

Florida Regional Modeling Simple Scenarios

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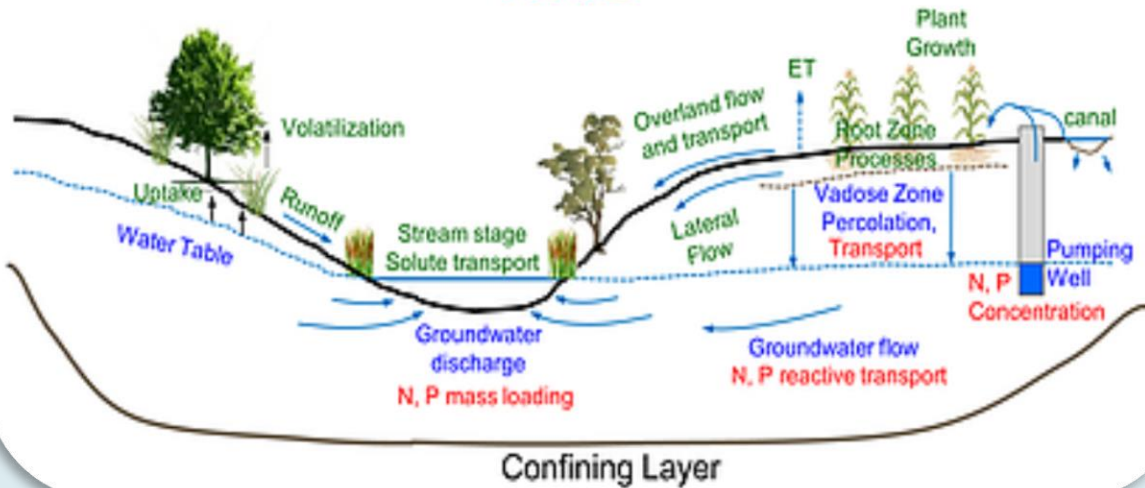


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Biophysical Modeling Framework

SWAT MODFLOW RT3D



Bailey et al, 2016

SWAT (USDA)

- Driven by:
 - Climate, land cover, land and water management, soils, topography
- Simulates:
 - Plant growth, water & nutrient uptake, yield
 - Root zone water flow, nutrient transport
 - Overland water flow and nutrient transport
 - Stream stage, flow and nutrient transport
 - Recharge and nutrient leaching to groundwater

MODFLOW-MODPATH-RT3D (USGS)

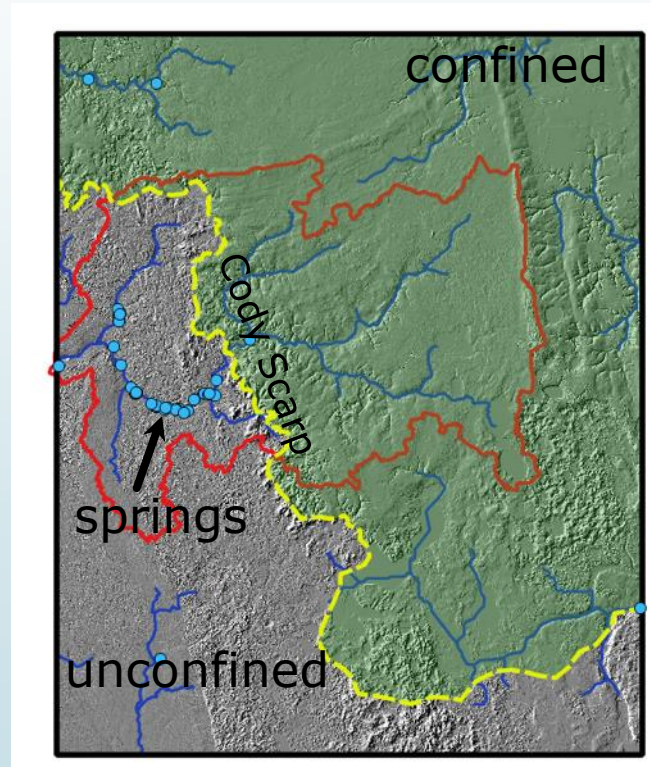
- Driven by:
 - Recharge, nutrient leaching, stream stage, groundwater pumping
- Simulates:
 - Groundwater levels, flows, nutrient transport
 - Groundwater and nutrient exchange with streams, springs

