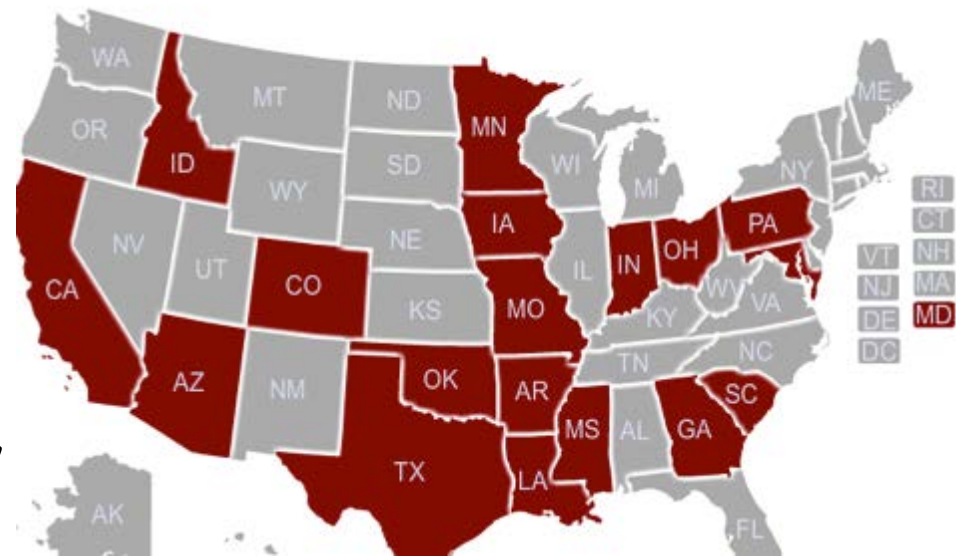


# *Problem Area 2*

## **Erosion, Sedimentation, and Water Quality**



### *ELUCIDATE PROCESSES*

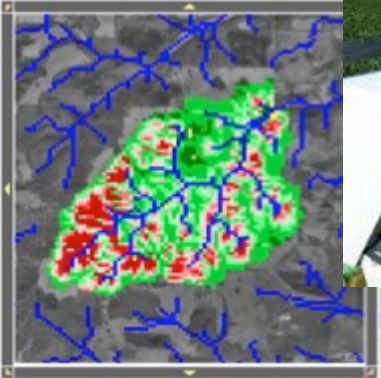
Field scale fate and transport

### *PREDICT IMPACT*

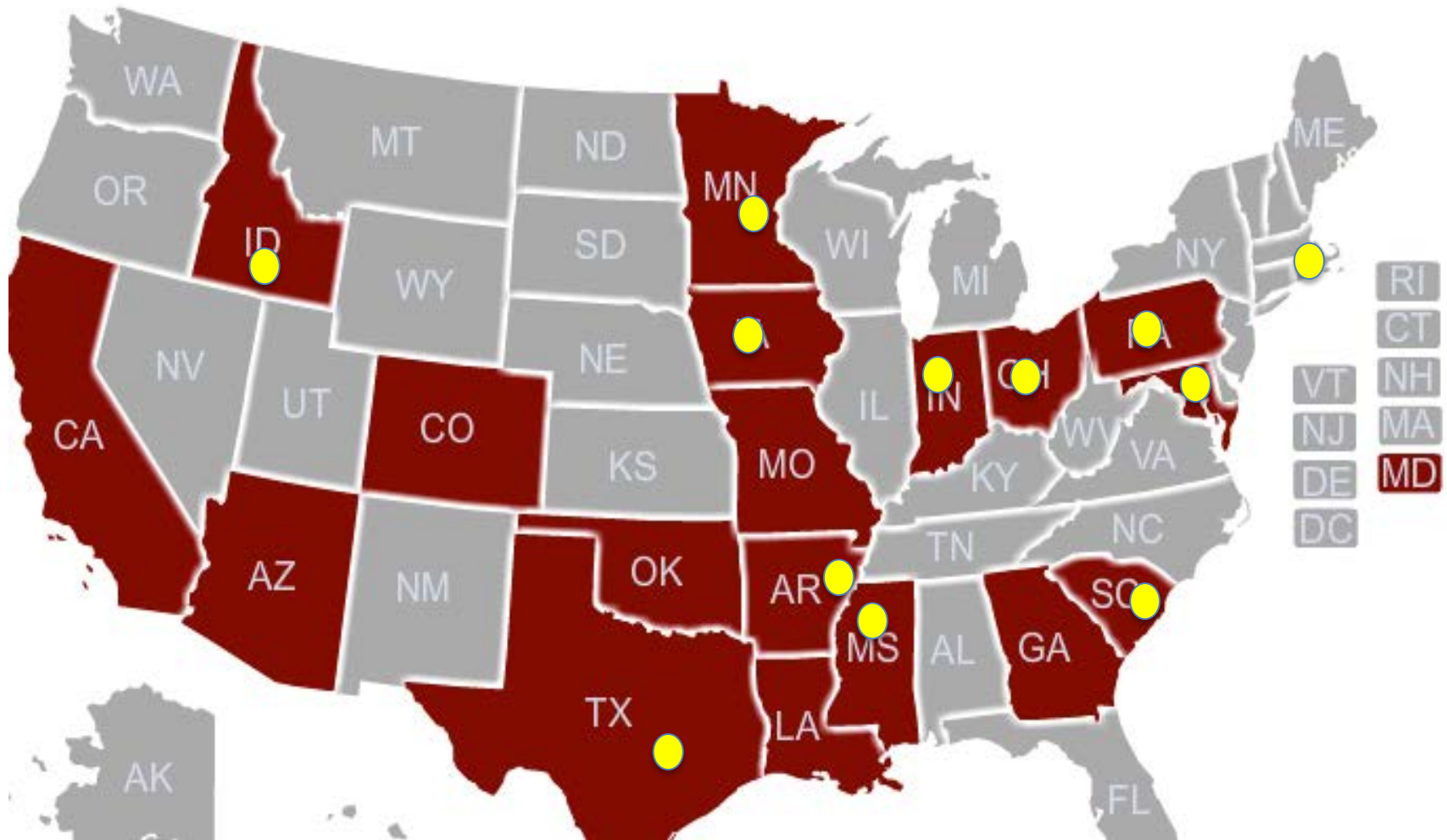
Water quality and ecological response

### *DEVELOP AND TEST TOOLS*

For agriculture, urban and turf systems



# *UNDERSTANDING AND MANAGING PHOSPHORUS LOSS IN DRAINAGE WATERS*



# Lake Erie - *Reminder of a global issue*

TOLEDO NEWS  
**NOW**

NEWS WEATHER SPORTS VIDEO TRAFFIC THIS MORNING

## Health Department: Those with sensitive skin, liver disease should avoid showering

Posted: Aug 02, 2014 11:35 PM EDT  
Updated: Aug 03, 2014 10:21 AM EDT

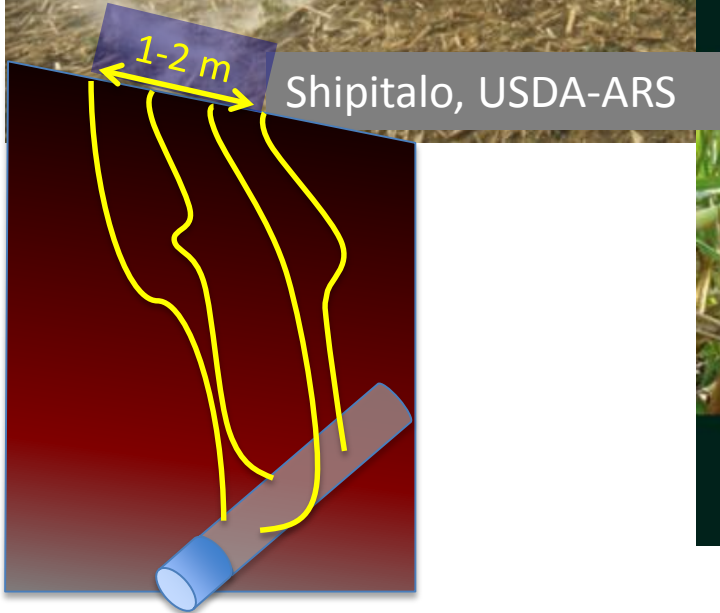
By Nick Bade



Toledo,  
OH



# Mechanisms



Shipitalo, USDA-ARS

