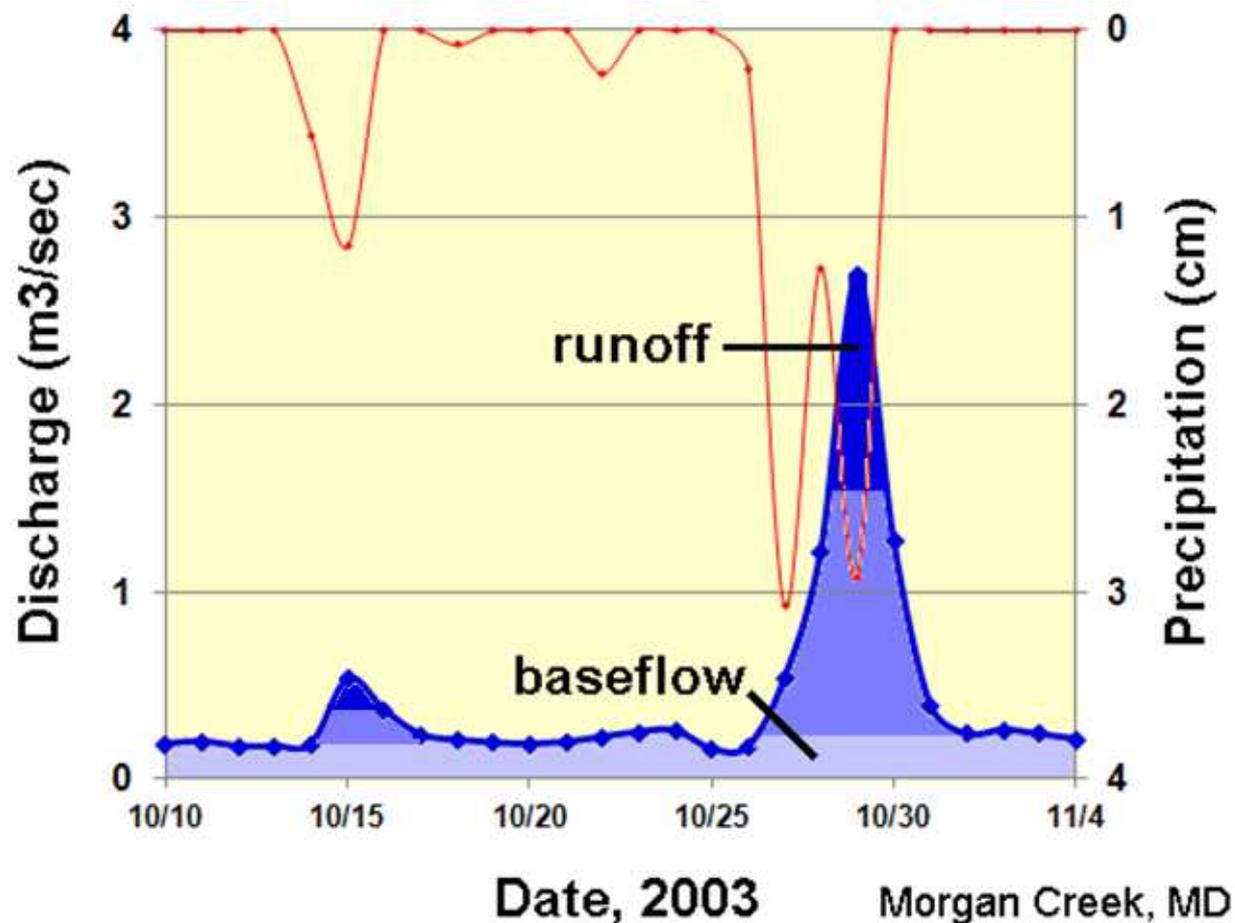

NAWQA Cycle 3: Integrated Watershed Studies



Integrated Watershed Studies

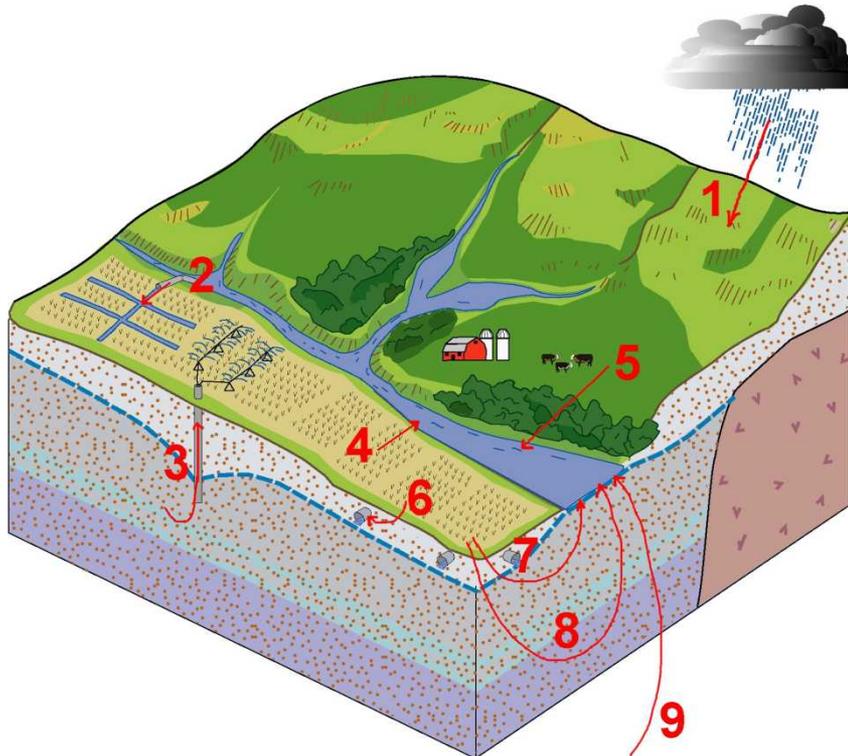
The water in the stream is an integration of the water that moves through the various hydrological compartments.



