



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

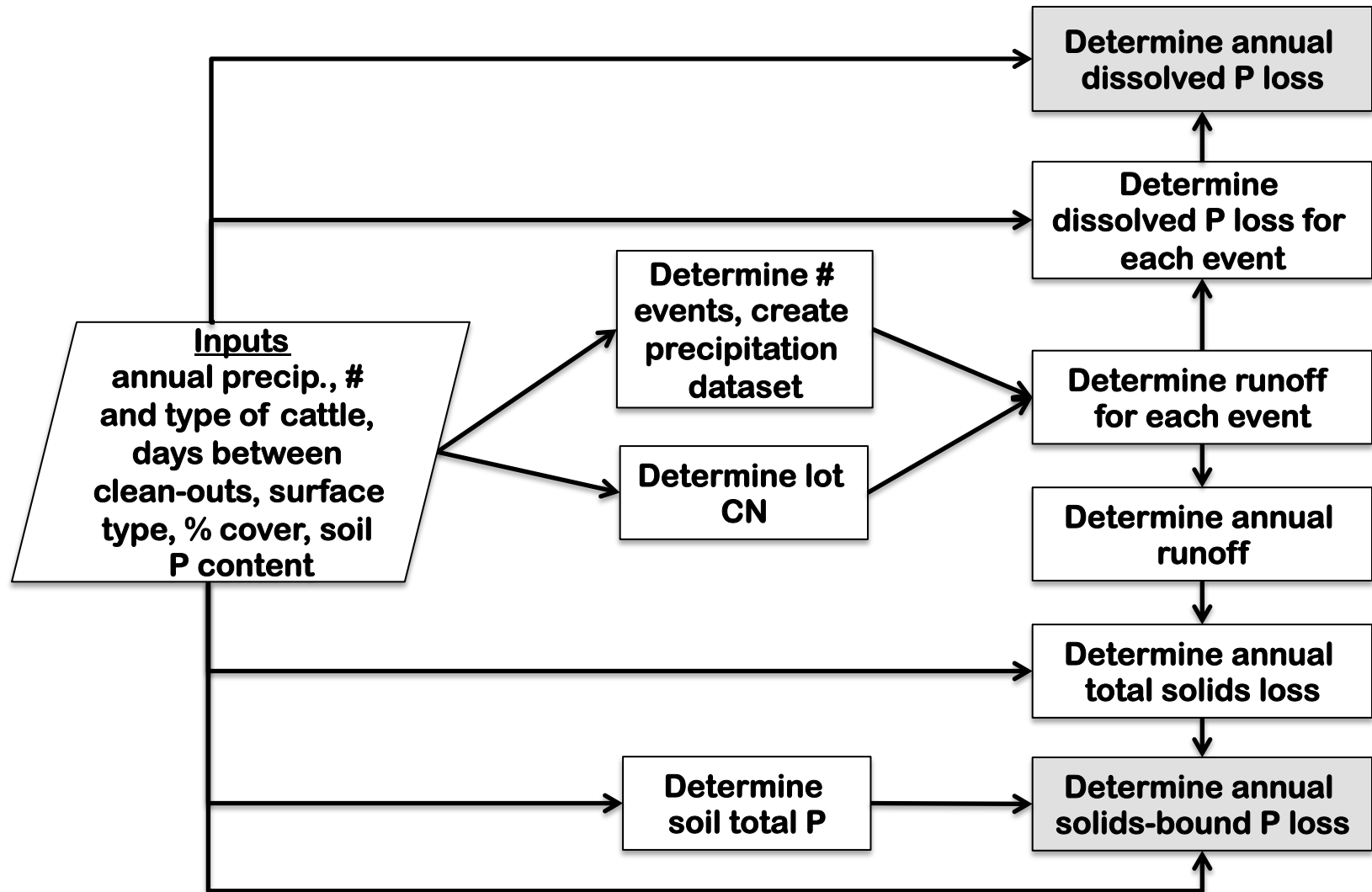
- ❑ Estimate P loss from outdoor lots
- ❑ Is P loss from lots excessive, especially relative to other land uses?
 - ❑ 100 acres of corn silage at 4 lb/ac P loss = 400 lbs P; 15% reduction = 60 lb P
 - ❑ 0.25 acre barnyard at 200 lb/ac P loss = 50 lb P; 100% reduction?
- ❑ How much can alternative management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