Regional Scale Modeling Domain

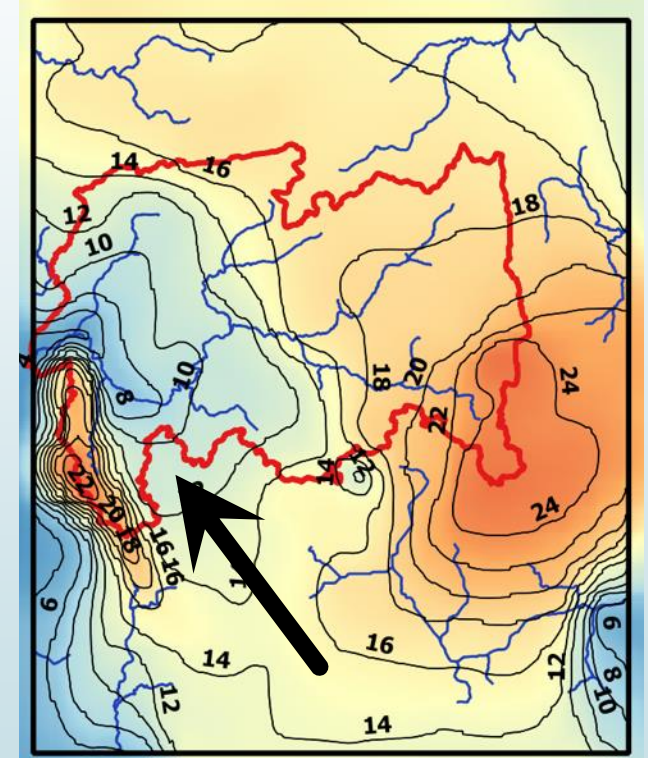
Santa Fe River Basin



Hydro-geomorphic Characteristics

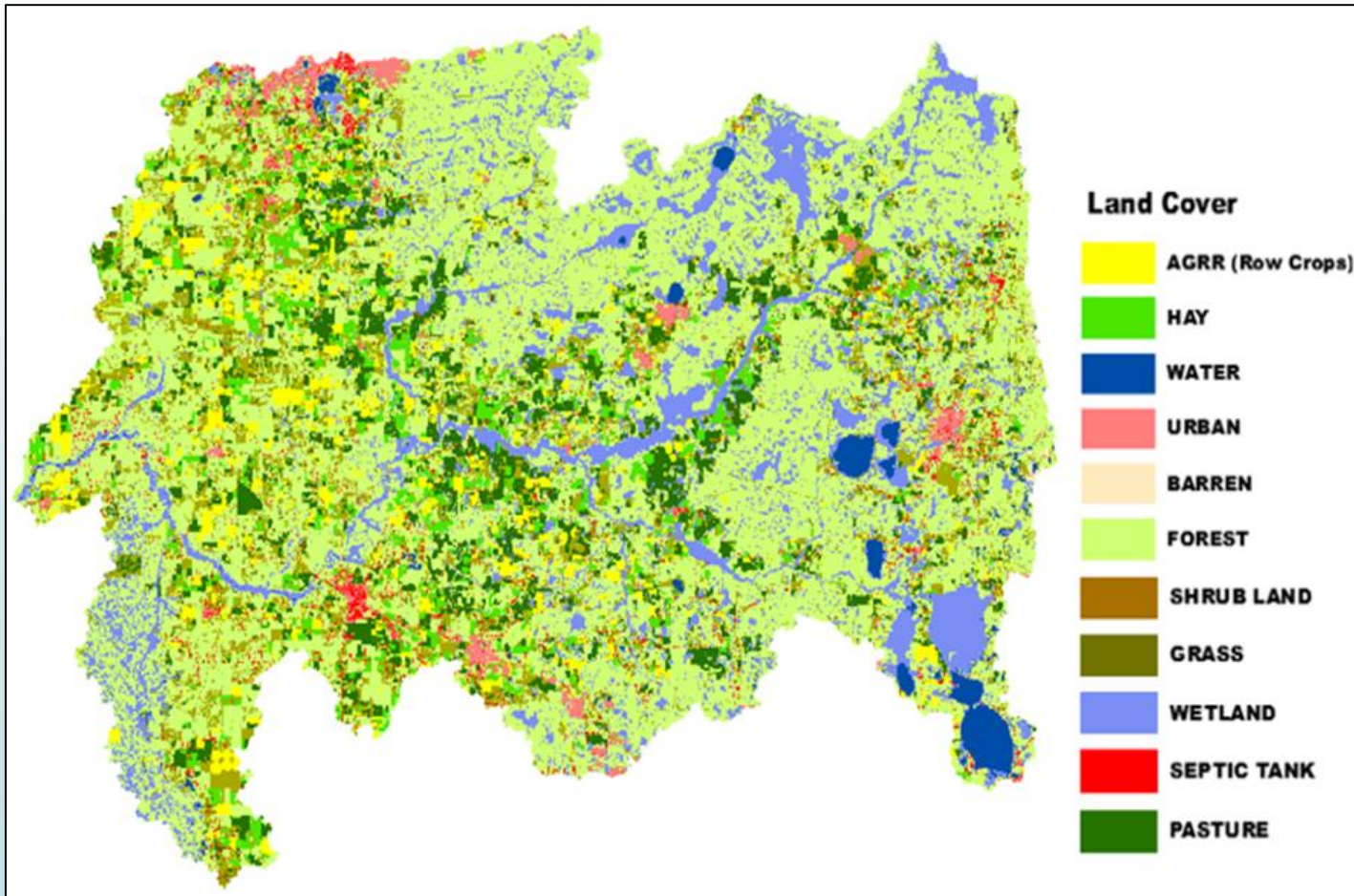


Aquifer levels in UFA

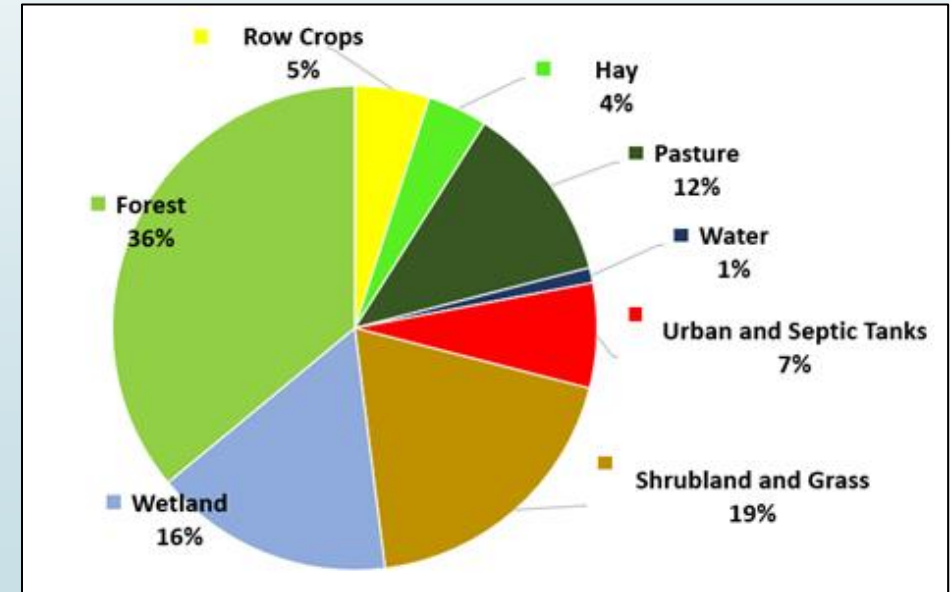


“Simple Scenarios”

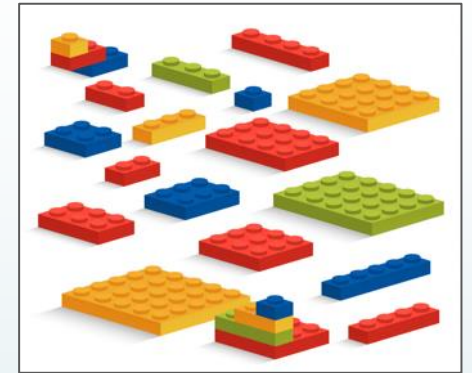
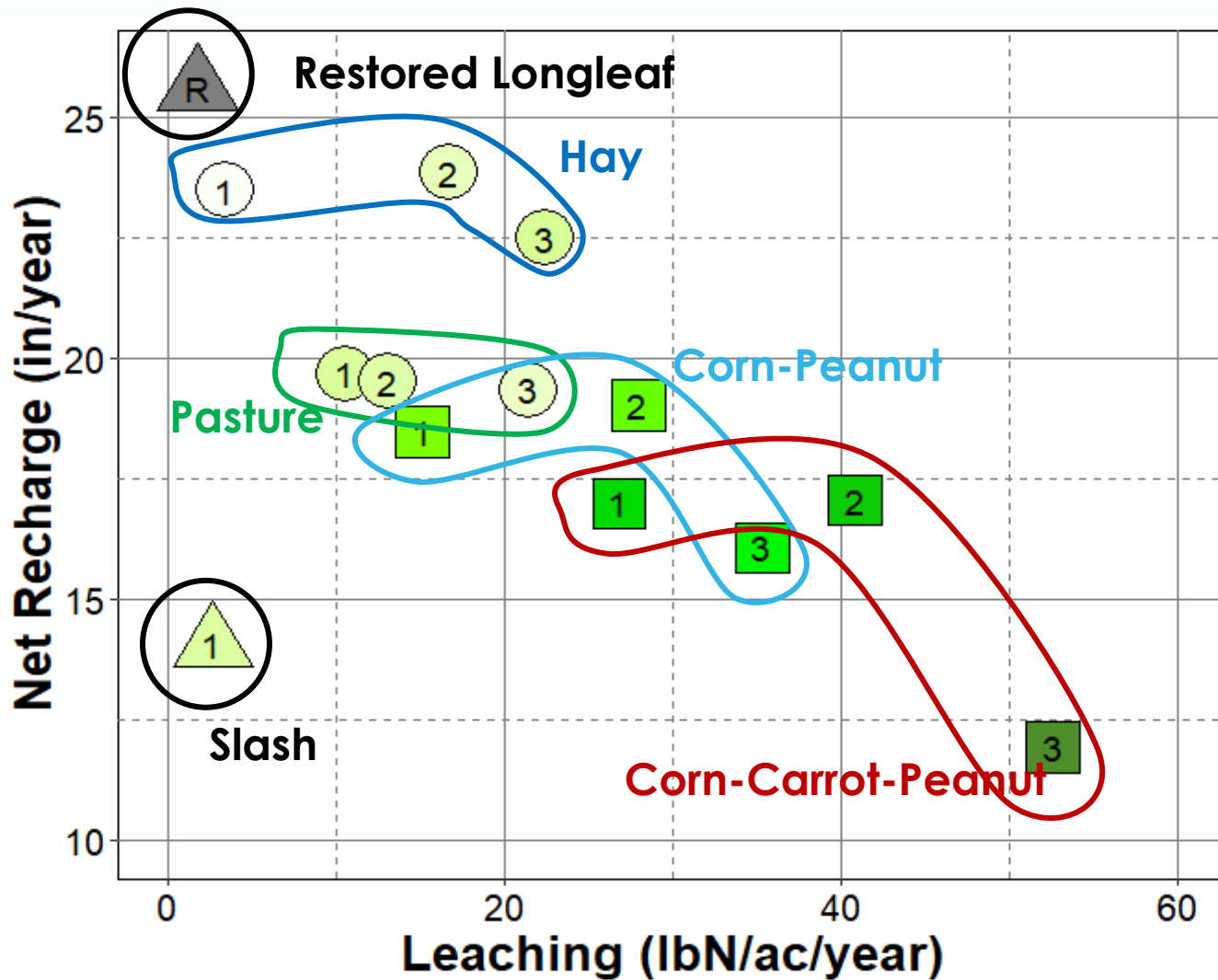
Santa Fe River Basin 2017 Land Use Map