Integrated Watershed Studies

QUESTION

How do natural and anthropogenic factors influence the flux of nutrients and sediment in surface and groundwater at the watershed scale?



INTEGRATION OF ...

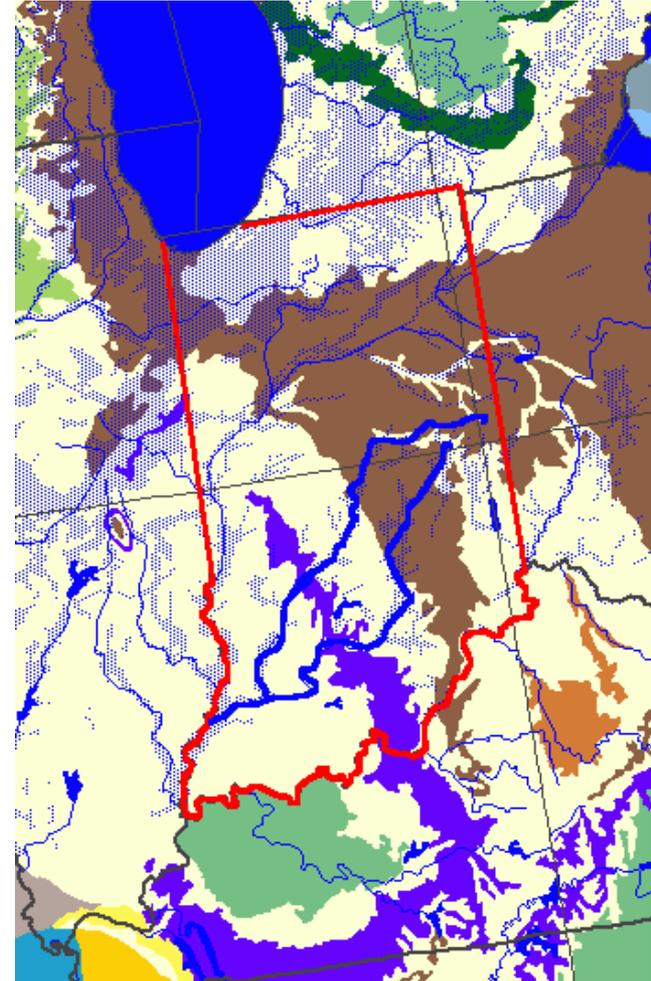
- Hydrologic compartments
- Monitoring
 - Discrete data
 - Continuous data
- Modeling
 - Statistical based
 - Process based
- Process understanding

Integrated Watershed Studies

SPATIAL CONTEXT



**Example:
White River, IN**



Integrated Watershed Studies

SCOPE

<u>Over the decade: 2013-2023</u>	Science Plan	Current Plan
Number of Basins	8 - 10	3 - 4
Number of Modeled Basins	8 - 10	3 - 4
Number of New-Data Basins	4	1
Targeted Constituents	N,P,C,SS, contaminants	N,P,C,SS

