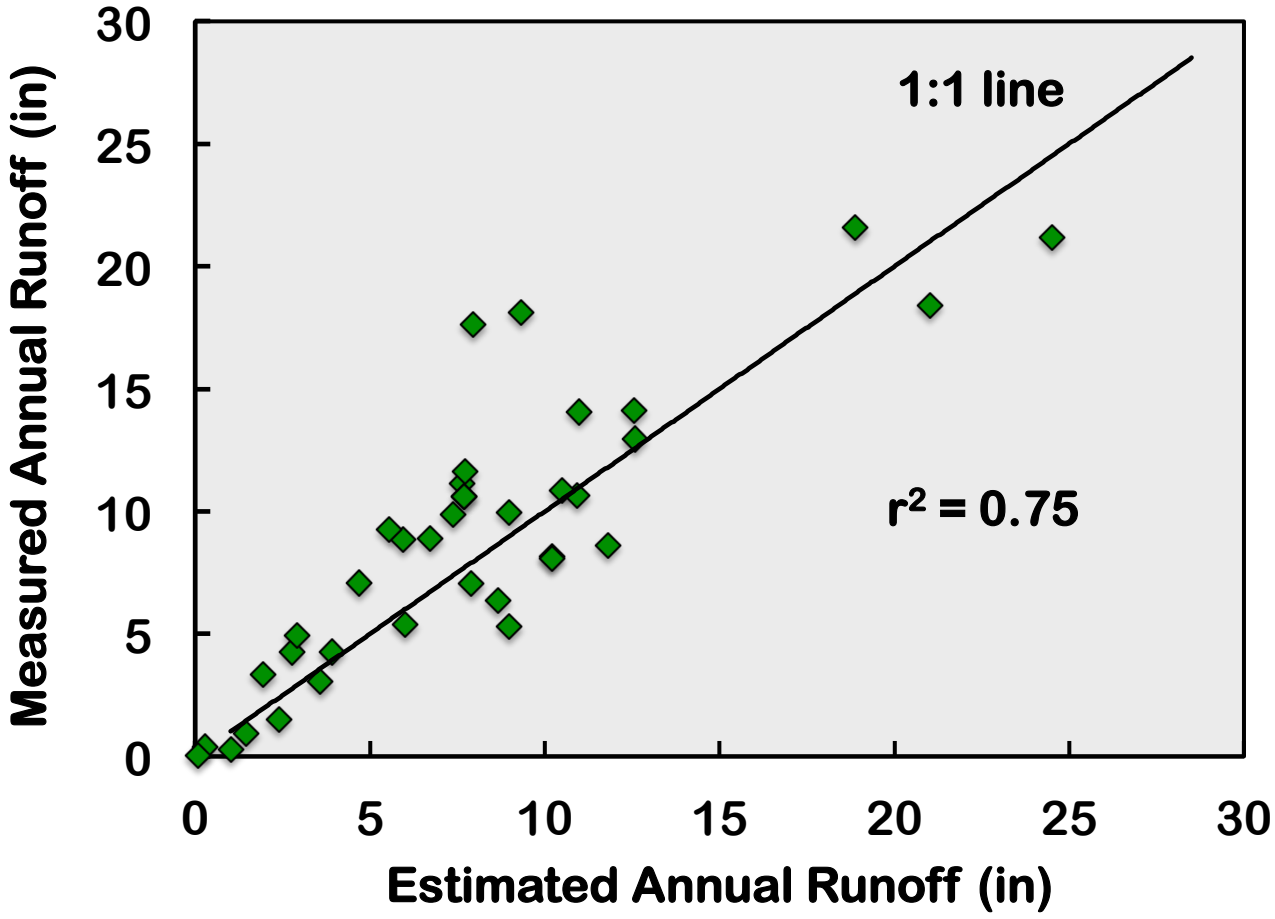
Runoff Estimation



Data from 11 studies, 21 site years in 6 states (MN, NE, WI, TX, SD, OH)

