

Transitioning from Farm-scale to Regional-scale Models



United States
Department of
Agriculture

National Institute
of Food and
Agriculture



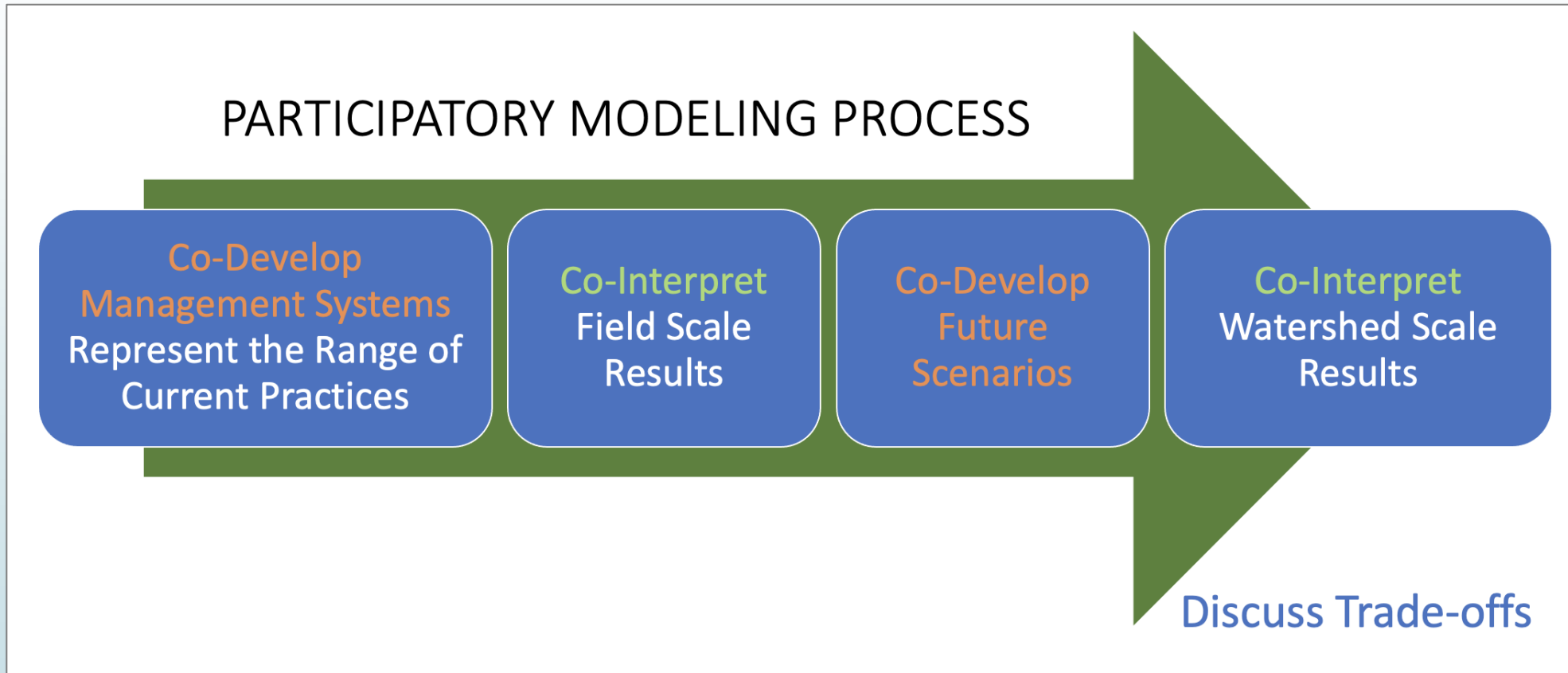
UNIVERSITY OF
GEORGIA



Albany State
University 
UNIVERSITY SYSTEM OF GEORGIA

UF | Water Institute
UNIVERSITY of FLORIDA

Reminder: The PROCESS



Management Systems

Albany, GA - in-depth discussion of management systems



PARTICIPATORY MODELING PROCESS

Co-Develop
Management Systems
Represent the Range of
Current Practices

Co-Interpret
Field Scale
Results

Co-Develop
Future
Scenarios

Co-Interpret
Watershed Scale
Results



Discuss Trade-offs



Camp Weed - first discussion
of *which* production systems

Management Systems: Florida

Current *Production Systems*

CROPS	Corn-peanut Corn-carrot-peanut
FORAGES	Hay (Bermuda) Pasture (Bermuda)
FORESTS	Slash pine Loblolly pine Longleaf pine