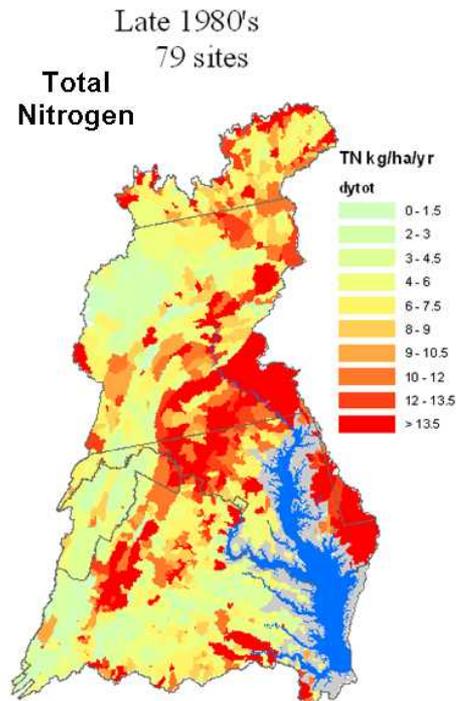
Integrated Watershed Studies

CONTRIBUTIONS

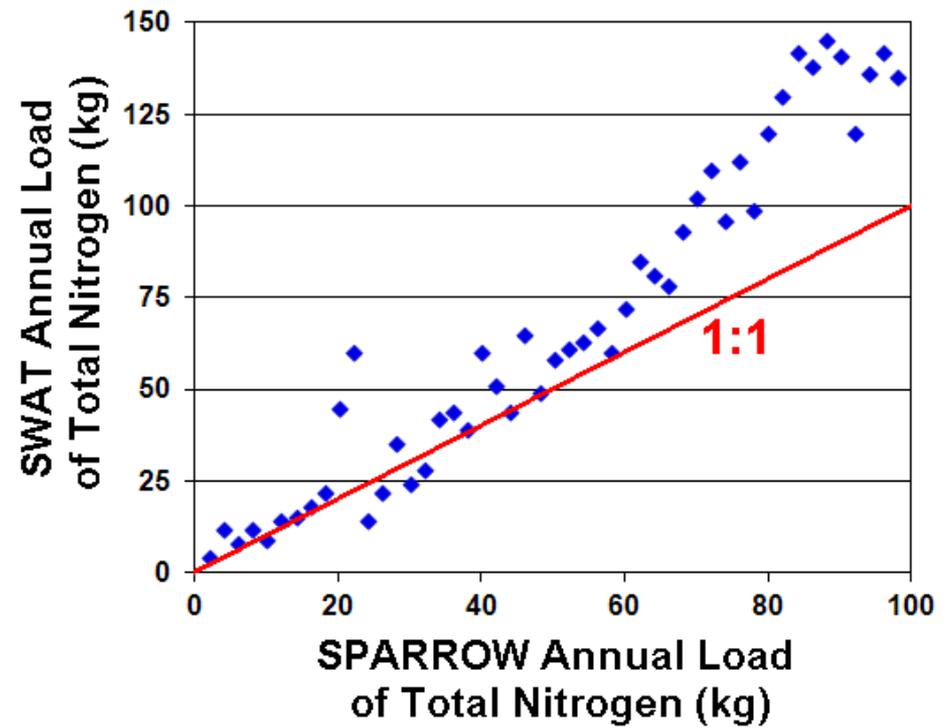
MODEL COMPARISONS ...

What are the various models telling us?