Research Need

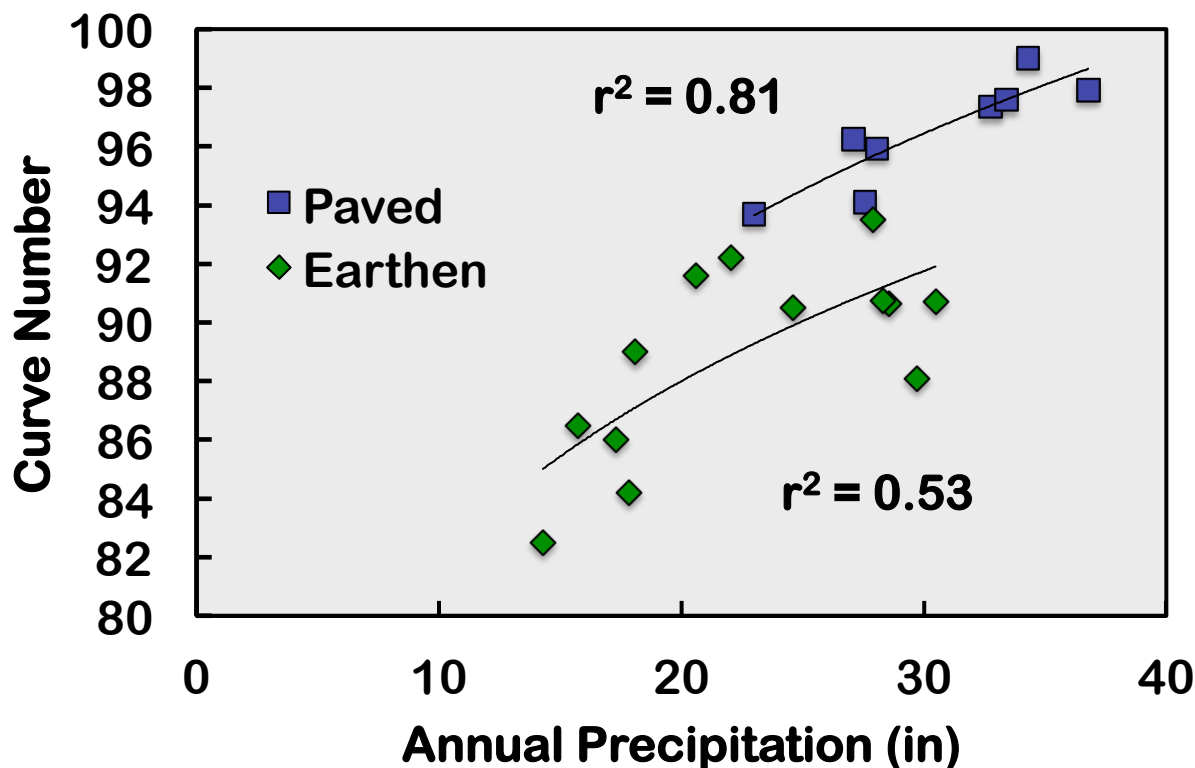
- ❑ Develop new tool to estimate P loss from barnyards and lots
- ❑ Test tool with data from studies monitoring P loss from lots
- ❑ Compare new tool with current WI lot P loss estimator (BARNY)