Scenario	Land use	Management
All Ag MS 3 row crops: corn-peanut forest: slash pine	2017	All Ag (row crops, hay, & pasture) uses MS 3; Forests use MS1
All Ag MS 2 row crops: corn-peanut forest: slash pine	2017	All Ag (row crops, hay, & pasture) uses MS 2; Forests use MS1
All Ag MS 1 row crops: corn-peanut forest: slash pine	2017	All Ag (row crops, hay, & pasture) uses MS 1; Forests use MS1
All Ag to Forest forest: slash pine	2017 except Ag	Forests use MS1

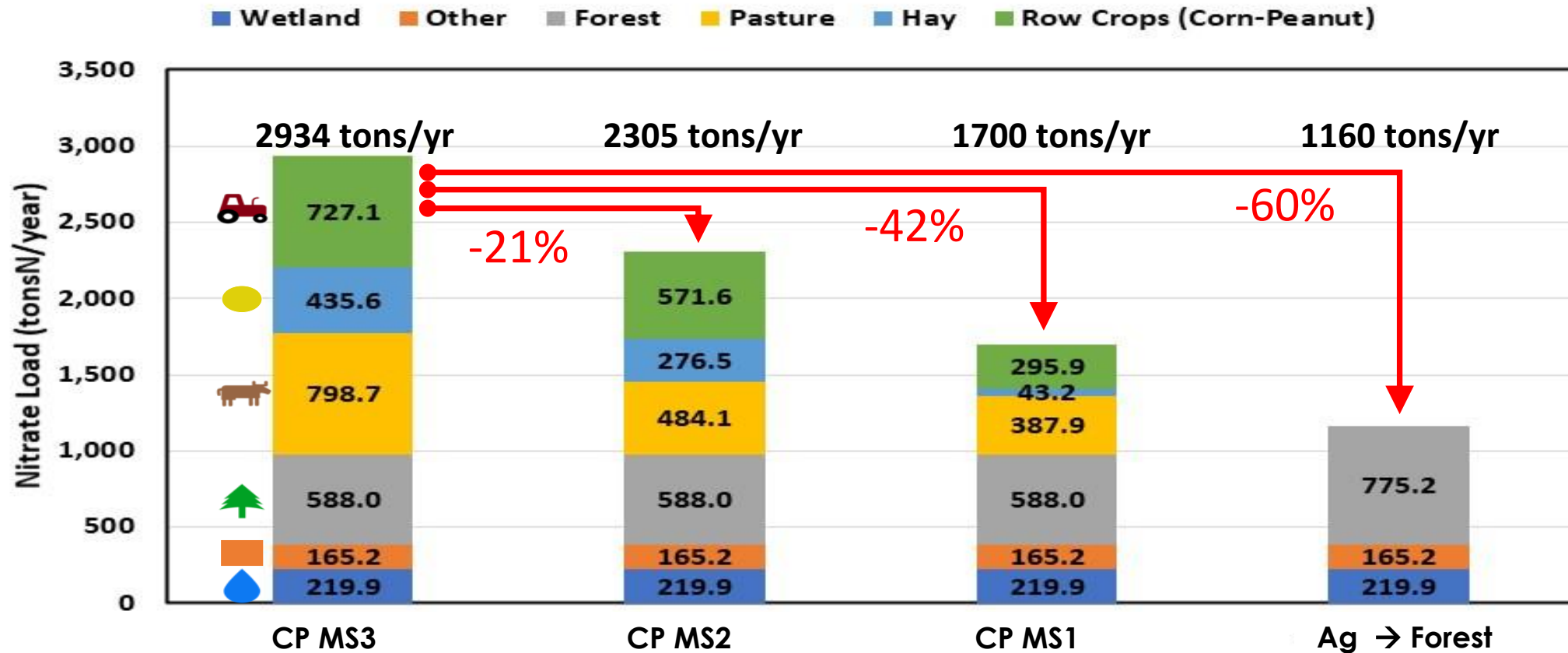


Recall: FL Farm/Forest Modeling Results



- ↑
- 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

Florida Simple Scenarios: Nitrate Leaching Load

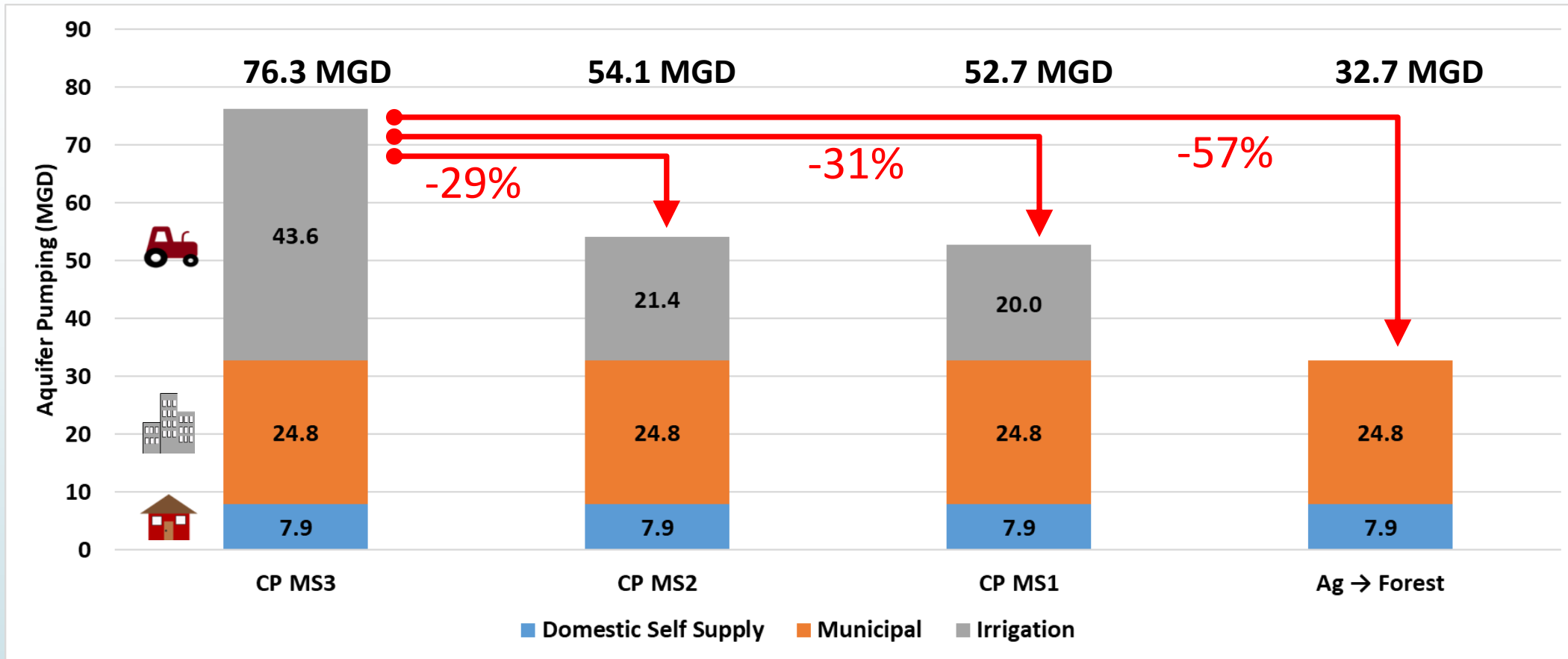


ROW CROPS:
CORN-PEANUT

No Urban Loads

- Pasture is largest load contribution for MS3 due to large land area and relatively high load per unit area
- Row crops have highest load per unit area but relatively small area, 2nd largest load contribution for MS3
- Forest has lowest load per unit area but large land area, relatively large portion of total load