Management System Summaries

	<u>Crops</u>	<u>Forages</u>	<u>Forests</u>
MS1	<ul style="list-style-type: none"> • Most efficient (SMS) irrigation • Lowest fertilization • Rye cover crop 	<ul style="list-style-type: none"> • Lowest fertilization • Lowest number of cuttings (hay) 	<ul style="list-style-type: none"> • No thinning • No fertilization • Longer rotation age • Lower initial planting density
MS2	<ul style="list-style-type: none"> • Efficient (SMS) irrigation • Medium N rate • Oat cover crop 	<ul style="list-style-type: none"> • Medium fertilization • Medium number of cuttings (hay) 	<ul style="list-style-type: none"> • Thinning • Medium N rate • Medium rotation age
MS3	<ul style="list-style-type: none"> • Least efficient (calendar) irrigation • Highest fertilization • No cover crops 	<ul style="list-style-type: none"> • Highest fertilization • Most number of cuttings (hay) 	<ul style="list-style-type: none"> • Thinning • Highest N rate • Shortest rotation age



Management Systems: Georgia

Current *Production Systems*

CROPS Corn-cotton-peanut
 Cotton-cotton-peanut

FORESTS Slash pine
 Loblolly pine
 Longleaf pine



Management System Summaries

Crops

Forests

MS1

- SMS-based irrigation
- Lowest fertilization
- Rye cover crop
- Strip tillage

- No thinning
- No fertilization
- Longer rotation age
- Lower initial planting density

MS2

- UGA checkbook irrigation
- Medium N rate
- No cover crop
- Conventional tillage

- Thinning
- Medium N rate
- Medium rotation age

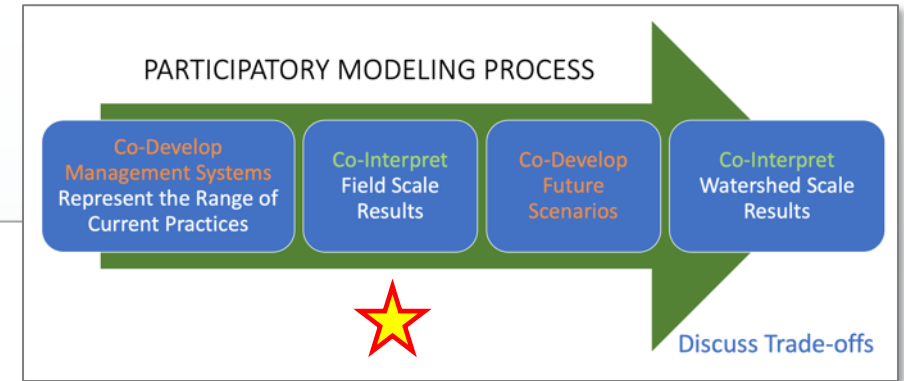
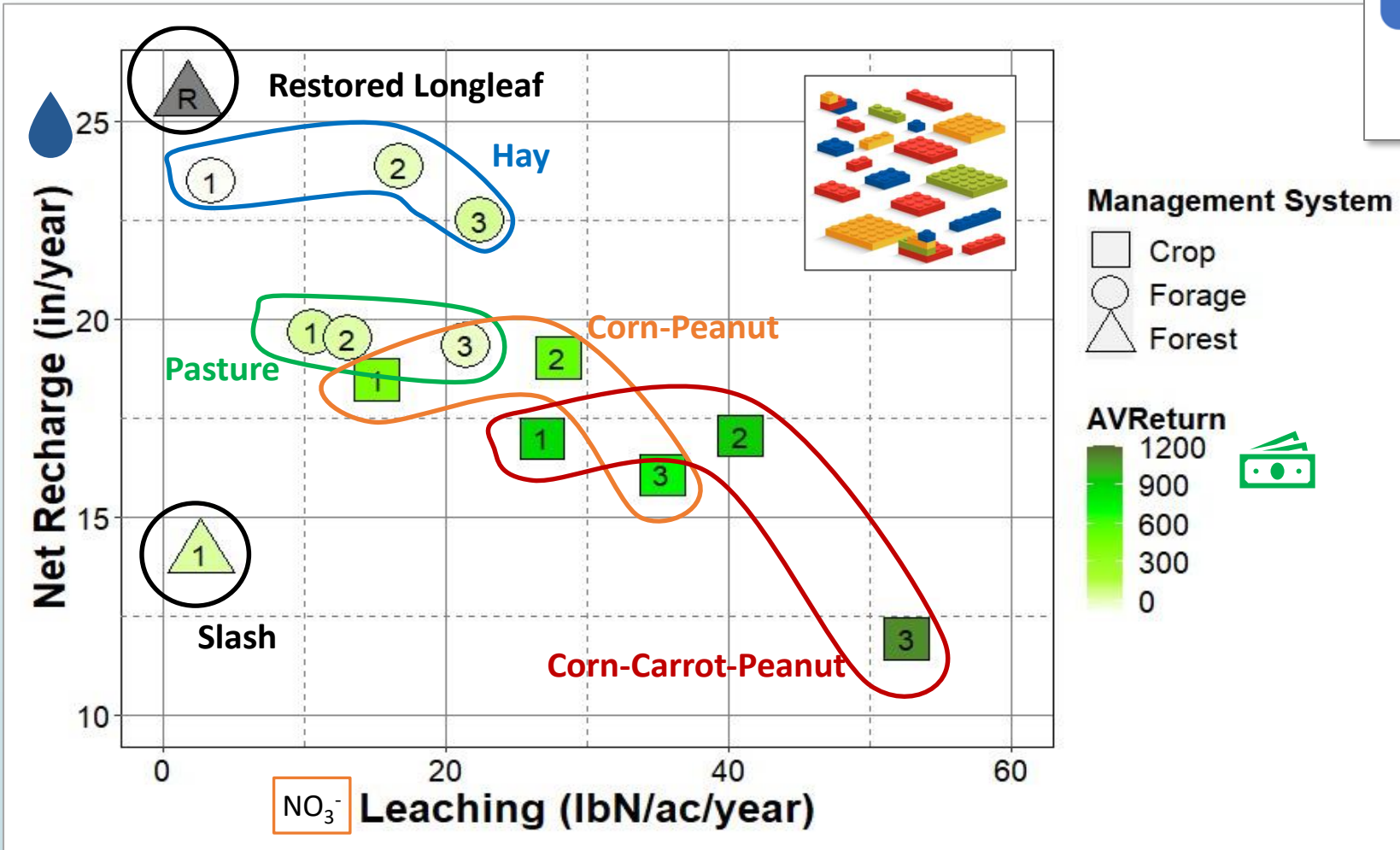
MS3