# ARS's foundational science

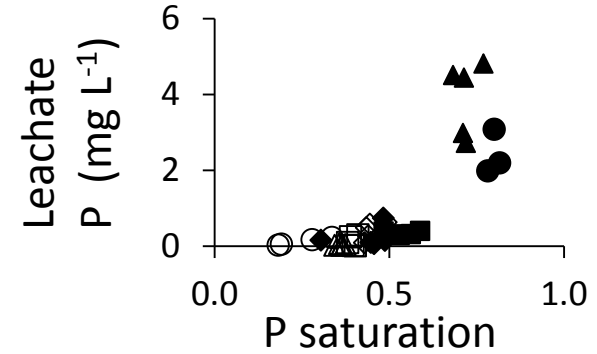


State of science  
(North America, Europe,  
S. Pacific)  
ARS – 9/17 papers



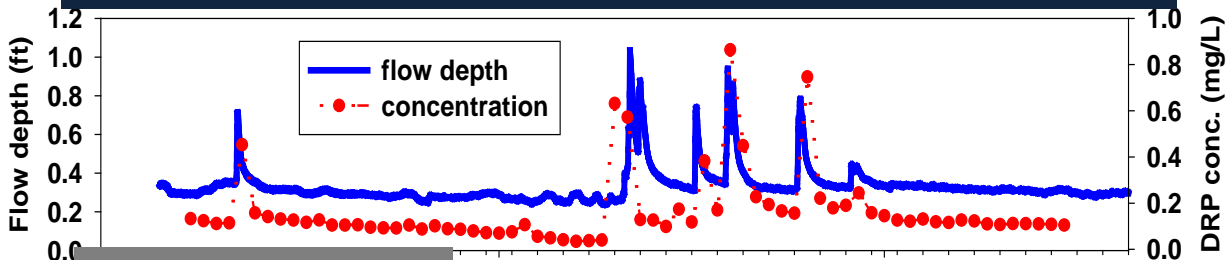
March, 2015

# Indicators



Kleinman, USDA-ARS

# Dynamics – similarities to surface runoff



King, USDA-ARS

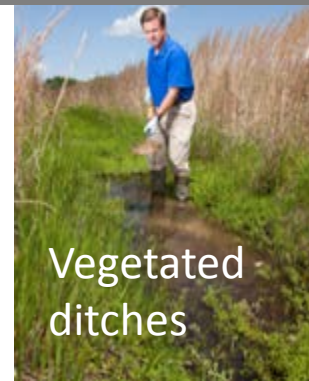
# ARS leadership in P management

*sources, drainage, strategies*



Gypsum filters

Moore, USDA-ARS



Vegetated ditches



Bryant, USDA-ARS



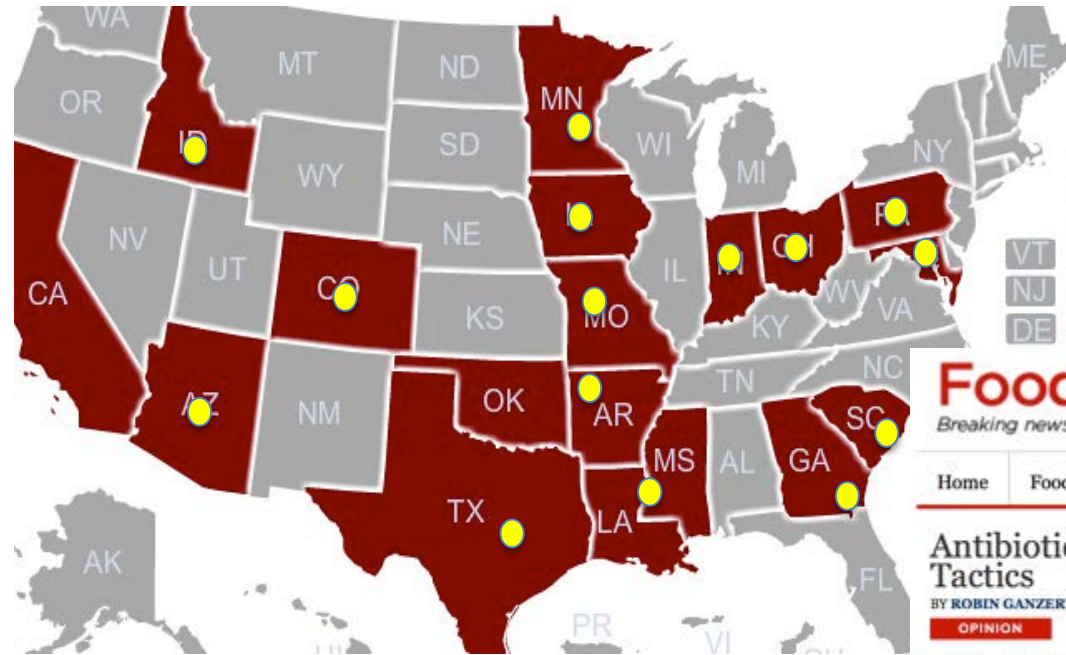
Blind Inlets

Livingston, USDA-ARS

## Gov. Hogan rolls out new phosphorus management plan



# PESTICIDES AND EMERGING CONTAMINANTS



Moving from  
“gotcha” to “got it”

## Food Safety News

Breaking news for everyone's consumption

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### Antibiotic Use Deserves Serious Conversation, Not Scare Tactics

BY ROBIN GANZERT | MAY 1, 2015

OPINION

The recent release of the Food and Drug Administration's report on antibiotic sales brought a round of calls from certain advocacy groups to ban the use of antibiotics in animal agriculture. These advocates remind me of another crowd: the anti-vaccination movement. Both the groups pushing for an antibiotic-free animal agriculture and the “anti-vaxxers” ignore established science on their respective issues in a way that leads to diminished human and animal welfare.

We certainly should have a debate about the judicious use of antibiotics in agriculture, but jumping to an outright ban defies science and common sense, will cause more animal suffering, and may have adverse effects on public health.