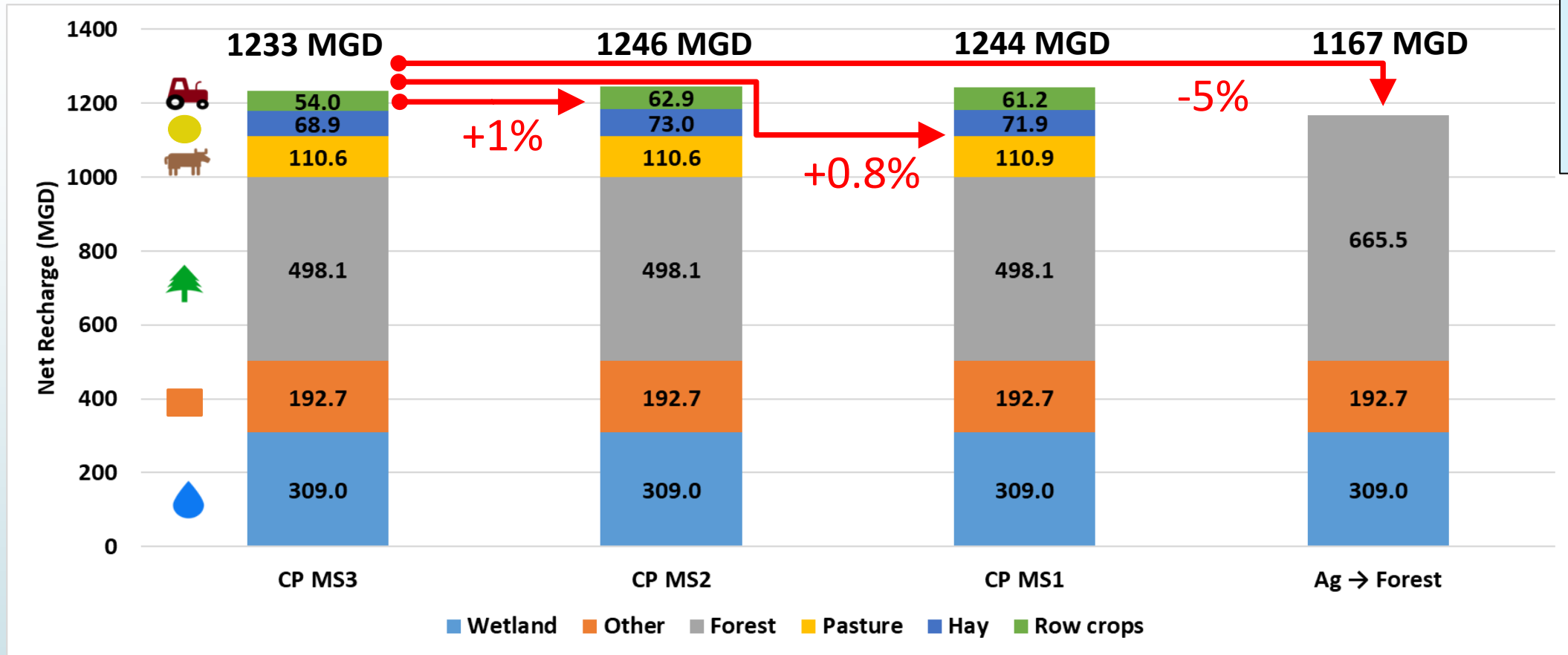
Florida Simple Scenarios: Aquifer Pumping



ROW
CROPS:
**CORN-
PEANUT**

- MGD = Million Gallons per Day
- Assumed all agricultural land (except hay and pasture) is irrigated corn-peanut rotation
- Pumping shown for the Santa Fe River surface basin only

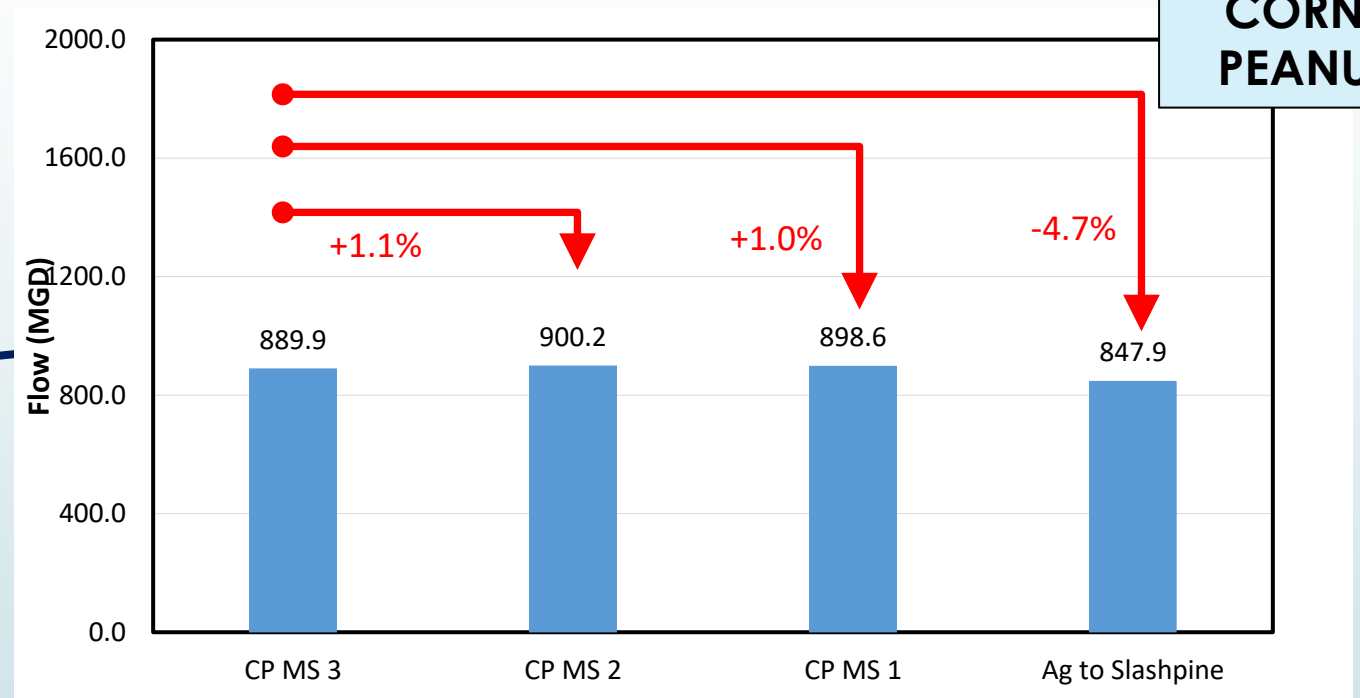
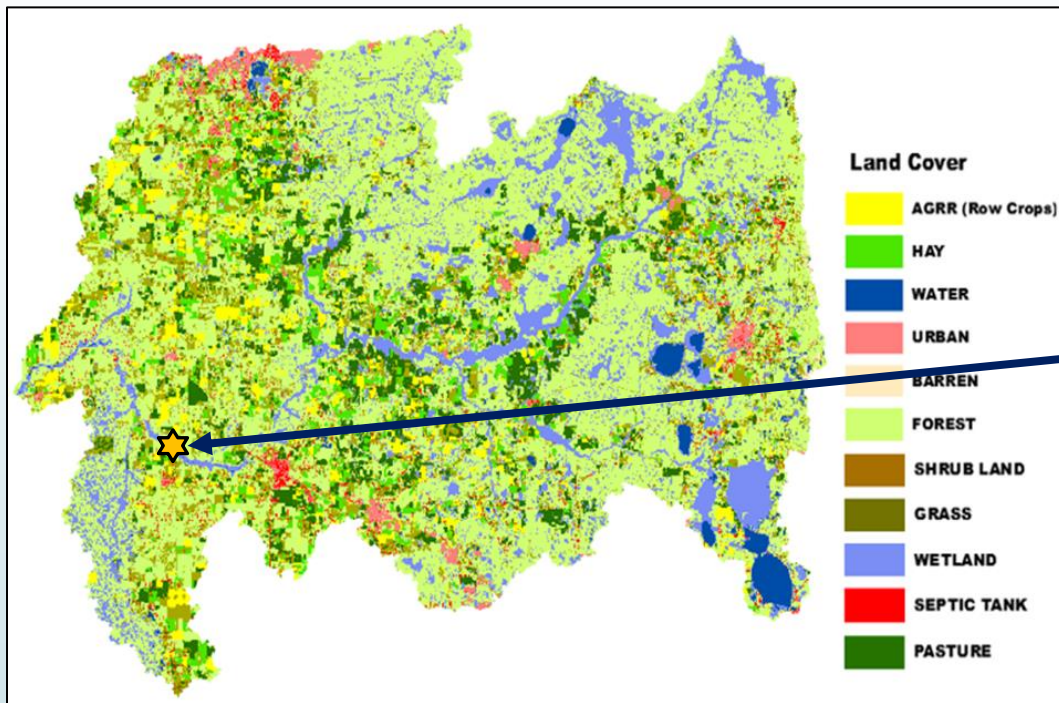
Florida Simple Scenarios: Net Recharge