New Cattle Lot P Runoff Model



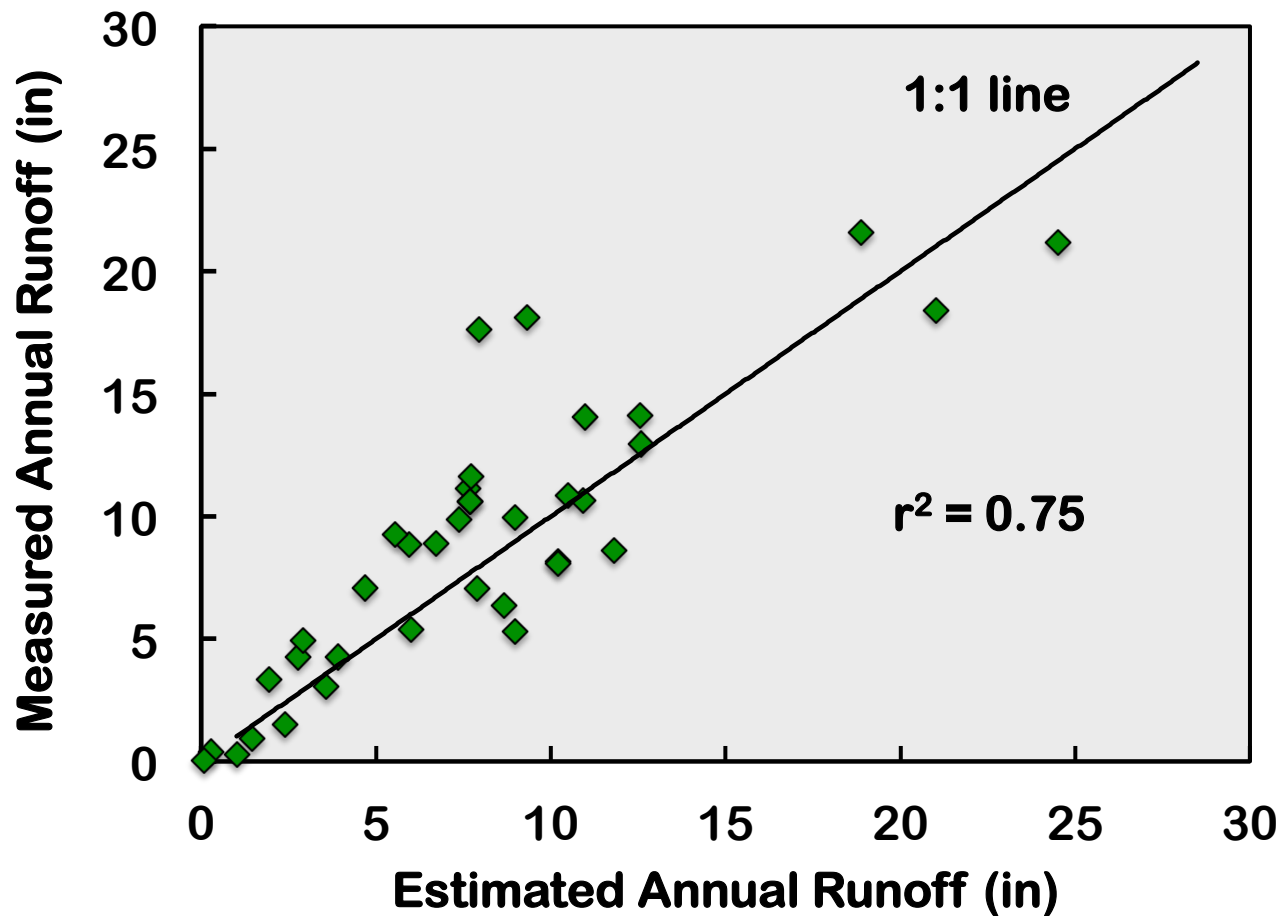
Runoff Estimation



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

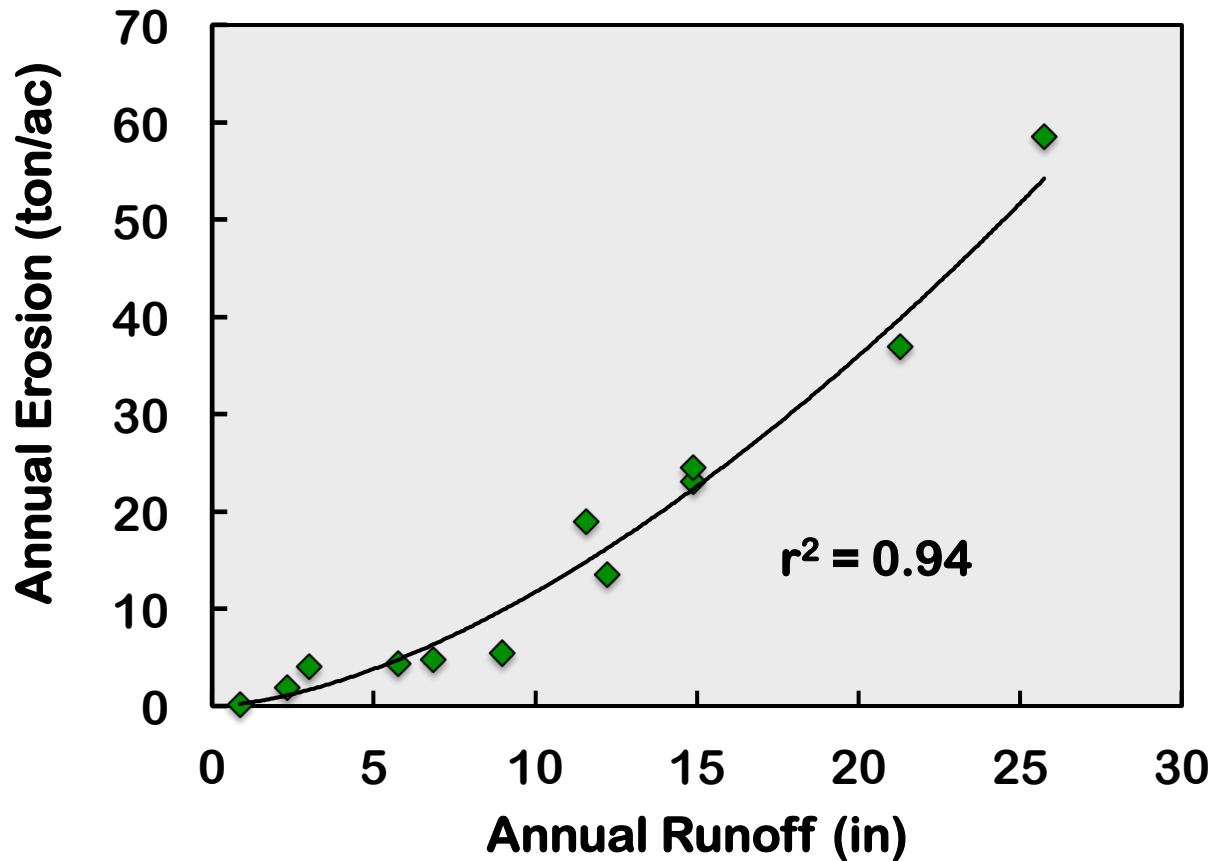
- CN is widely-used method to estimate runoff; greater CN means more estimated runoff
- Model uses CN to estimate runoff for each precipitation event, sums all events for annual runoff (no accounting for snow or frozen conditions)
- For paved lots, runoff decreases as % of lot area covered by manure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