Incremental Yield All Sources



Brakebill and others



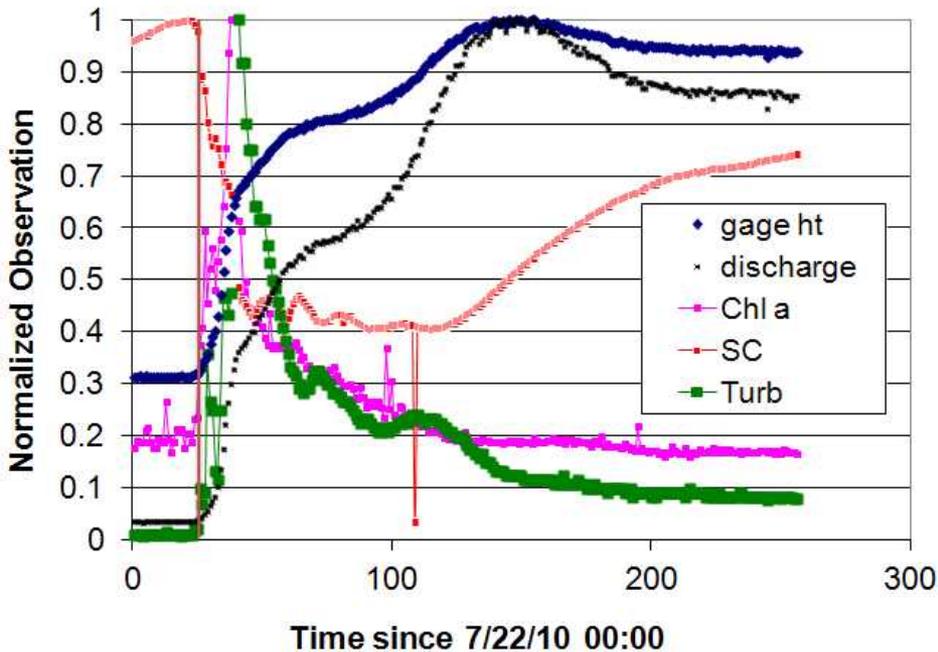
Pretend results

Integrated Watershed Studies

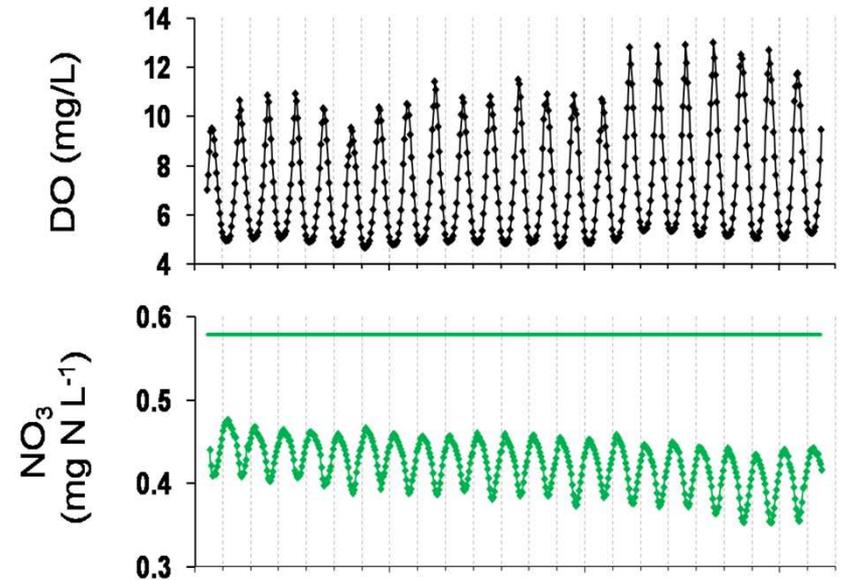
CONTRIBUTIONS

CONTINUOUS DATA ...

What understanding / utility can we get from these data?



South Fork River (at NP), IA

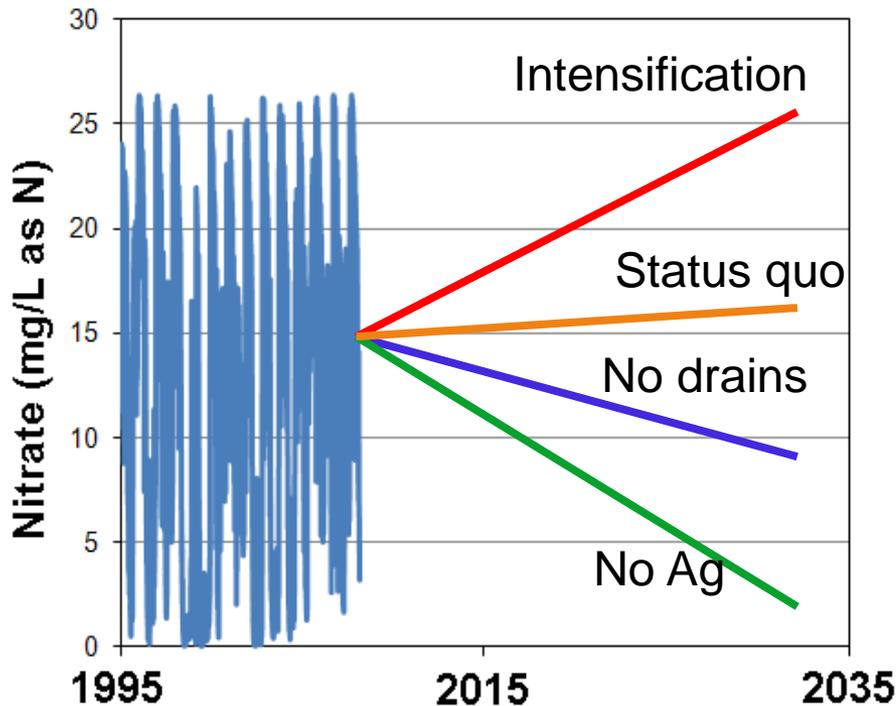


Heffernan and Cohen 2010

Integrated Watershed Studies

CONTRIBUTIONS

FORECASTING ... What are the futures?



Changes in ...