ROW
CROPS:
**CORN-
PEANUT**

- Net Recharge is similar between MS 1-3 since irrigated row crops are a small portion of Santa Fe River surface basin
- Conversion of all agricultural lands to slash pine MS1 reduces net recharge even though agricultural pumping removed due to high slash pine MS1 evapotranspiration

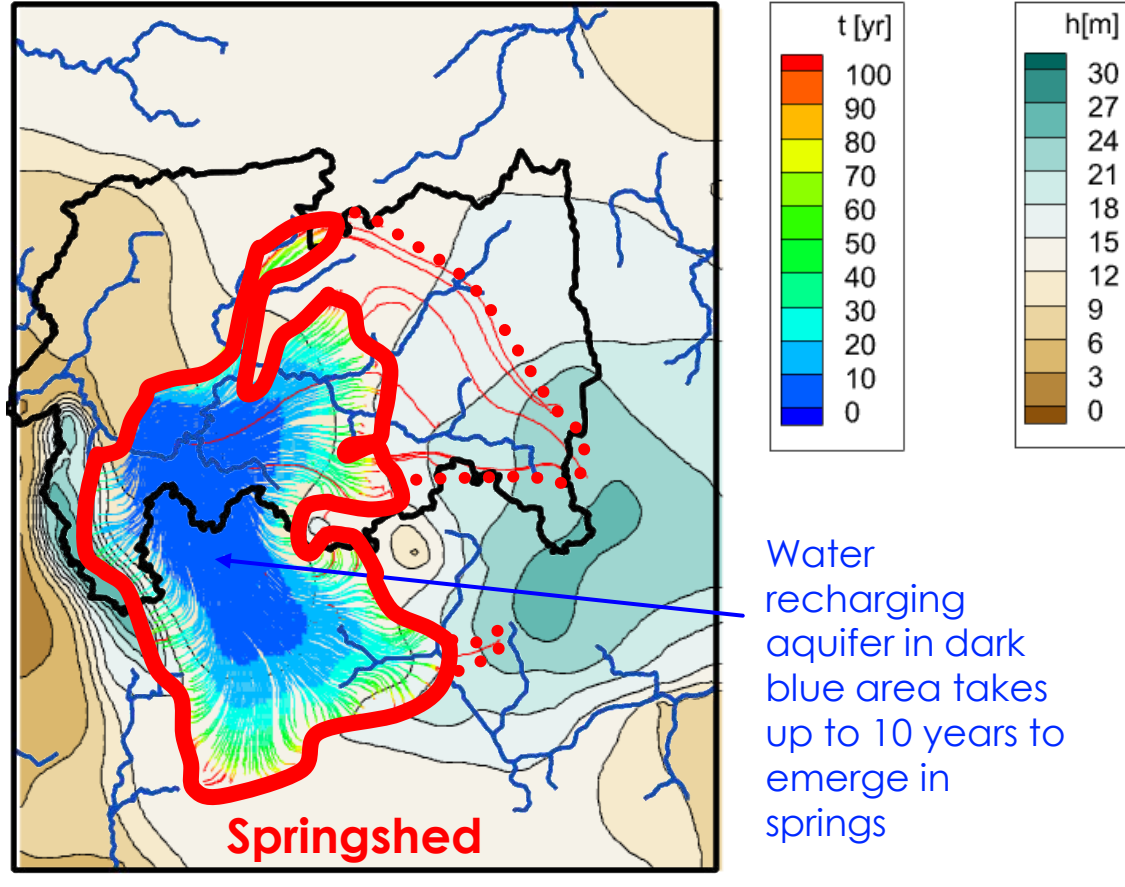
Florida Simple Scenarios: Streamflow at Ft White



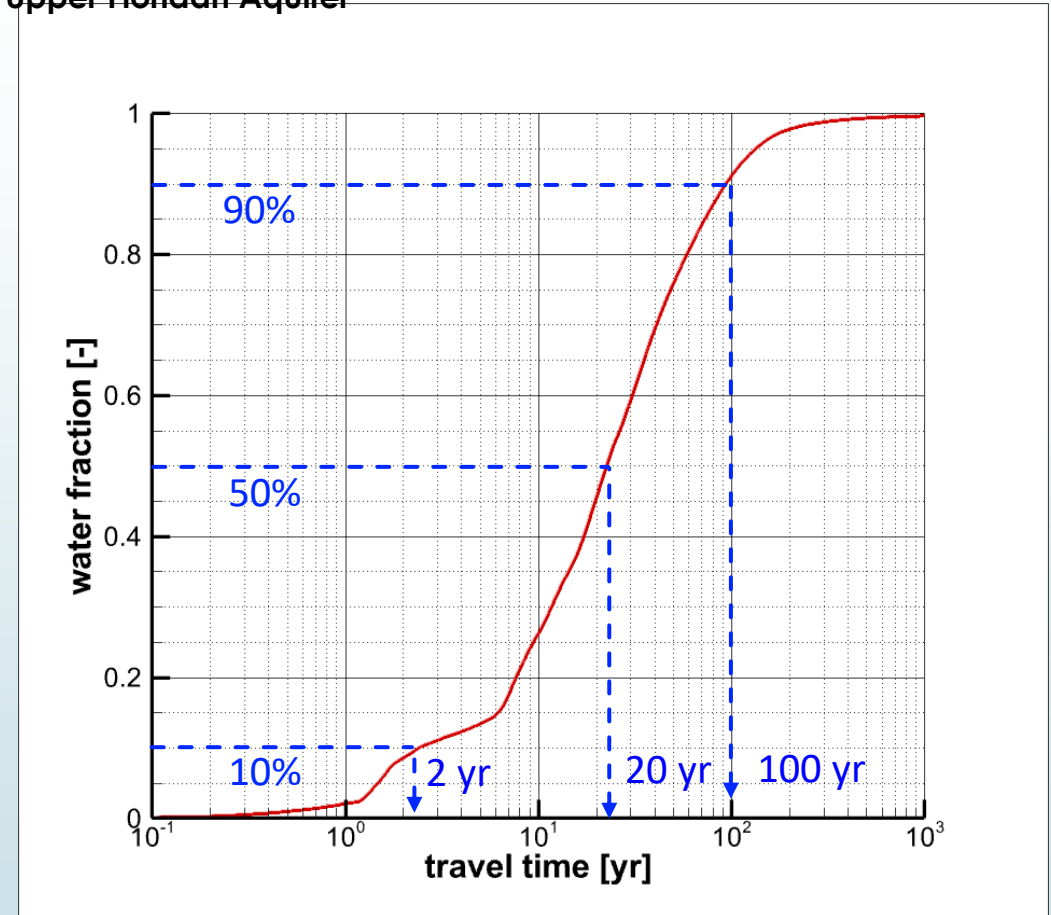
- MGD = Million Gallons per Day
- Streamflow is similar between MS 1-3 since irrigated row crops are a small portion of Santa Fe River surface basin
- Conversion of all agricultural lands to slash pine MS1 reduces streamflow even though agricultural pumping removed due to high slash pine MS1 evapotranspiration