- Least efficient irrigation
- Highest fertilization
- No cover crops
- Conventional tillage

- Thinning
- Highest N rate
- Shortest rotation age



Field-Scale Results: FL Tradeoffs



Florida focused on:

- 💧 Net Recharge (in/yr)
- NO₃⁻ Nitrate Leaching (lb N/ac/yr)
- 💰 Net Returns (\$/yr)

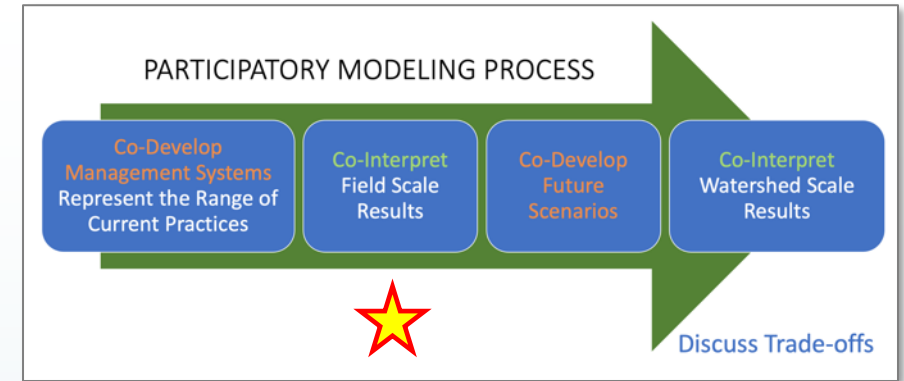
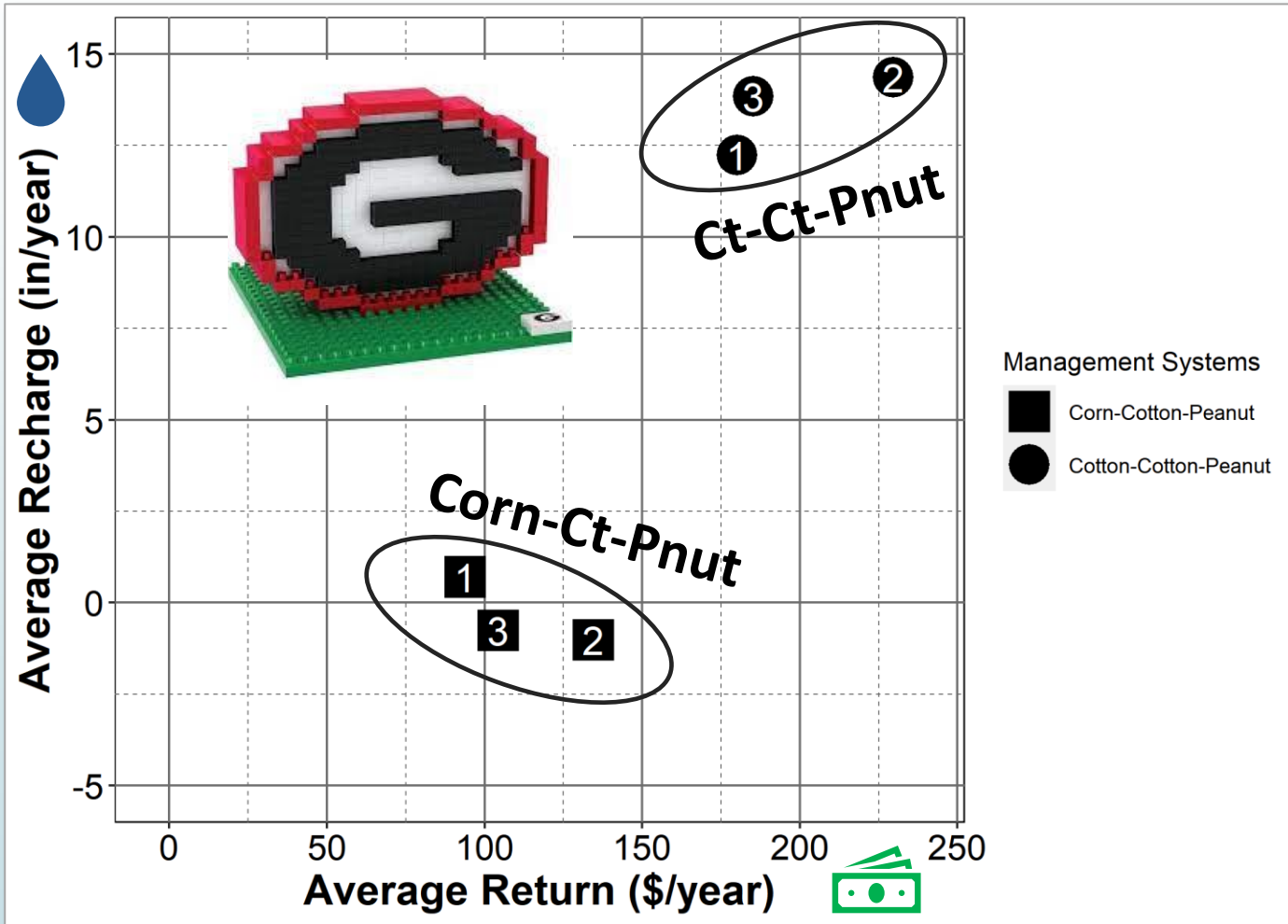
More Inputs ↓