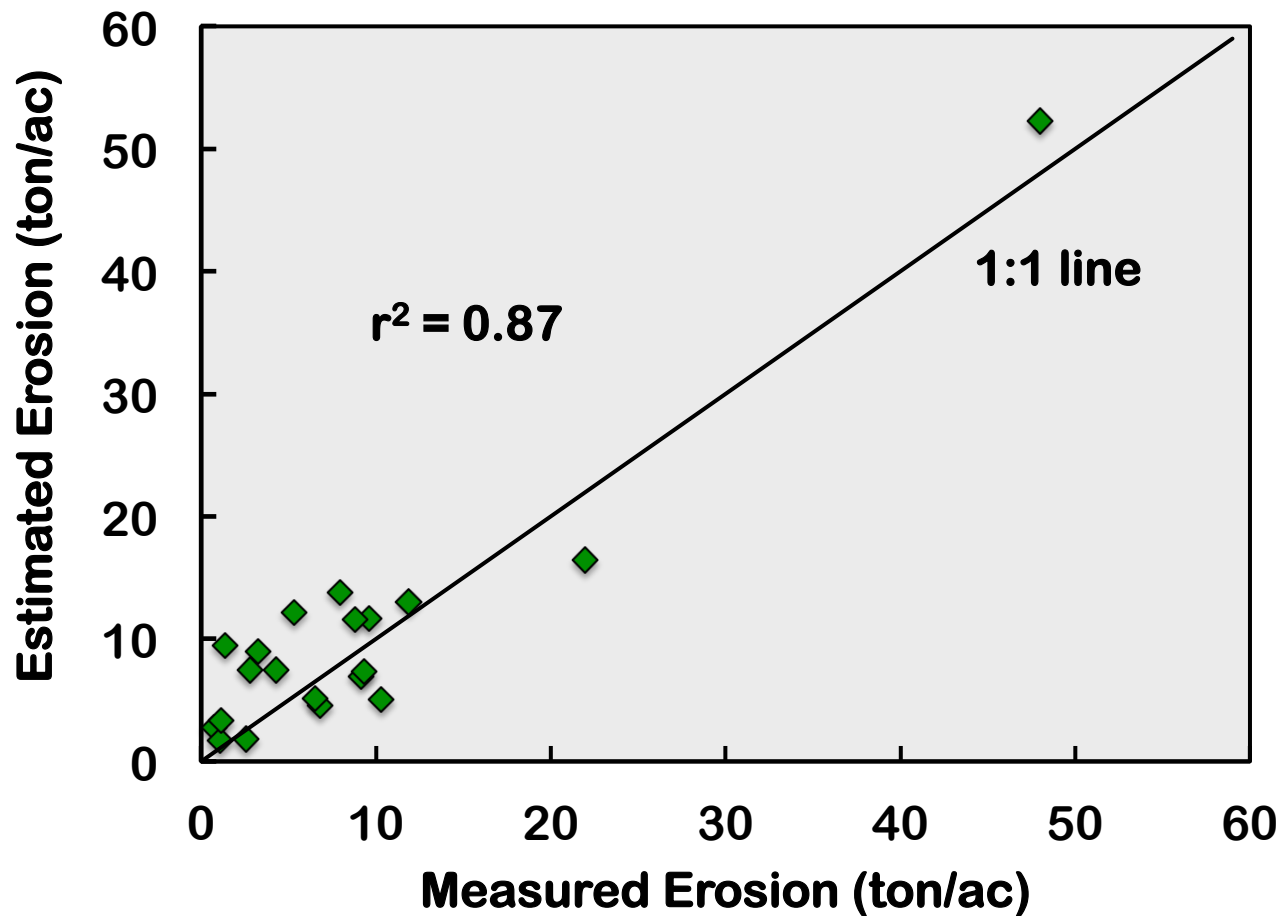
Erosion Estimation



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

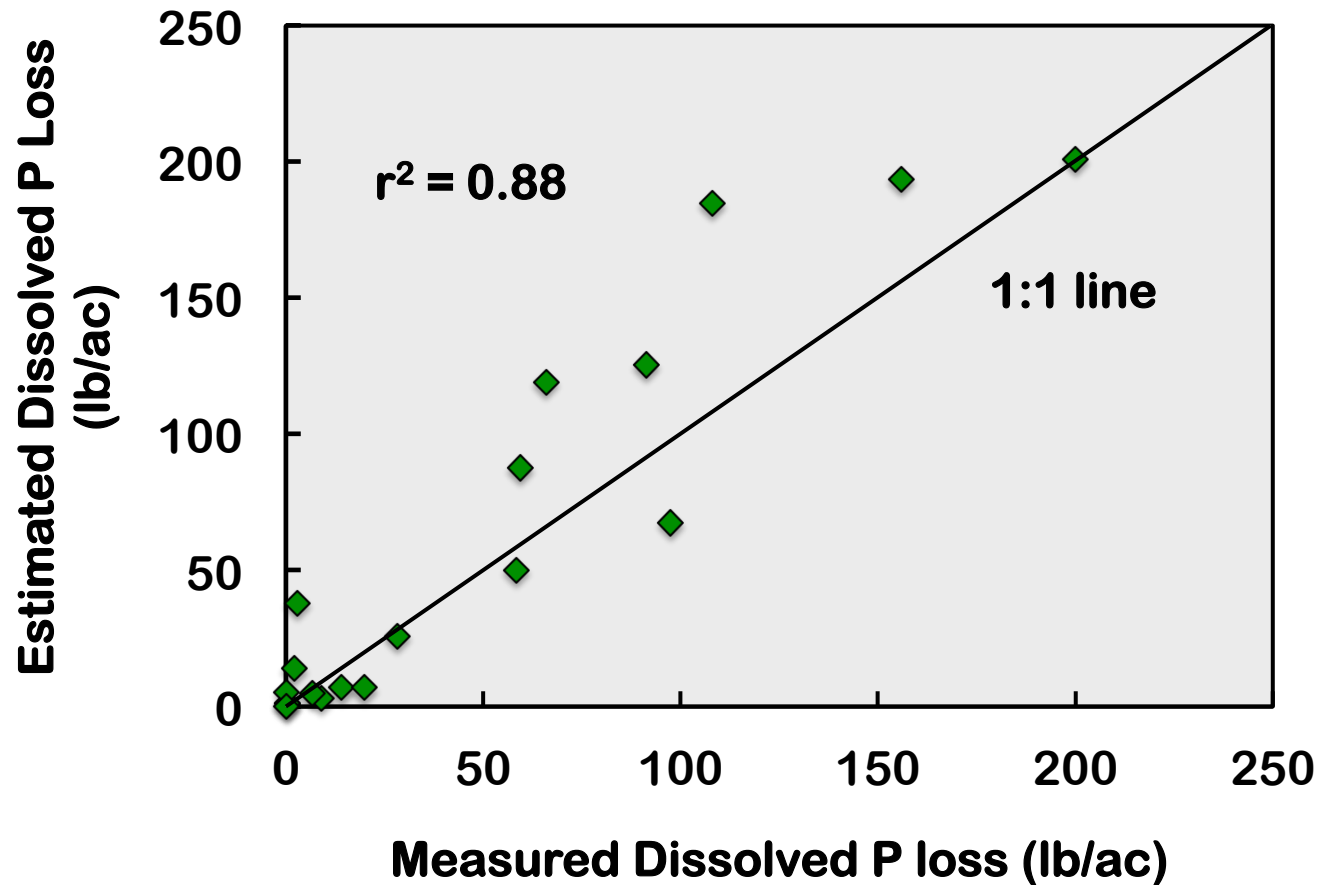
Solids-bound P Loss Estimation

- ❑ 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

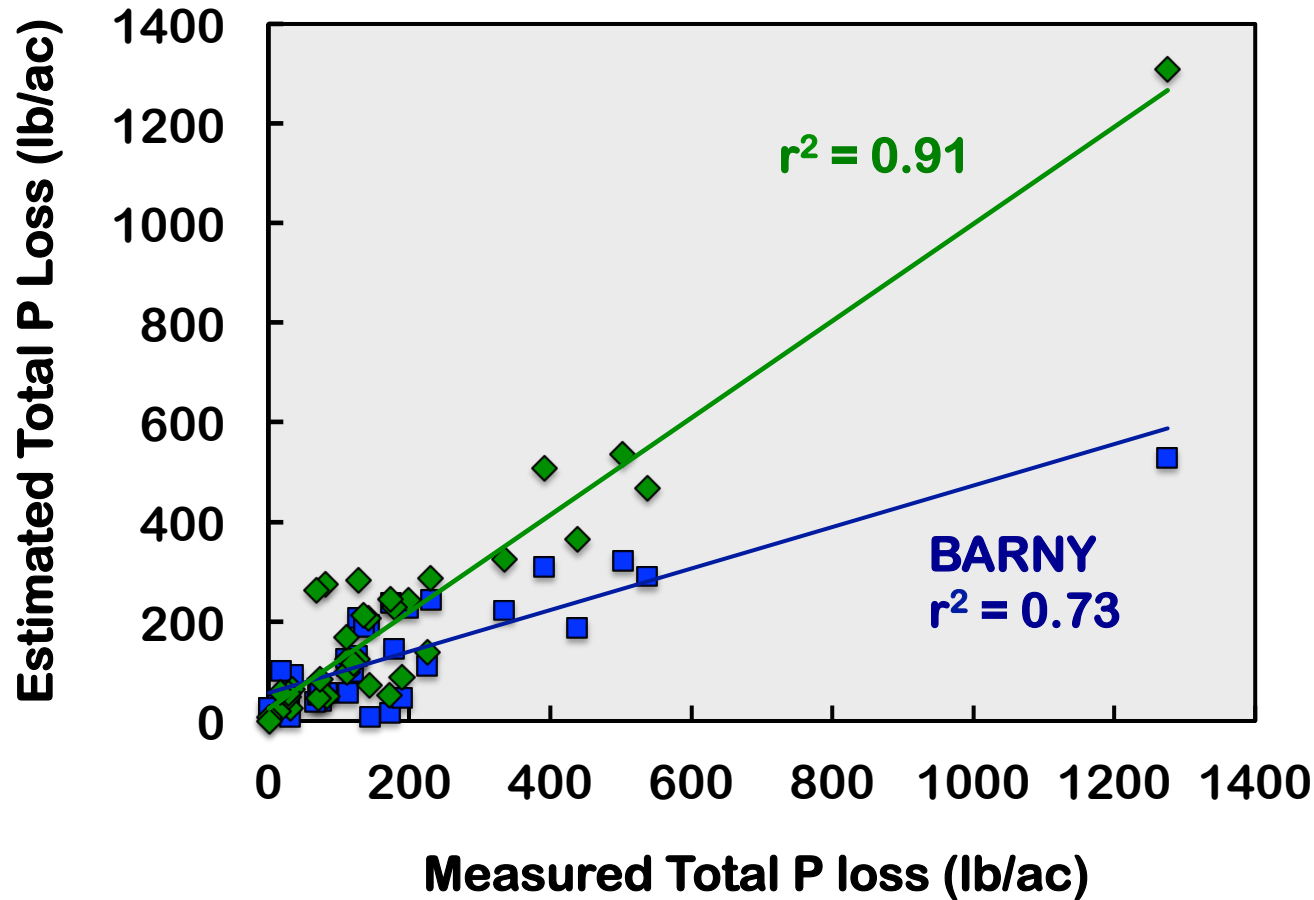
- ❑ Estimate dissolved P loss for each precipitation event
- ❑ Based on amount of precipitation and amount of manure
- ❑ Dissolved P loss decreases with fewer cattle, more frequent cleaning

Dissolved P Loss Testing



Data from 6 studies, 19 site years

Total P Loss Testing

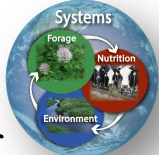


Data from 12 studies, 35 site years

- 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