SWAT-MODFLOW-MODPATH: Particle Tracking

Travel time to reach Devil's Complex Springs



Water level in Upper Floridan Aquifer

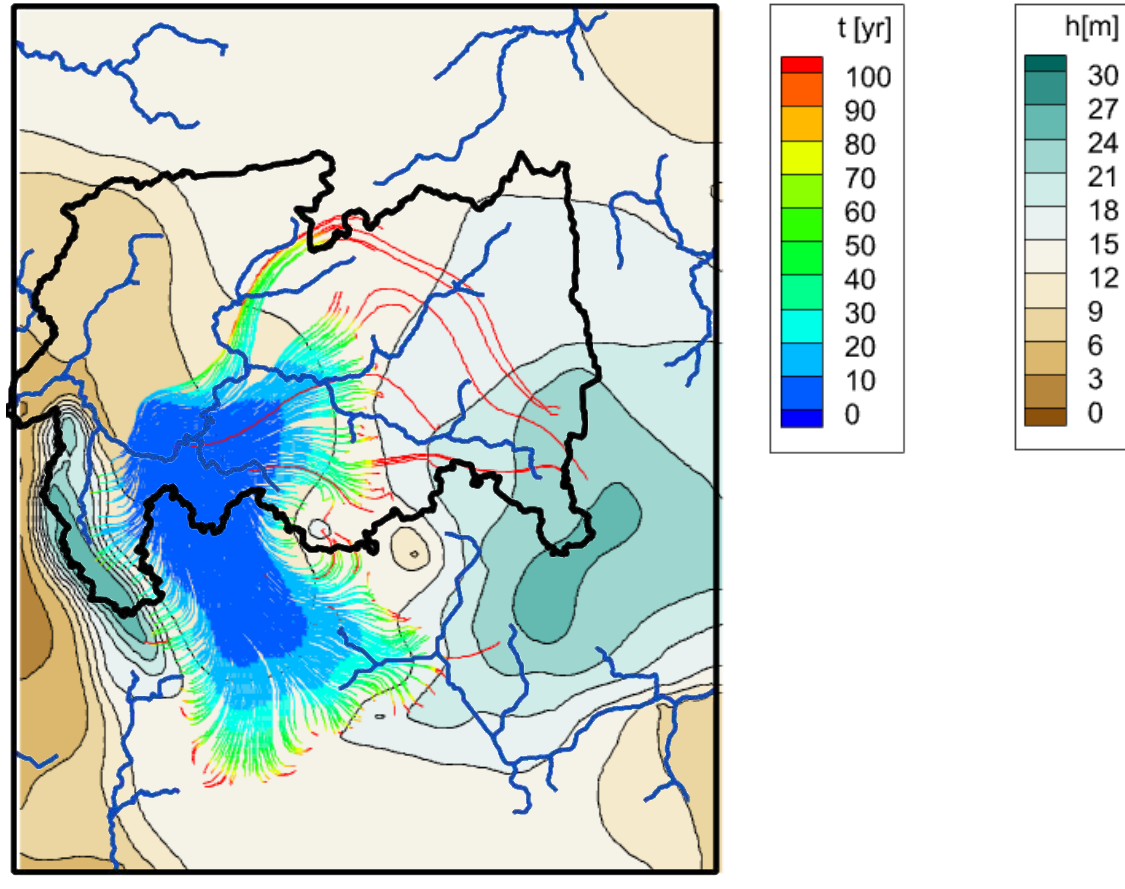


Groundwater Contributing Area to Santa Fe River near Fort White (Devil's Eye Complex & Poe Springs)

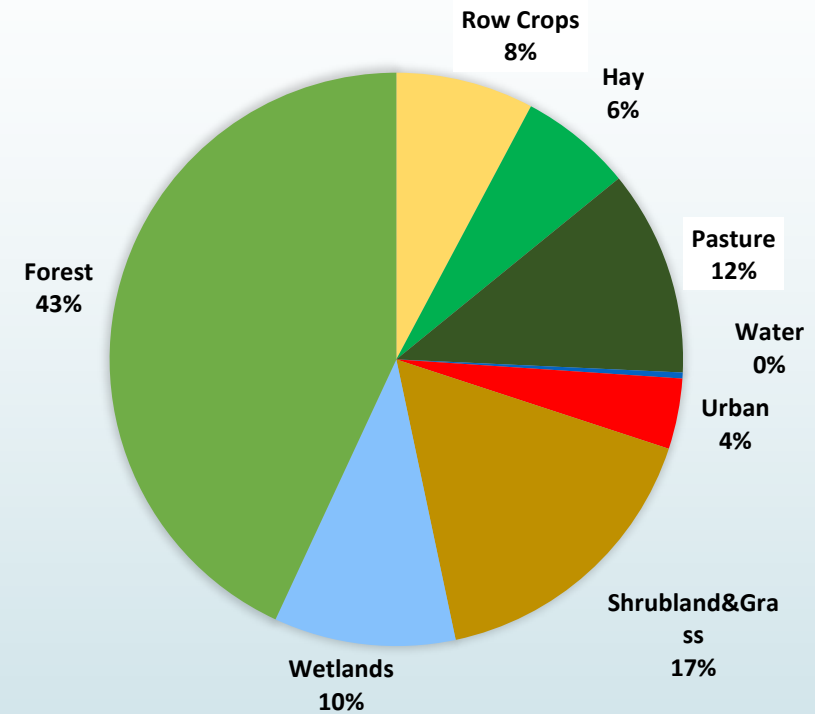
Median travel time for groundwater emerging from springs ~20 years

It will take decades to see full water quality impacts of changes in land-use and management