Climate

Land use

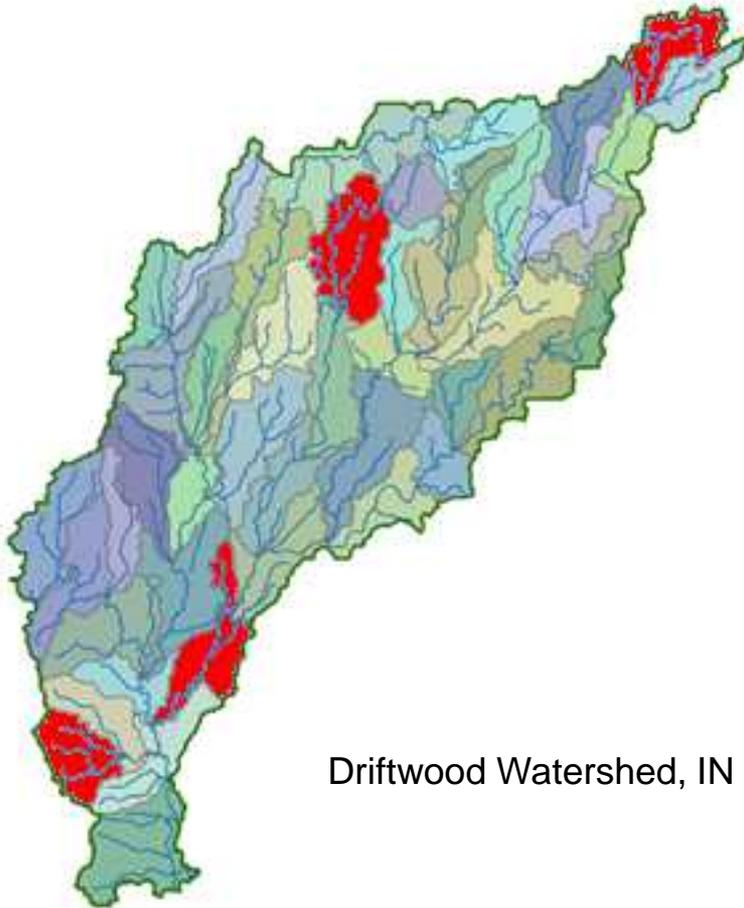
Management practices

South Fork River (at NP), IA

Integrated Watershed Studies

CONTRIBUTIONS

EXTRAPOLATION BETWEEN LOCAL BASINS...



MODEL INTERROGATION ...

Process understanding
Lag times, legacy effects
Intelligent monitoring

MODEL ADVANCEMENT ...

Dynamic SPARROW

Real-time modeling

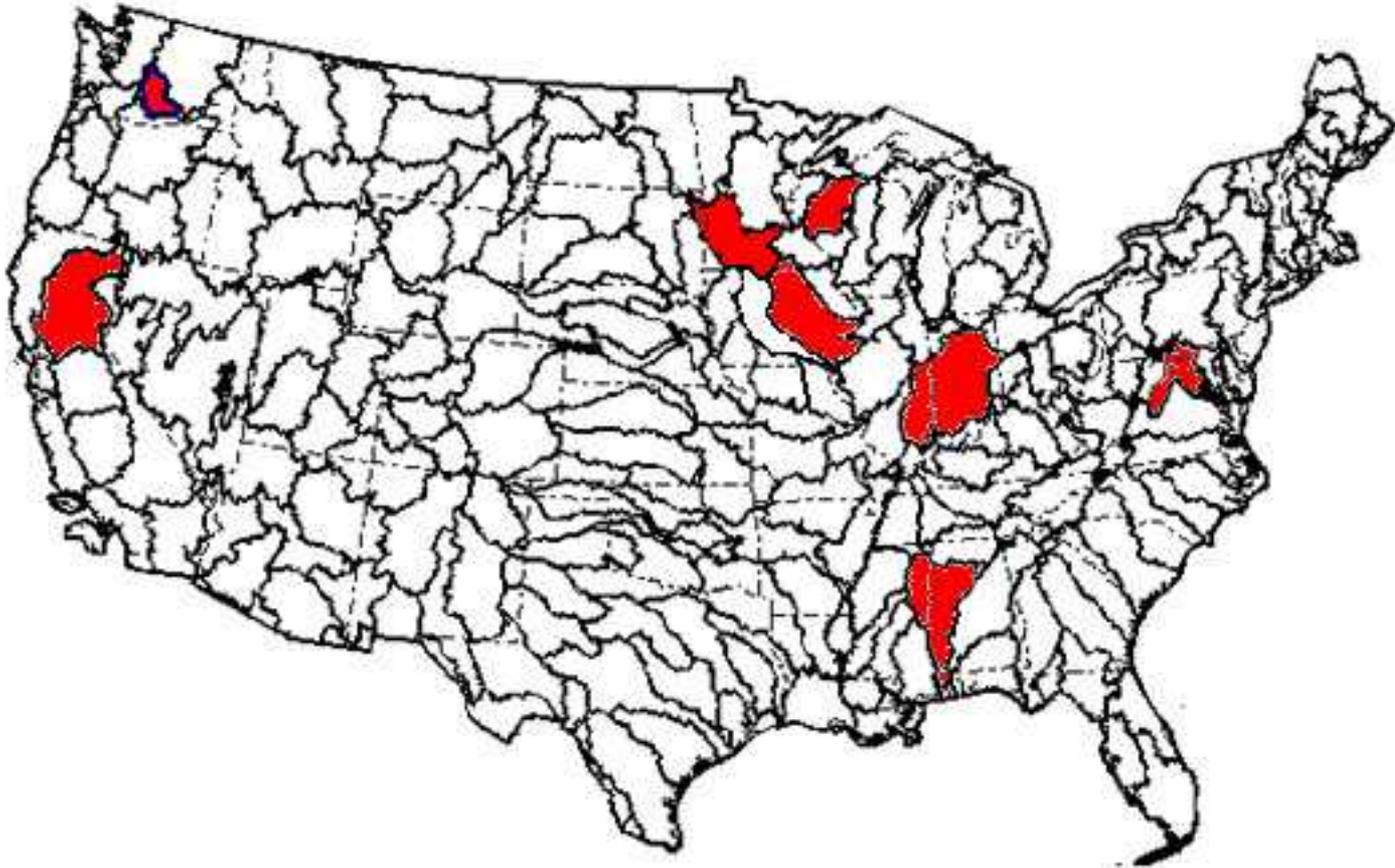
Where should hydrological modeling be in 10 years?