MS1: Most efficient irrigation, lowest N rate, rye cover

MS2: Efficient irrigation, medium N rate, oat cover crop

MS3: Least Efficient irrigation, highest N rate, no cover crop

Field-Scale Results: GA Tradeoffs



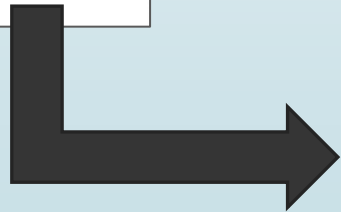
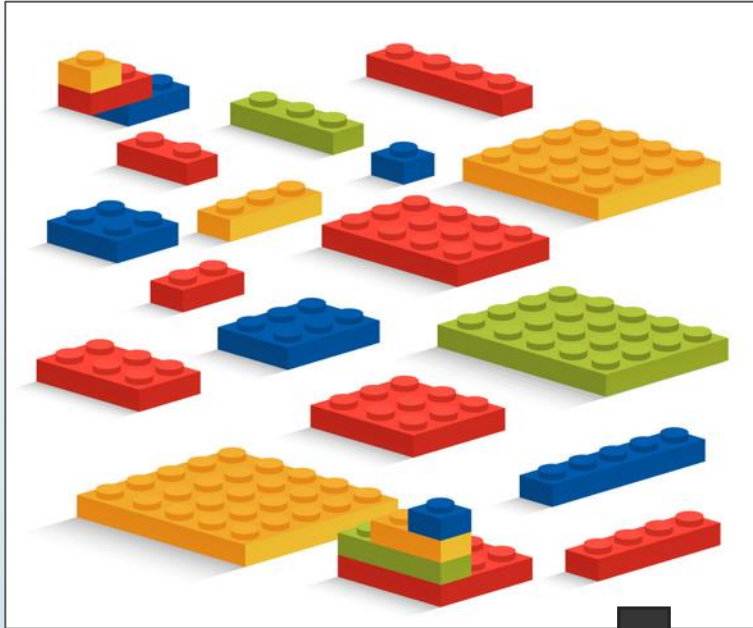
Georgia focused on:

- Net Recharge
- Net Returns

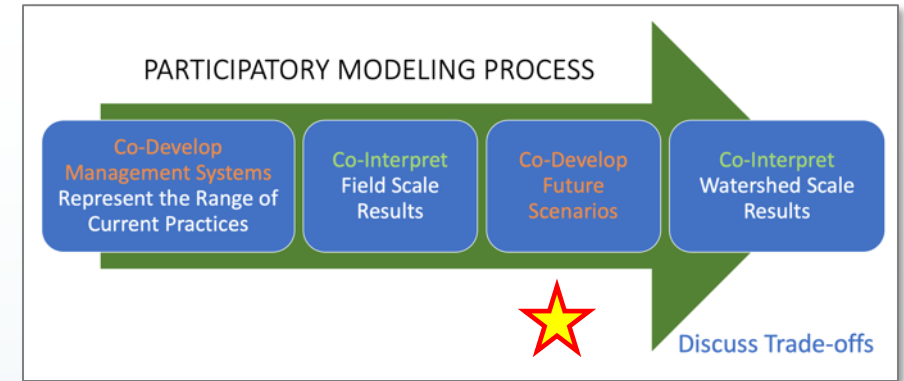
- More Inputs** ↓
- MS1:** Most efficient irrigation, lowest N rate, cover crop, strip till
 - MS2:** Efficient irrigation, medium N rate, no cover crop, conventional till
 - MS3:** Least efficient irrigation, highest N rate, no cover crop, conventional till

Moving to the Regional Scale

Field-Scale Models



Regional/Watershed-Scale Models



Regional Scale Inputs and Outputs

Inputs → “Levers or Scenarios”

Cropping/forest systems
(e.g., corn-fallow-peanut;
slash pine plantation)

Management systems
(e.g., practices used for
nutrient management,
water management)

Soil types

Weather/climate data and
scenarios

Outputs

- Regional Economy

- Regional crop and forest production

- Aquifer/stream N concentrations
- Spring & stream flows
- Aquifer water levels

Regional Scale Inputs and Outputs

BOLD = Will be reported today

- Regional Economy

- Regional crop and forest production

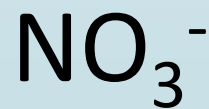
- Aquifer/stream N concentrations
- Spring & stream flows
- Aquifer water levels



- Employment (# of jobs)**
- Value added (\$; like GDP)**
- Taxes (\$; local, state, federal)**
- Labor Income (\$; money/benefits to employees)
- Industry Output (\$, sales revenue)



- Aquifer pumping (e.g., Million Gallons Per Day)**
- Net recharge (Recharge - Irrigation Applied; MGD)**
- Streamflow (MGD or ft³/s)**
- Aquifer level (ft)



- Nitrate leaching load (tons/year)**
- Nitrate concentration in water entering spring (mg/L)**
- Nitrate concentration in river (mg/L)

Regional-Scale Simple Scenarios

Simple Scenarios

- 1) All Crop/Forage Management Systems = MS 1
- 2) All Crop/Forage Management Systems = MS 2
- 3) All Crop/Forage Management Systems = MS 3



For ALL Simple Scenarios: All Forestry is MS1

Interpreting Results and Envisioning Future Scenarios

- 1) Think about what other variables (**outputs!**) you might want to see
- 2) What land-use/management activities or climate drivers (**inputs/levers!**) do you expect to have the biggest effects on results?
- 3) Focus on magnitude and direction of **changes** (% change in an output)