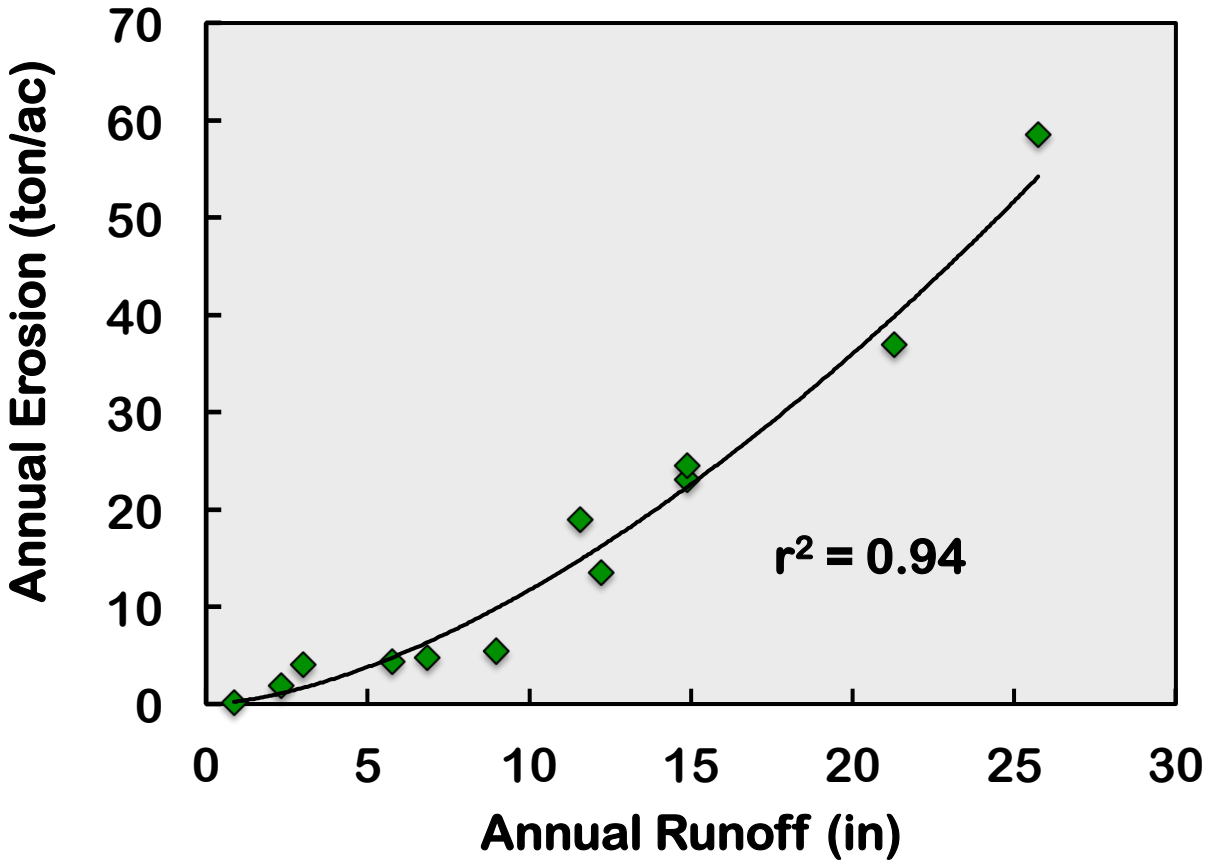
- CN is widely-used method to estimate runoff; greater CN means more estimated runoff
- Model uses CN to estimate runoff for each precipitation event, sums all events for annual runoff (no accounting for snow or frozen conditions)
- For paved lots, runoff decreases as % of lot area covered by manure increases
- For earthen lots, runoff decreases as % vegetative cover increases

Runoff Testing



Data from 12 studies, 37 site years in 7 states (IA, MN,NE, OH, WI, SD, NC), Canada, Finland