While those pushing for an outright ban are on the fringe, concerns about antibiotic-resistant bacteria in agriculture are starting to hit the mainstream. In the American Humane Association's 2014 Humane Heartland Farm Animal Welfare Survey, more than half of the respondents indicated that they seek out food labeled “Antibiotic



*Foundation science:  
occurrence, fate and  
transport*

*Better management*

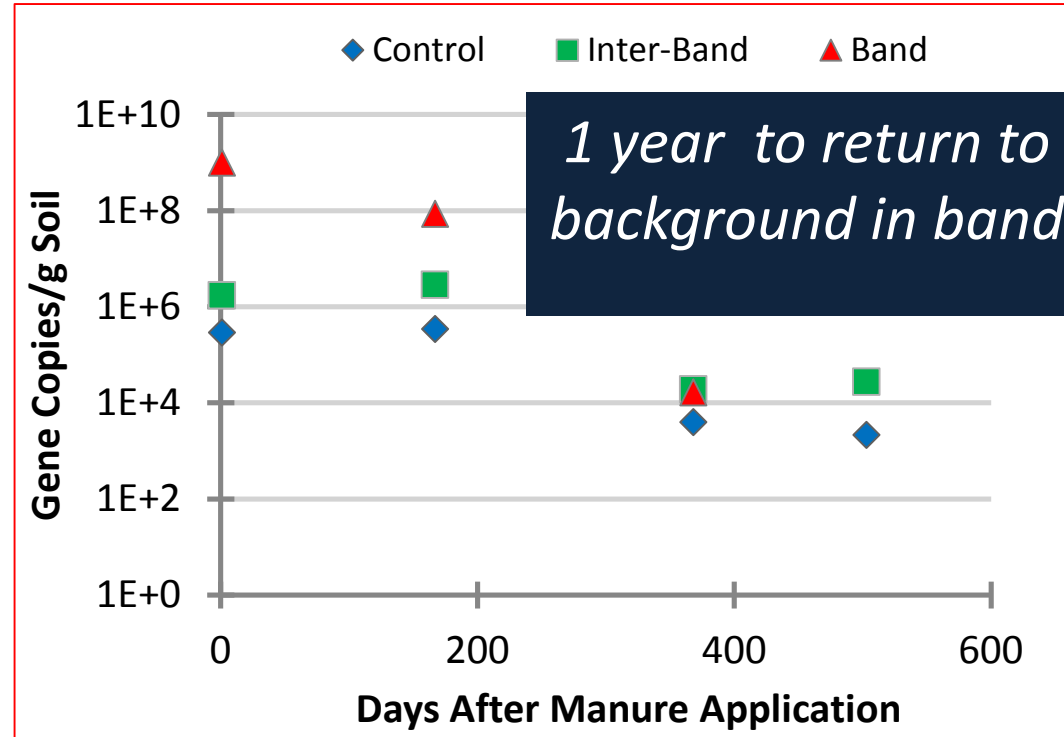
# PESTICIDES AND EMERGING CONTAMINANTS

## ANTIBIOTICS AND RESISTANCE GENES

Does antibiotic use in animal agriculture affect resistance in clinical settings?



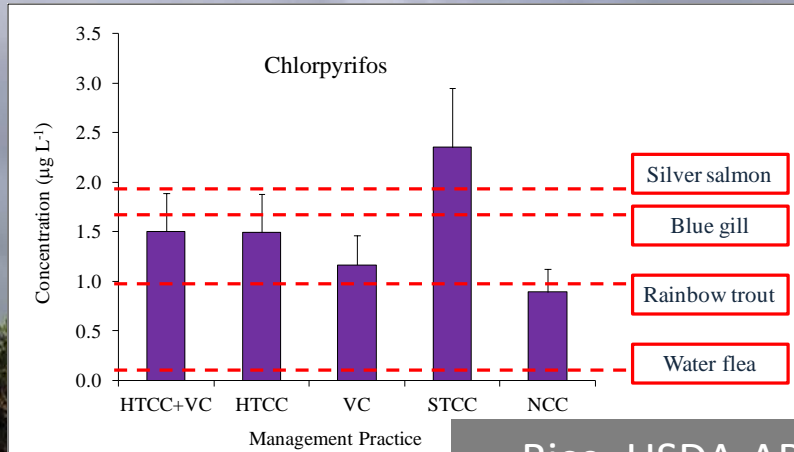
*Erm* genes confer resistance to macrolide antibiotics (tylosin, erythromycin)



*Erm* increased in drainage waters in wet years, not dry or average moisture years