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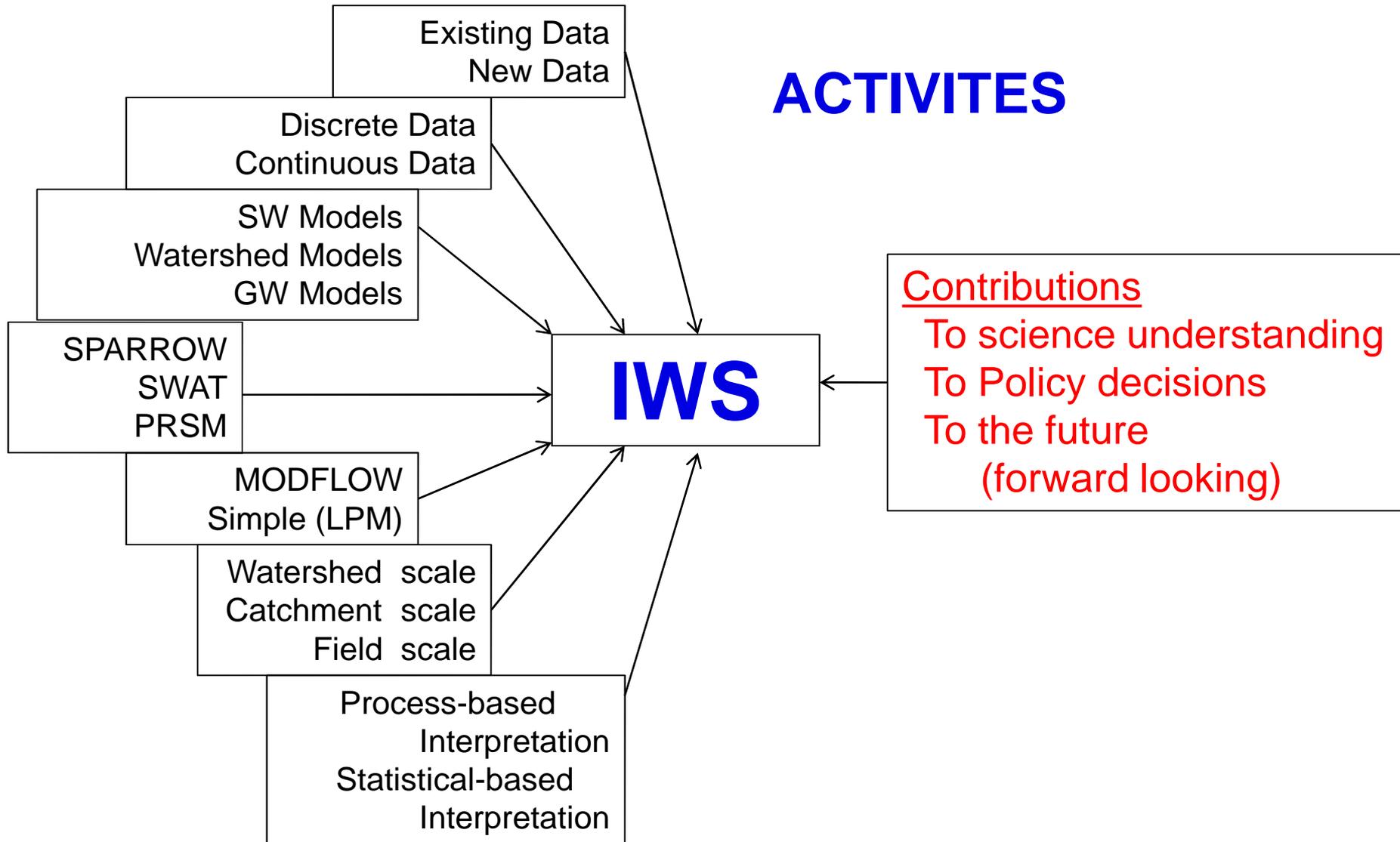
CONTRIBUTIONS

FOUNDATION FOR NATIONAL EXTRAPOLATION...