SWAT-MODFLOW-MODPATH: Particle Tracking



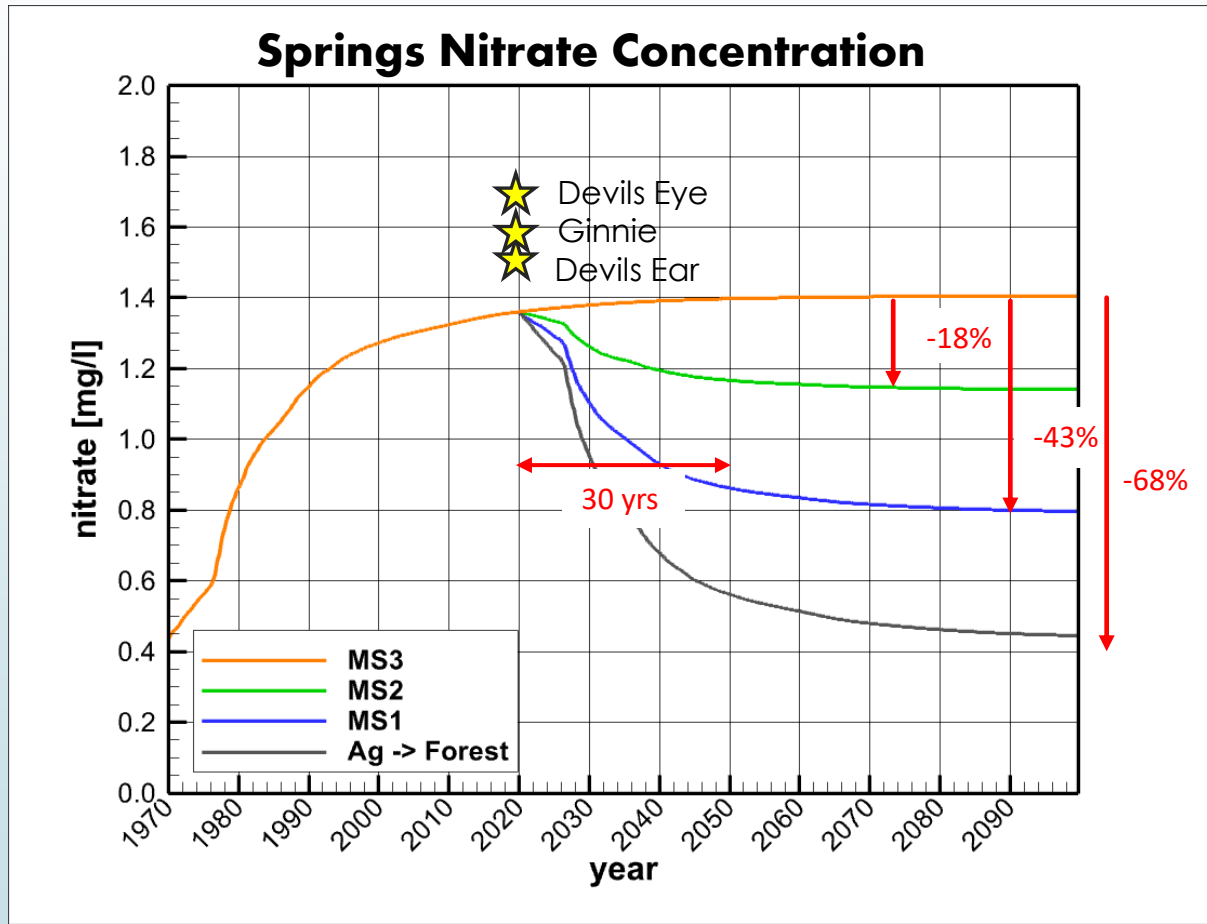
Groundwater Contributing Area to Santa Fe River near Fort White (Devil's Eye Complex & Poe Springs)



Land Use in Groundwater Contributing Area
→ Similar to Santa Fe Surface Basin Land Use, slightly higher row crops & hay.

SWAT-MODFLOW-MODPATH Simple Scenarios

Nitrate Transport to Devil Complex Springs



	Scenario
MS3: corn-peanut	Row Crops, Hay, Pasture: MS3 1970-2100 Slash Pine: MS 1 1970-2100
MS2: corn-peanut	Row Crops, Hay, Pasture: MS3 1970-2020 Row Crops, Hay, Pasture: MS2 2020-2100 Slash Pine: MS 1 1970-2100
MS1: corn-peanut	Row Crops, Hay, Pasture: MS3 1970-2020 Row Crops, Hay, Pasture: MS1 2020-2100 Slash Pine: MS 1 1970-2100
All Slash Pine MS1	Row Crops, Hay, Pasture: MS3 1970-2020 Row Crops, Hay, and Pasture to Slash Pine: 2020-2100 Slash Pine: MS 1 1970-2100

- Recall no urban loads included in simple scenarios
- Changing from MS3 → MS2 → MS1 → Forest reduces nitrate in groundwater emerging from springs, consistent with leaching % reduction
- Long lag time (~30 years) to see full impacts of reduction

Economic Modeling Framework - IMPLAN

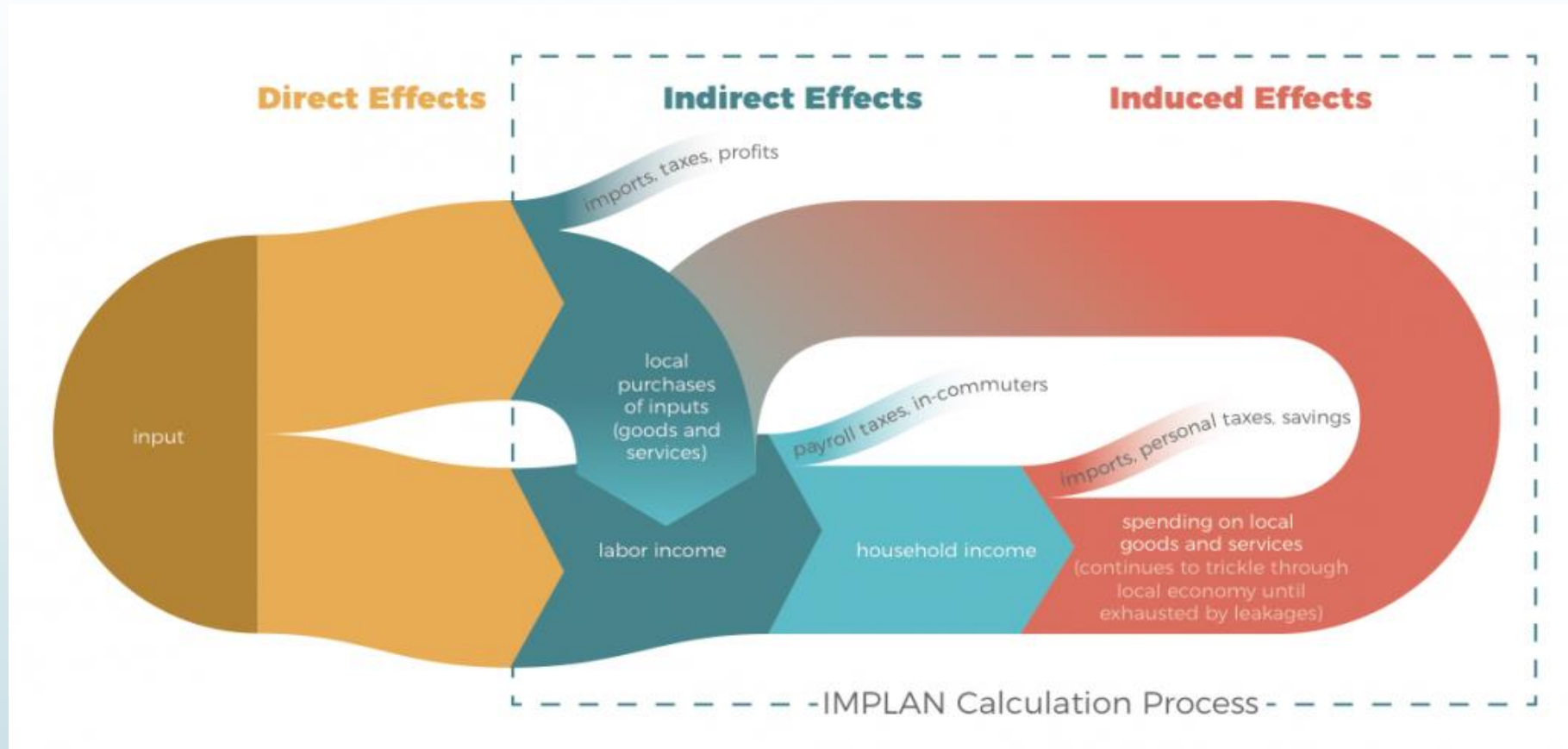
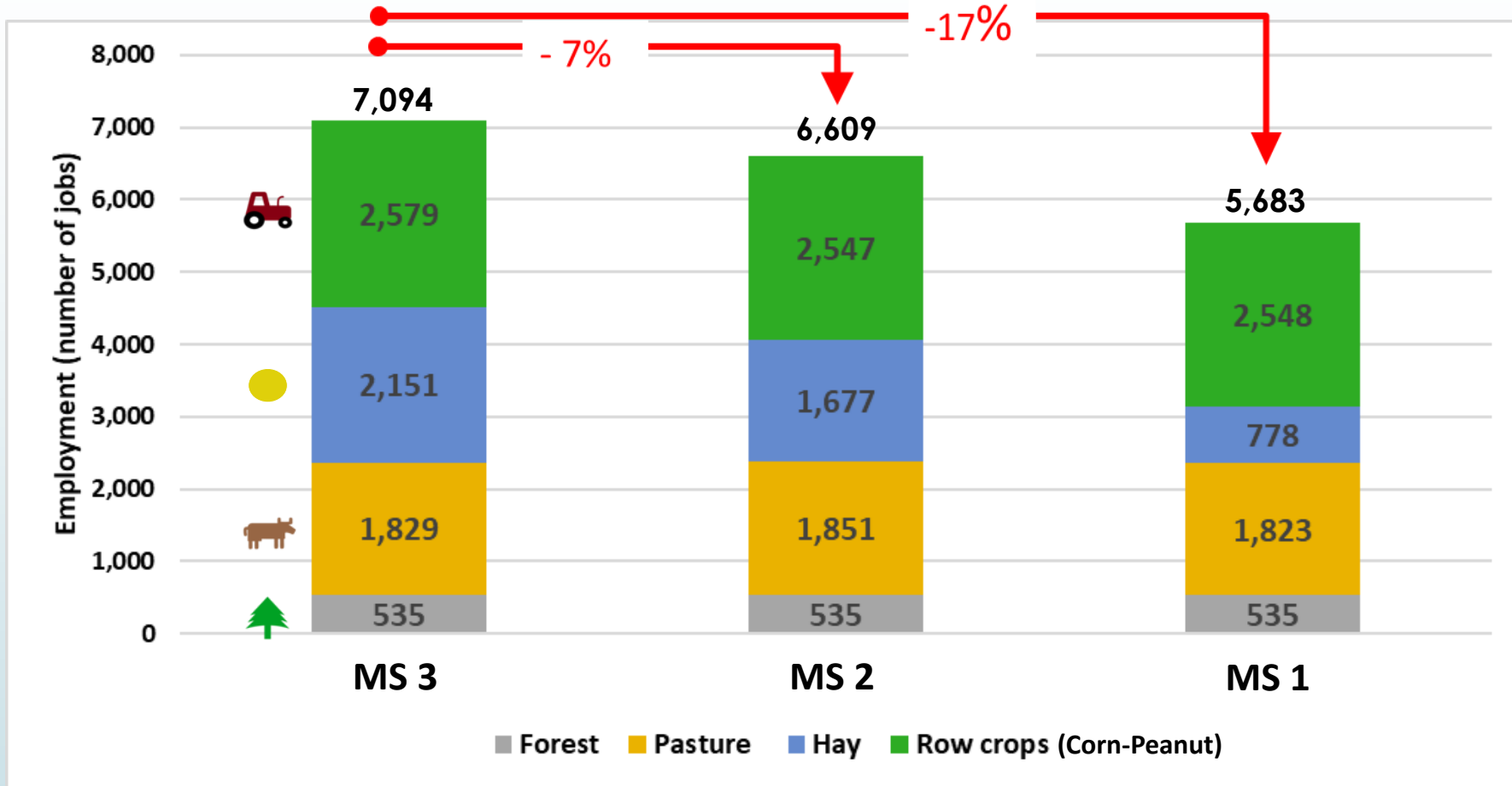