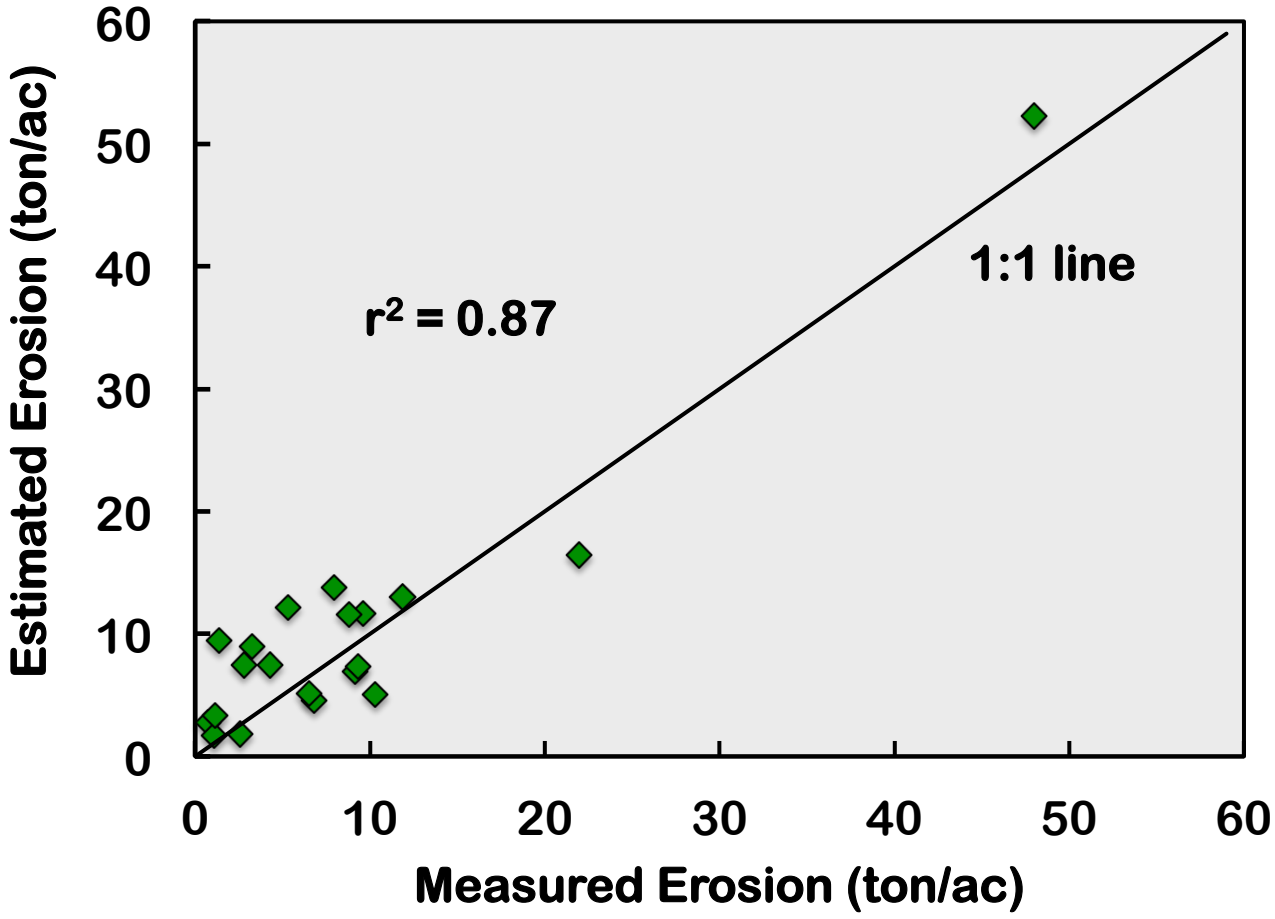
Erosion Estimation



Data from 6 studies, 12 site years

- For paved lots, erosion is manure solids only; erosion decreases as cleaning frequency increases
- For earthen lots, erosion is manure solids and soil; erosion decreases as % vegetative cover increases