**STRATEGIES TO ELIMINATE LOSSES?**  
(avoid, control, trap)

# MINIMIZING PESTICIDE AND NUTRIENT TRANSPORT IN RUNOFF FROM TURF



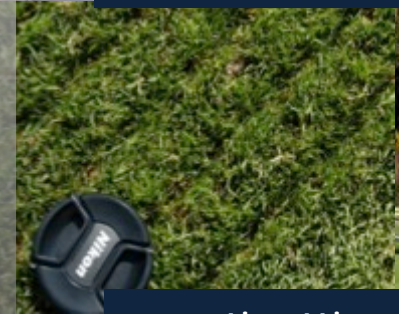
Rice, USDA-ARS

Best



hollow tine  
core cultivation

Better



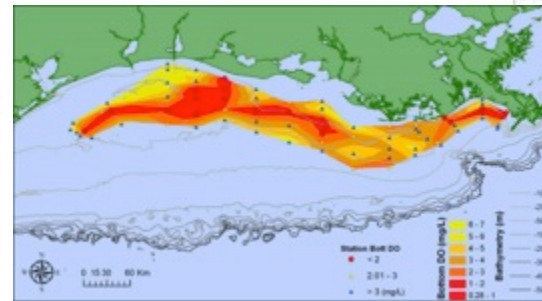
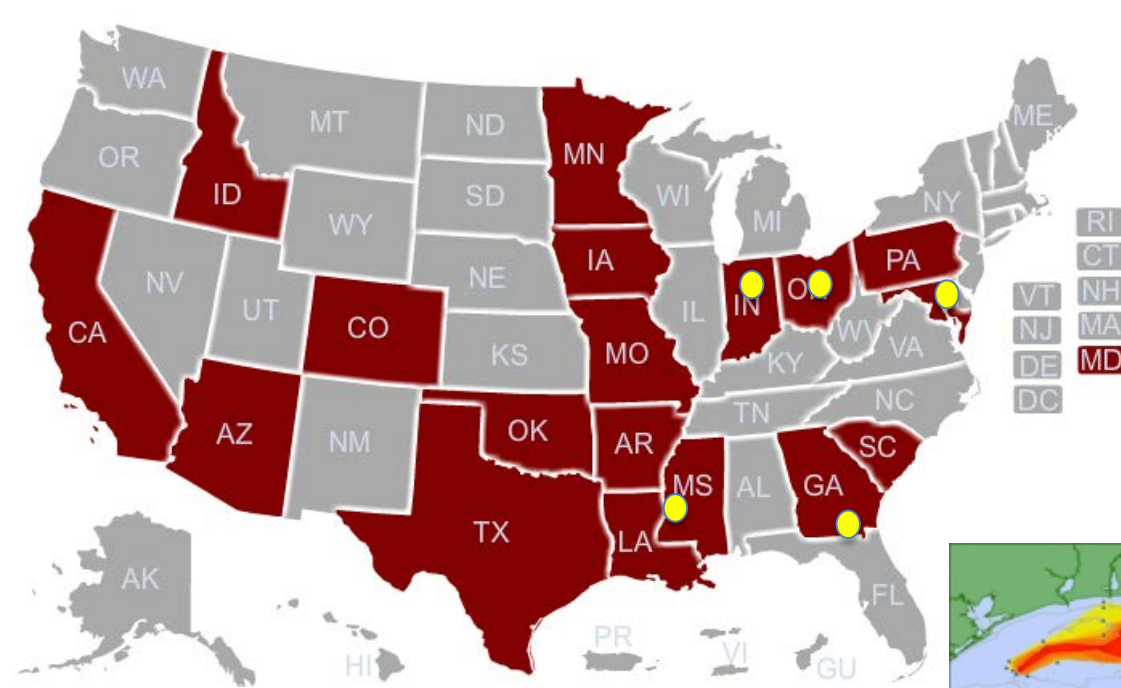
verticutting



solid tine core  
cultivation



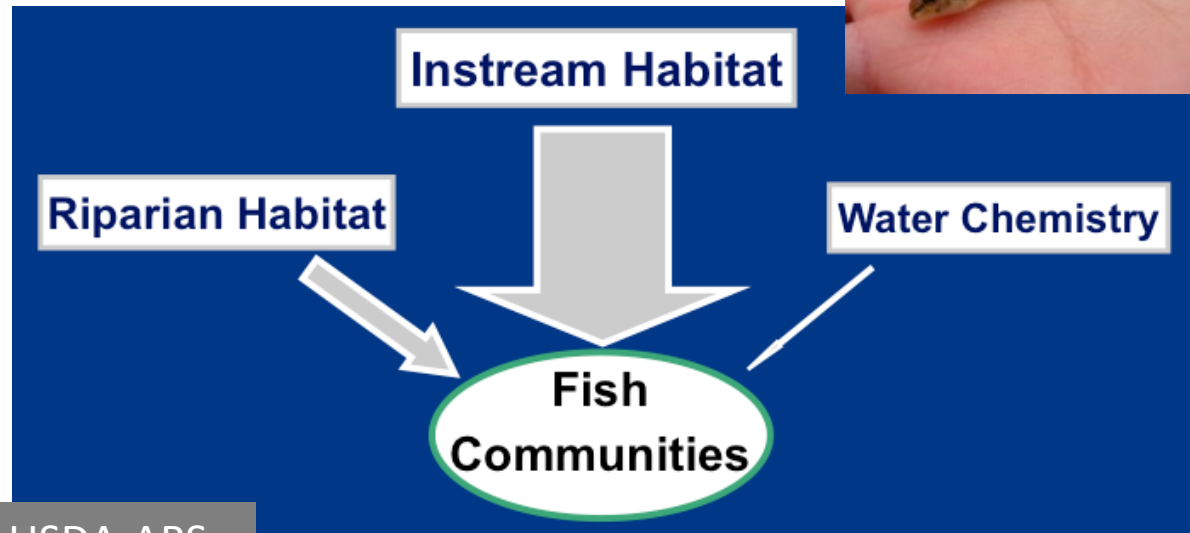
# ECOLOGICAL RESPONSE TO WATER QUALITY CHANGES