The screenshot displays the 'Aple Lots' web application interface. The browser window shows the URL 'localhost:52006/index.aspx'. The application header includes the 'Aple Lots' logo, navigation links for 'Identify Tools', 'Drawing Tools', and 'Create PDF of Map', and a status bar indicating 'Active Tool: Navigation'.

The main interface is divided into three sections:

- Layers Panel (Left):** Contains a list of layers with checkboxes for 'Turn on/off all':
 - Base Layers
 - Restriction Layers
 - Farm Layers
- Map (Center):** An aerial view of a rural landscape with a yellow polygon outlining a specific lot. A blue button labeled 'Active Tool: Navigation' is positioned above the map.
- Configuration Panel (Right):** Contains several sections for lot management:
 - Lot Size:** Displays '151,745.27 sq/feet based on drawing'. Input fields for 'Earth lot size: 151,745' and 'Paved lot size:' are present.
 - Herd set up:** Includes a dropdown for 'Animal Groups' (set to 'Beef Bulls 1400 lbs'), a text input for 'Number of Animals:', a dropdown for 'Month' (set to 'January'), and an 'Add to lot' button.
 - Animal groups for this lot:** A vertical list box for selecting animal groups.
 - Copy herd forward how many months:** A text input followed by a dropdown set to '1'.
 - Save Lot:** A 'Save Lot' button.

Questions?

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

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



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