Erosion Testing



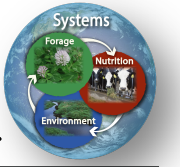
Data from 5 studies, 20 site years

Solids-bound P Loss Estimation

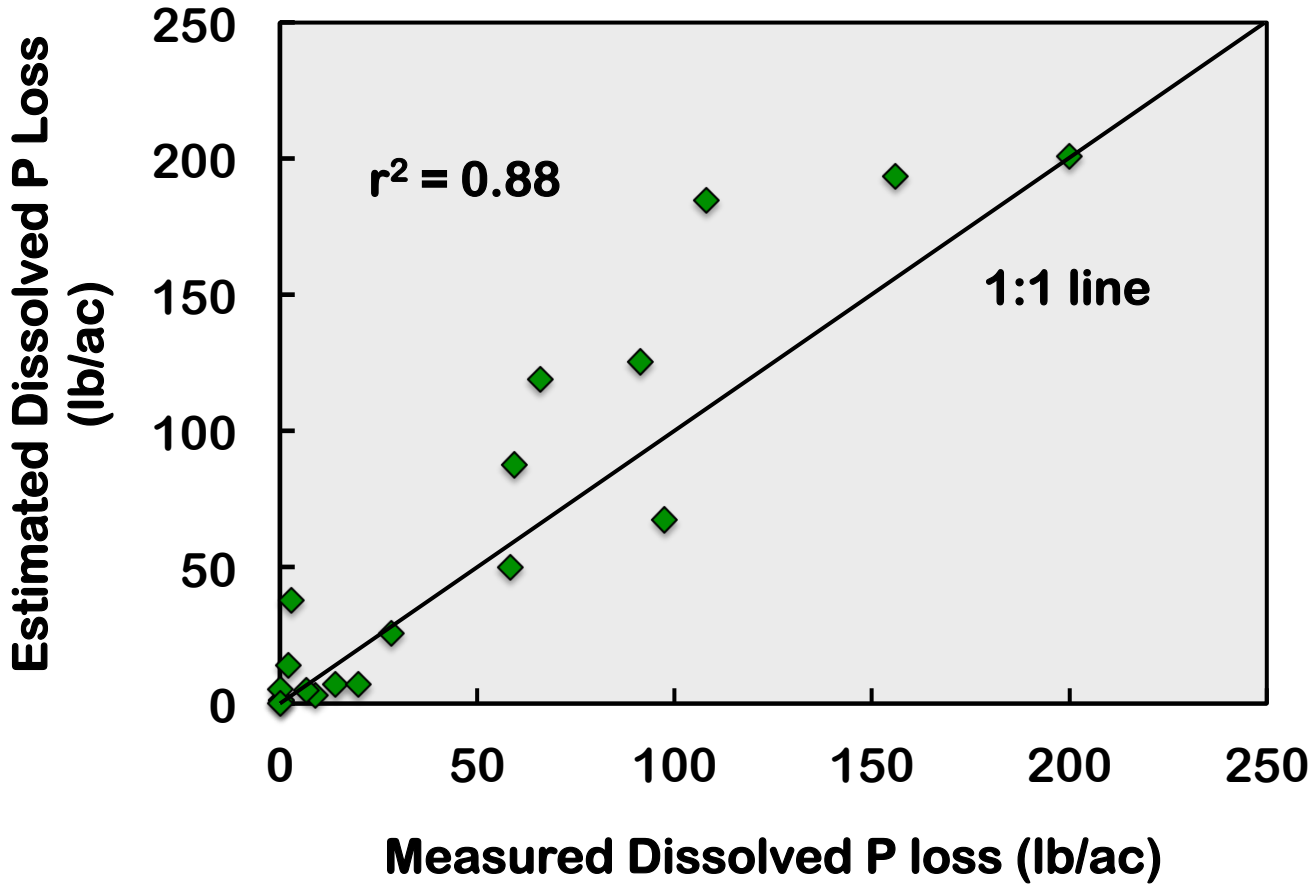
- Solid-bound P loss = Eroded solids loss x solids P content
- For paved lots, P content equal to manure P content (book values)
- For earthen lots, assume solids is 30% manure and 70% soil. Soil P content is an input. 30/70 ratio increases too 0/100 as % area covered by manure decreases.

Dissolved P Loss Estimation

- Estimate dissolved P loss for each precipitation event
- Based on amount of precipitation and amount of manure
- Dissolved P loss decreases with fewer cattle, more frequent cleaning