How can agriculture contribute to healthy aquatic ecosystems and improve ecosystem services?

# FOUNDATIONAL SCIENCE: HABITAT AND CHEMISTRY EFFECTS ON AQUATIC ECOSYSTEMS

*Fishes are more strongly influenced by physical habitat than by water chemistry*



Conservation strategies improving both habitat **and** water quality in agricultural streams provide greater ecological benefits than those that improve water quality alone

# INTRODUCING WETLAND SERVICES IN DRAINED SYSTEMS

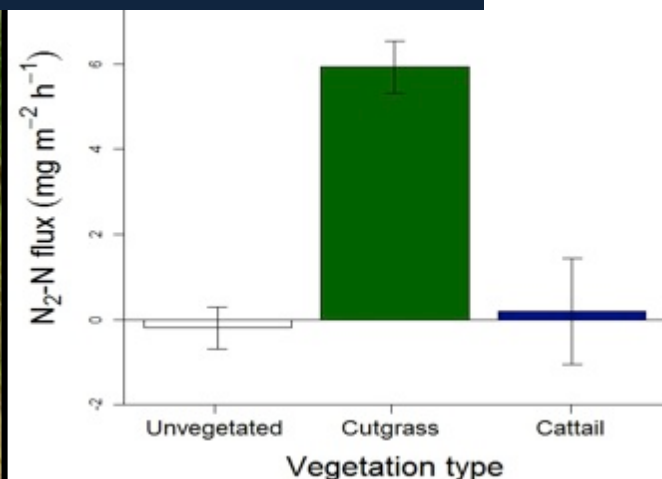
Sediment trap pond

Low-head weir and vegetation

Lizotte, USDA-ARS

Cutgrass enhanced denitrification

Moore, USDA-ARS



Taylor, USDA-ARS

Greater residence time and chemical removal – *drainage control structures*

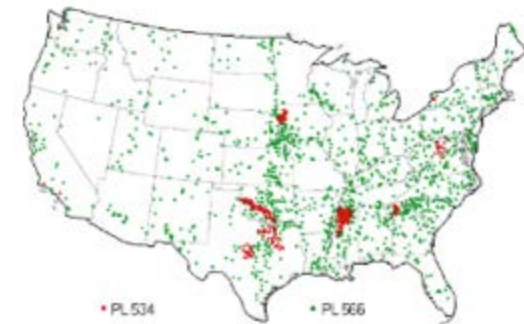
Improved biotic interactions, nutrient removal and sediment retention - *vegetation selection*

# MODELING TO PREDICT EROSION, SEDIMENTATION AND WATER QUALITY



## RESERVOIR REHABILITATION

### USDA ASSISTED FLOOD CONTROL DAMS



Modeling to support  
better management

*Sedimentation*  
*Water demand*  
*Risks*

**USDA supported construction of  
>11,000 dams since 1948**

*\$15 billion infrastructure*  
*\$2 billion benefits annually*  
*50 to 100 yr design life*

# DAM AND RESERVOIR MANAGEMENT

Roller spillways and dissipator basins



New design guidelines:

- *Greater spillway capacity*
- *Overtopping protection*
- *Greater life expectancy*

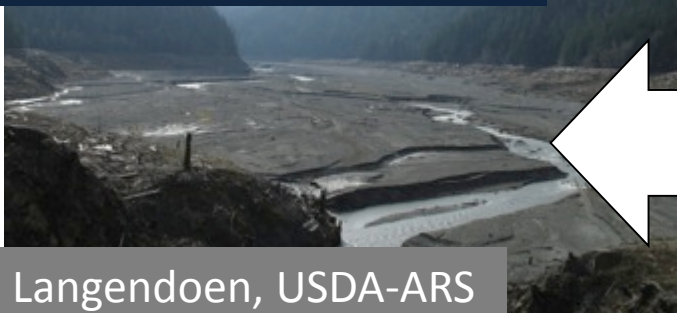
Embankment erosion



New algorithms for WinDam:

- *Prioritize rehabilitation*
- *Better flood warning systems*
- *Better emergency action plans*

Sediment erosion



Additions to CONCEPTS and TELEMATAC :