NAWQA Cycle 4



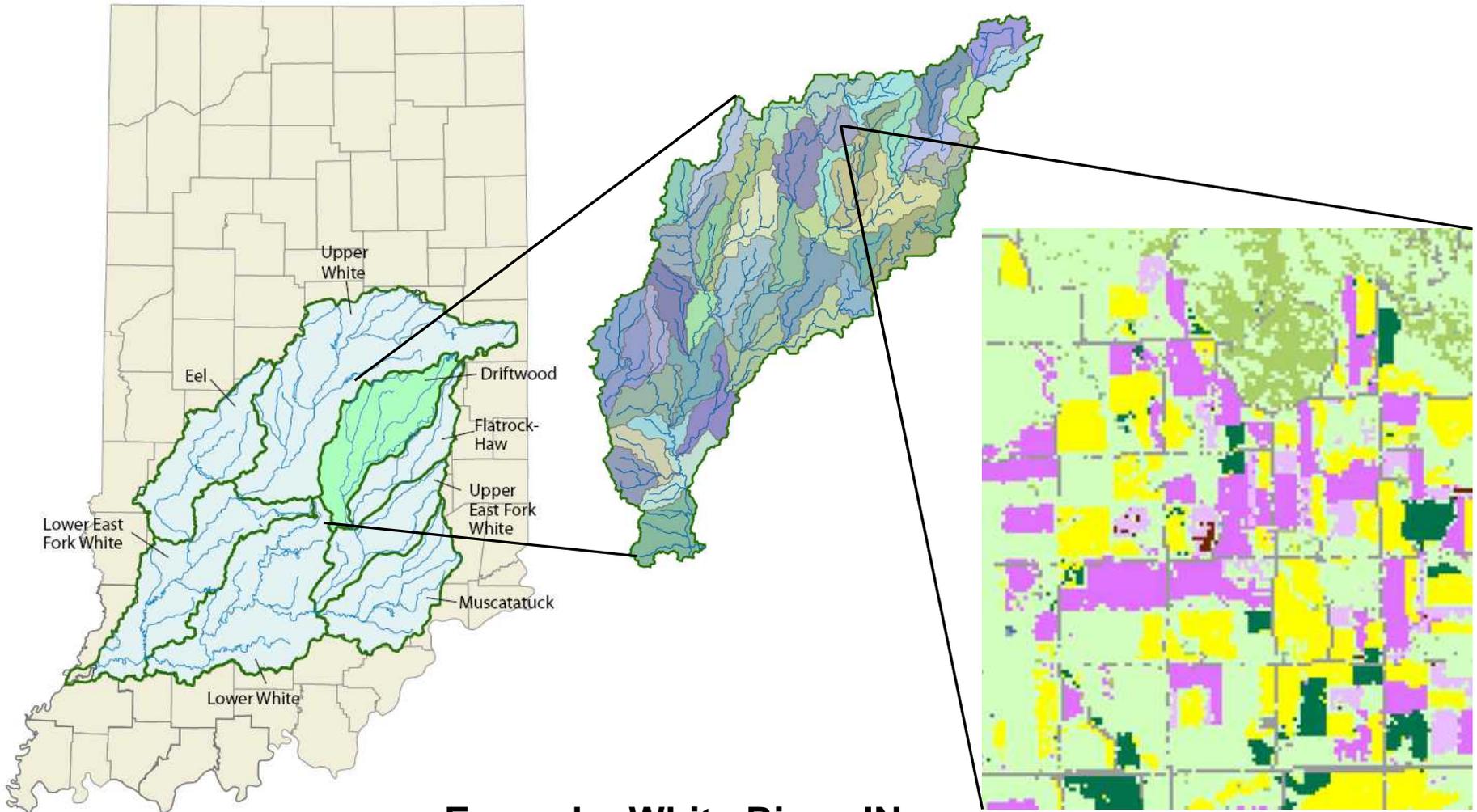
Integrated Watershed Studies



Extra Slides

Integrated Watershed Studies

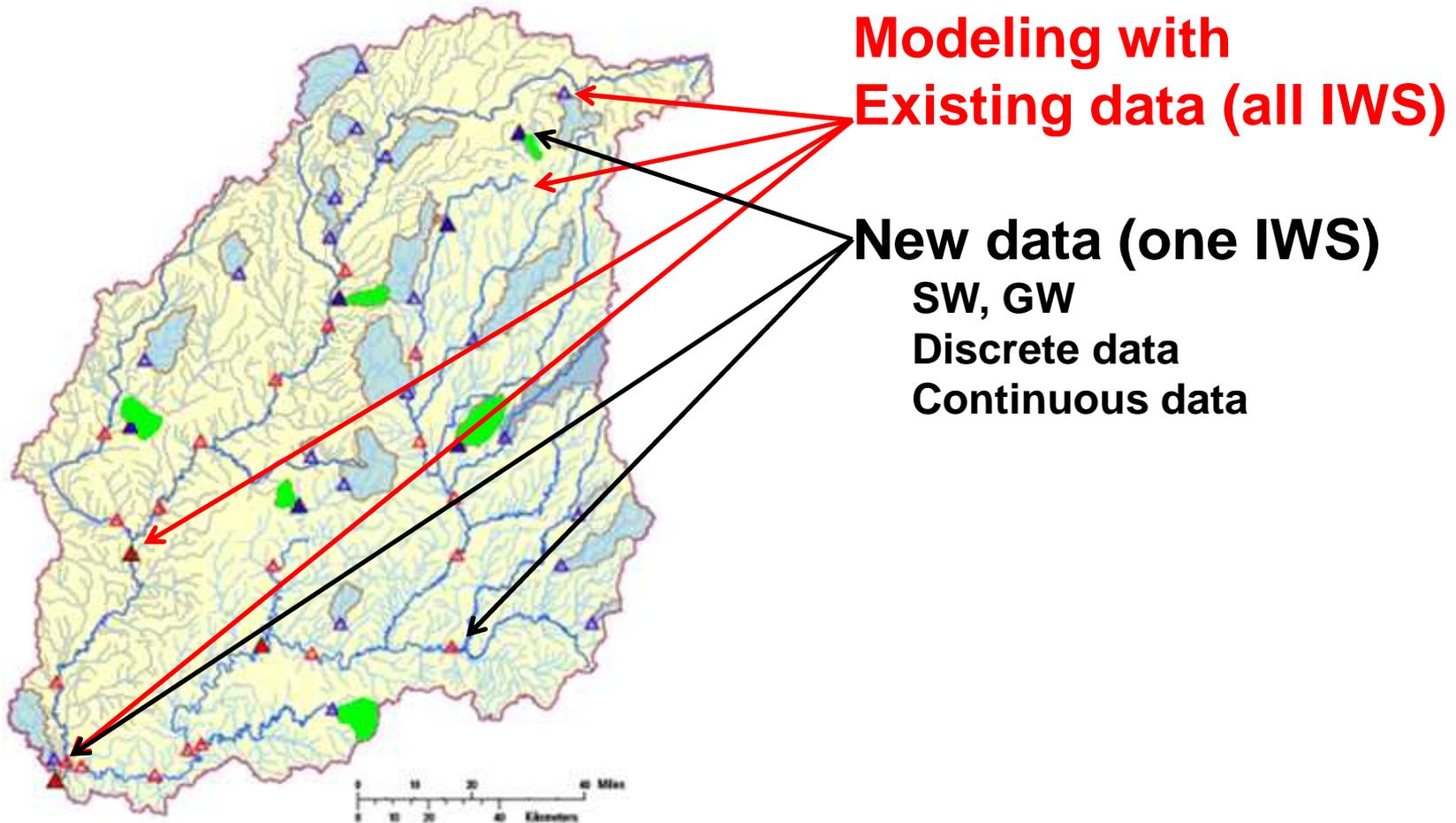
APPROACH – Multi-scale



Example: White River, IN

Integrated Watershed Studies

APPROACH



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ACTIVITES - MODELING

Watershed (SPARROW, SWAT, PRSM, HSPF)

Groundwater (MODFLOW/MODPATH, LPM)

Aggregated field-scale (WEPP, RUSLE)

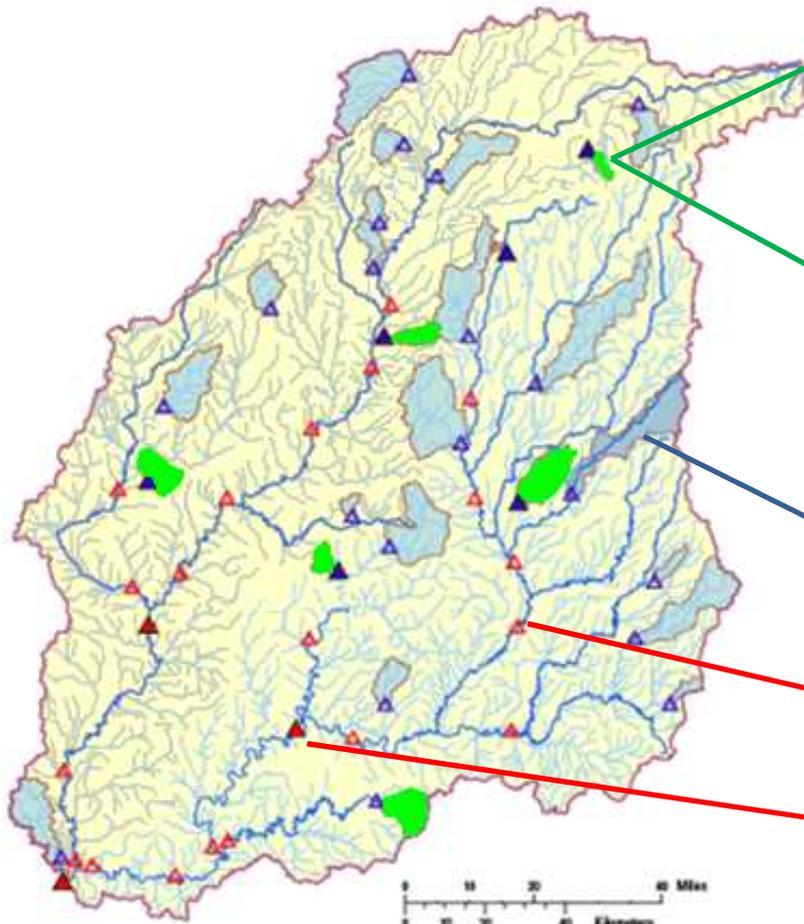
Continuous sensor-based (Turbidity, SC, T, Q)

Range: **Environmental Compartments**
Spatial Scales
Temporal Scales

Purpose: **Comparison**
Extrapolation / Interpolation
Process understanding
Advancement of modeling

Integrated Watershed Studies

ACTIVITES - FIELD



Intensive small stream studies
continuous discharge
discrete WQ sample collection
continuous WQ parameters

GW-SW Interaction studies
flowpaths studies
age dating

Spatial synoptic surveys

Longitudinal synoptic surveys

Large river fixed sites

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NAWQA CYCLE III