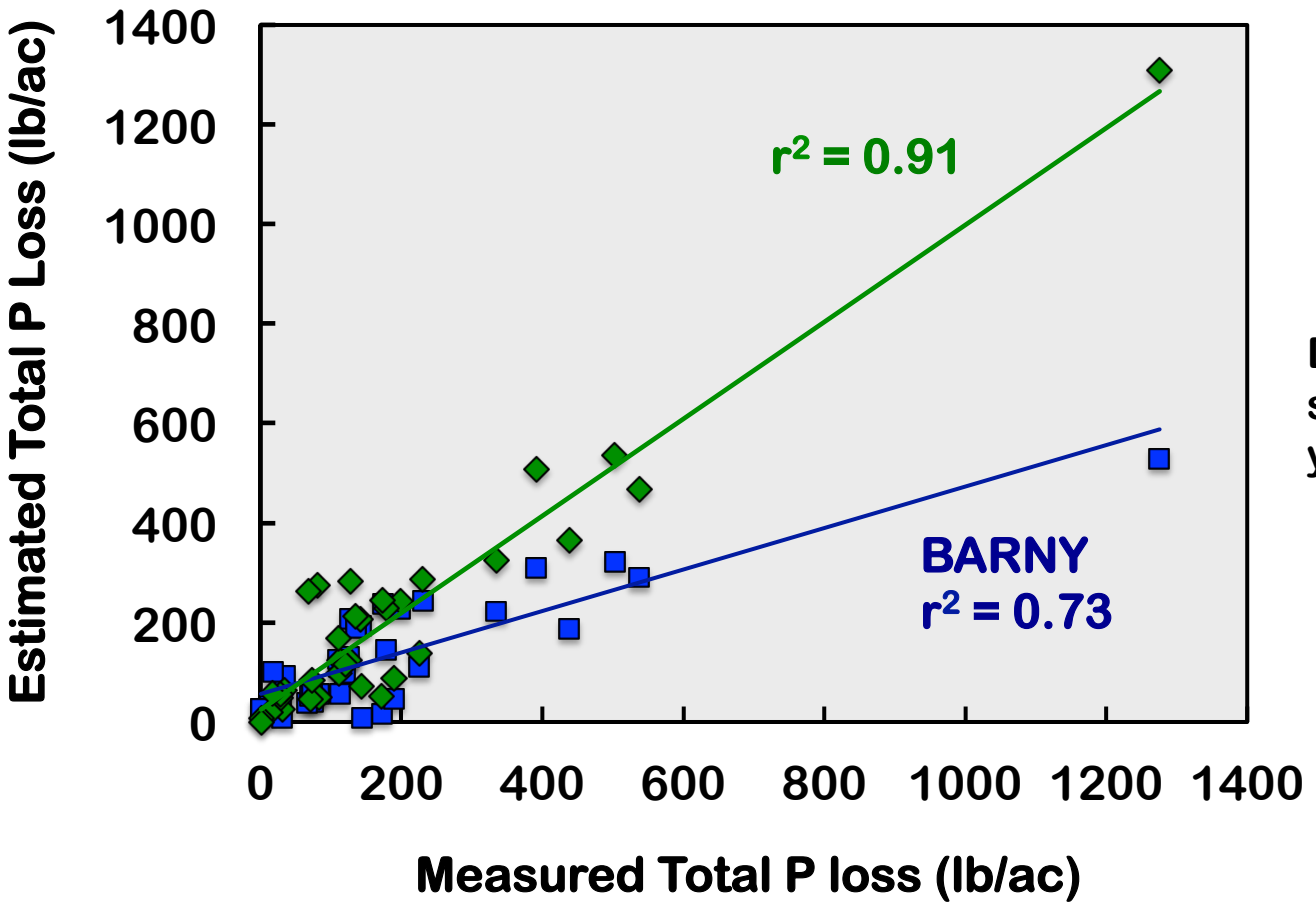


Dissolved P Loss Testing



Data from 6 studies, 19 site years

Total P Loss Testing

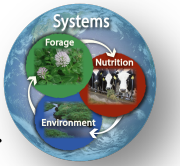


Data from 12 studies, 35 site years

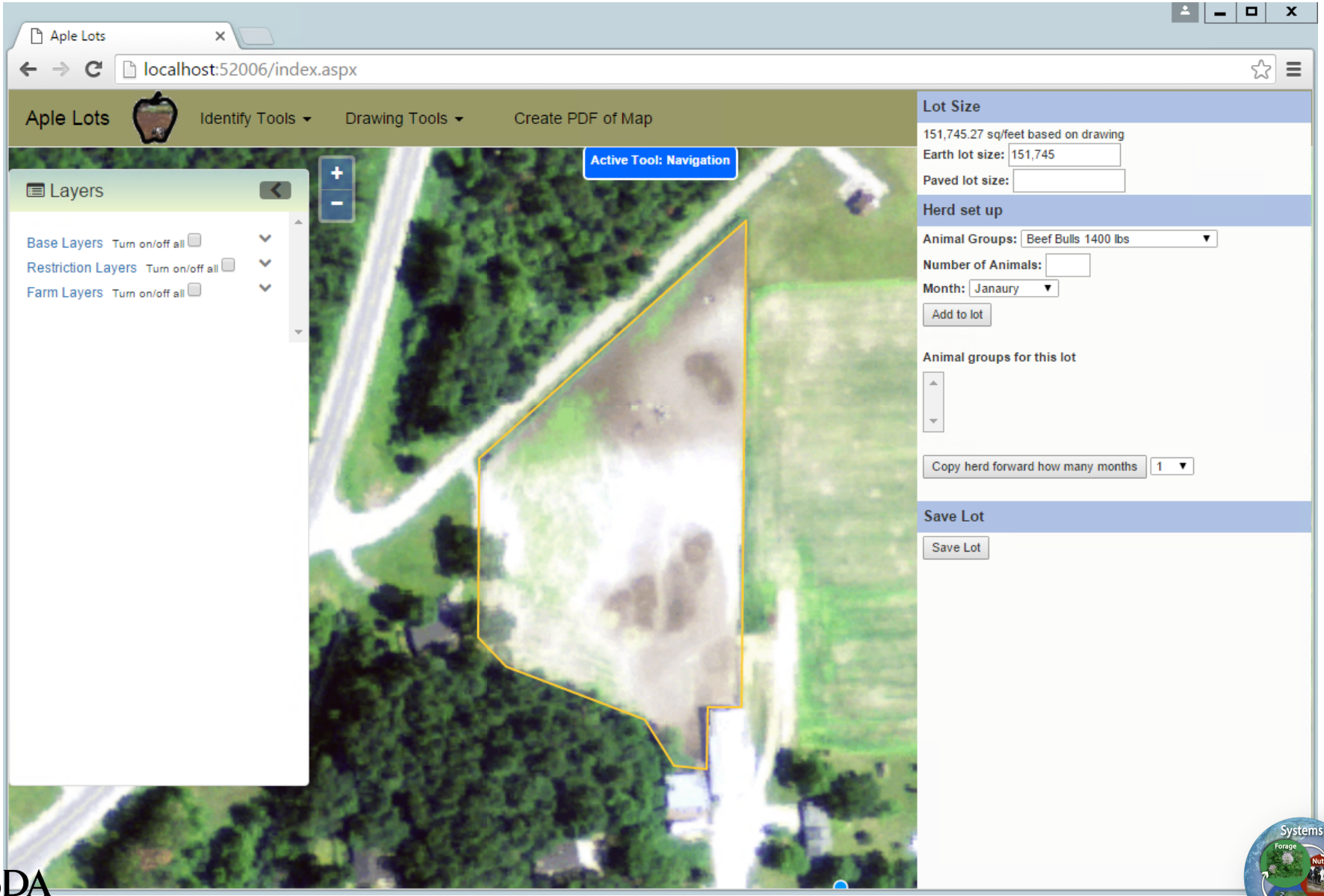
- BARNY overestimates at lower P loss, underestimates at higher P loss; because it uses constant P concentration (65 ppm) in runoff
- New model more accurate across range of P loss scenarios

Lot P Loss Tool Development

- Collaboration between USDA-ARS Dairy Forage Research Center, UW Soils and BSE departments
- Develop web-based software platform for tool that estimates annual sediment and P loss from cattle lots
  - Barnyards, exercise lots, over-winter areas
- Uses
  - Design of treatment options
  - Screen and ranking lots for remediation
  - TMDL, Adaptive Management assessment
  - Pre- and post-BMP assessment
- Conditions and Practices
  - Lot type, current management, off-site water input
  - Settling ponds, earthen diversions, gutters, designed filter strips



Lot Model Mock-up



Questions?

http://www.ars.usda.gov/Services/docs.htm?docid=25452

(APLE-Lots; Excel spreadsheet tool for basic edge-of-lot P loss)