- *Better simulation of reservoir incision and stabilization*
- *Better flood risk assessment*

# RHEM

## The Rangeland Hydrology and Erosion Model



**RHEM Web Tool** Rangeland Hydrology and Erosion Model Web Tool

Hello, Mark Log Out Account

Home About Documentation Contact Us

Now: Wed, May 13 2015

**INPUT PARAMETERS**

1. Define Scenario [?](#)

Clear Scenario [?](#)

Name: Mountainair NM B [?](#)

Description:

Select units: Metric:  English:  [?](#)

Display User Scenarios [?](#)

Manually Edit Model Input File [?](#)

2. Climate Station [?](#)

3. Soil Texture Class [?](#)

4. Slope [?](#)

5. Cover Characteristics [?](#)

6. Run Scenario [?](#)

7. Compare Scenarios [?](#)

**RESULTS**

Download results as CSV [?](#)

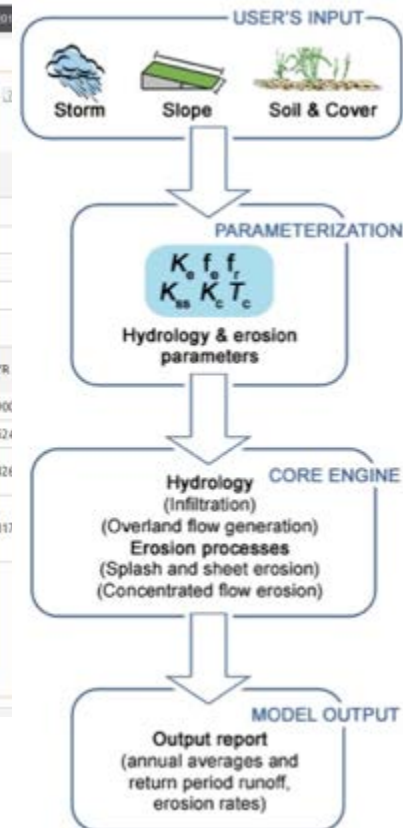
ANNUAL AVERAGES

	MOUNTAINAIR NM B						
Avg. Precipitation (mm/year)	337.850						
Avg. Runoff (mm/year)	25.352						
Avg. Sediment Yield (ton/ha/year)	5.942						
Avg. Soil Loss (ton/ha/year)	6.208						

RETURN FREQUENCY RESULTS [?](#)

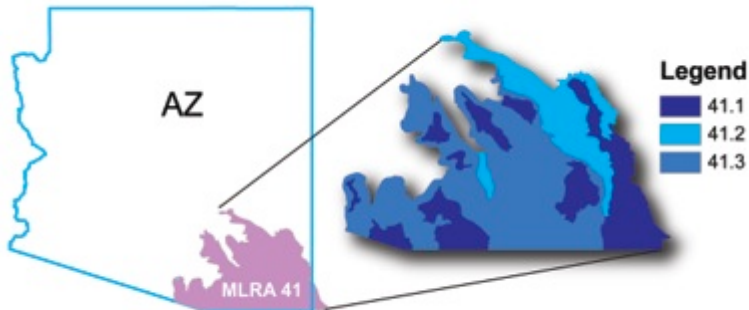
VARIABLE	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Rain (mm)	36.800	52.500	66.700	77.700	85.600	86.900
Runoff (mm)	10.983	22.438	32.572	42.576	45.840	48.521
Soil Loss (ton/ha)	2.488	4.744	6.502	8.435	9.754	10.821
Sediment Yield (ton/ha)	2.461	4.712	6.481	8.286	9.753	10.811

Ran scenario in 48.528 seconds.



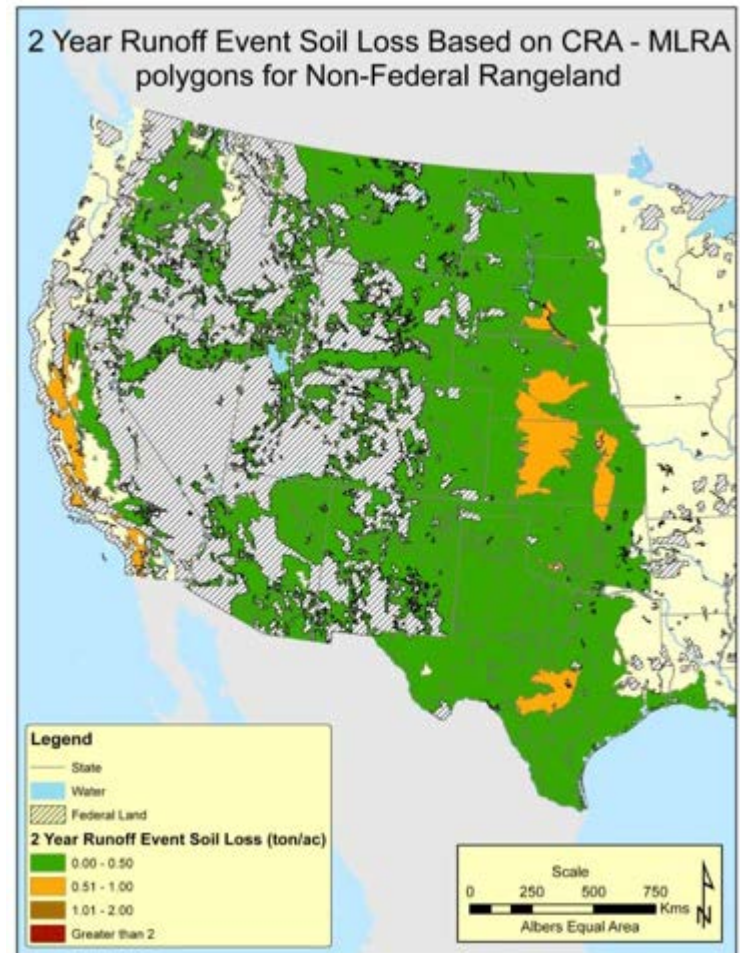
# RHEM

Methods were developed to use RHEM  
to predict erosion rates for NRI data



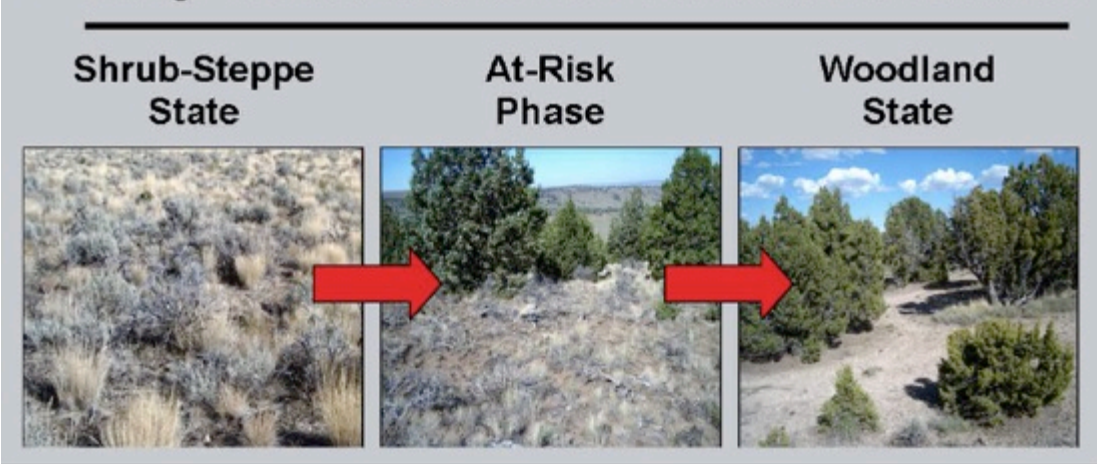
Methodology worked out in Tucson  
on MLRA 41

Was used for NRI and RCA Reports  
2011/2012 (ARS Reno & Tucson)

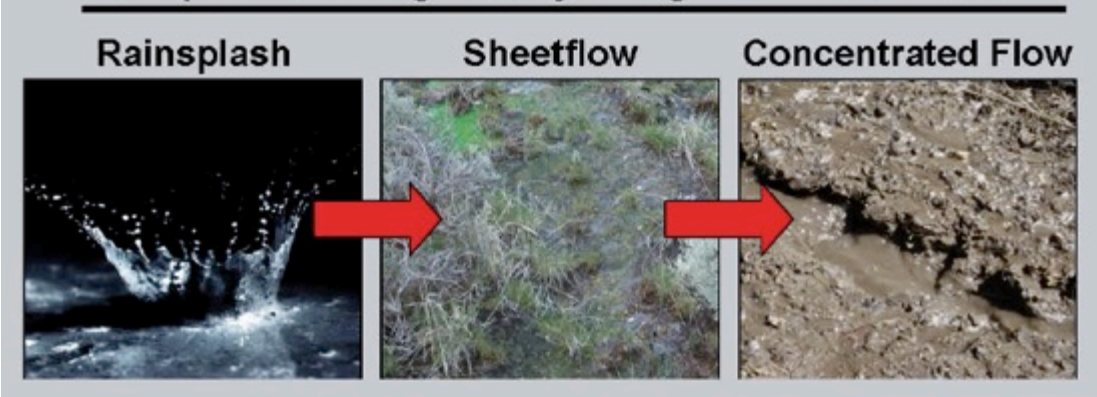


Are being developed by NRCS, BLM, and FS across the western US.

### A Change in Biotic Structure with Woodland Encroachment



### B Respective Changes in Hydrologic/Erosion Function



Credit: Jason Williams, Fred Pierson, Boise, ID: South Slopes 12-16 PZ" Ecological Site Malheur High Plateau Mountain Land Resource Area (MLRA 23, USDA 2006)