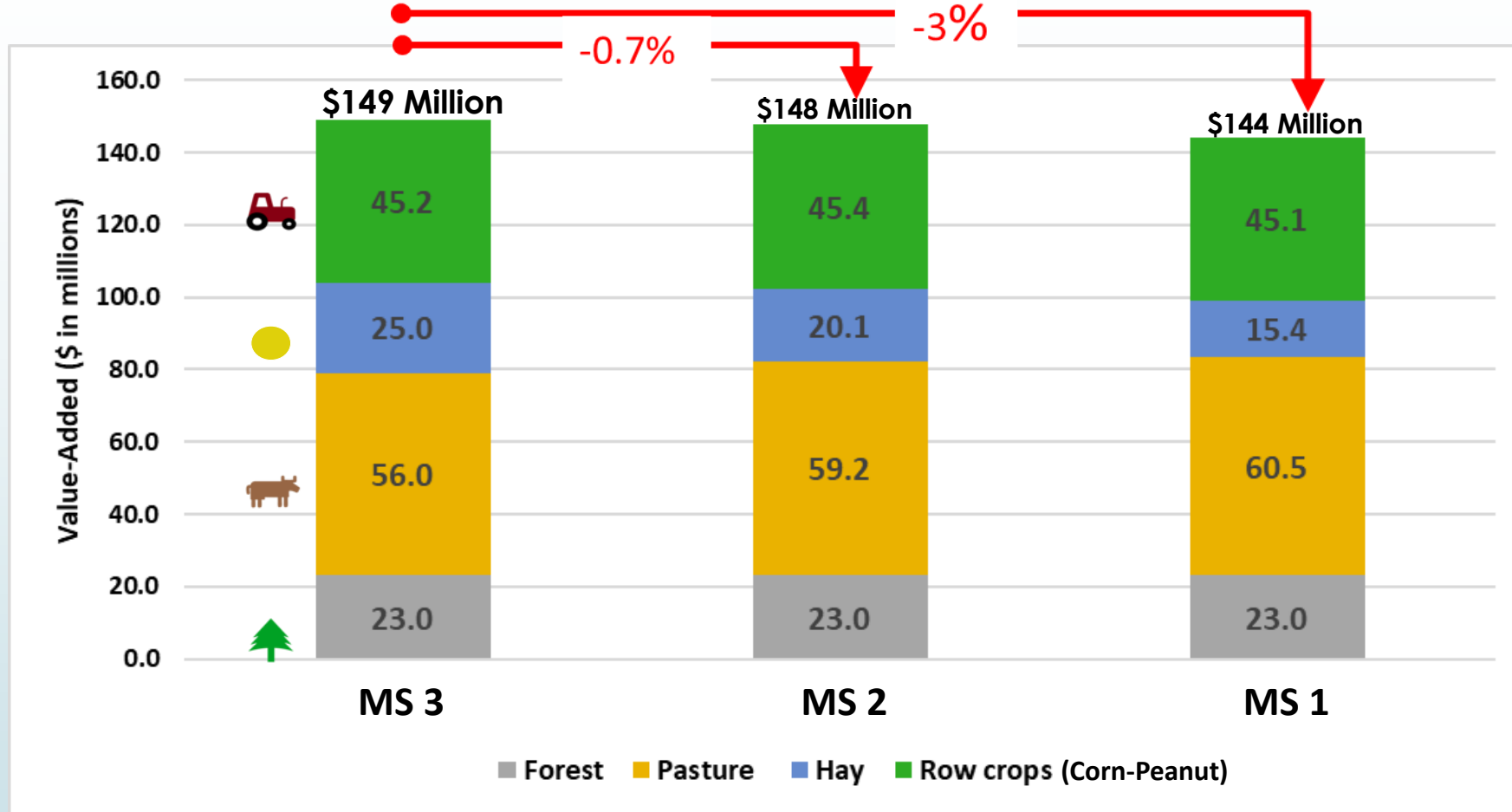
Figure: Flowchart showing direct, indirect and induced impacts estimated by IMPLAN within a regional economy

FL Simple Scenarios: Regional Economy (Employment)



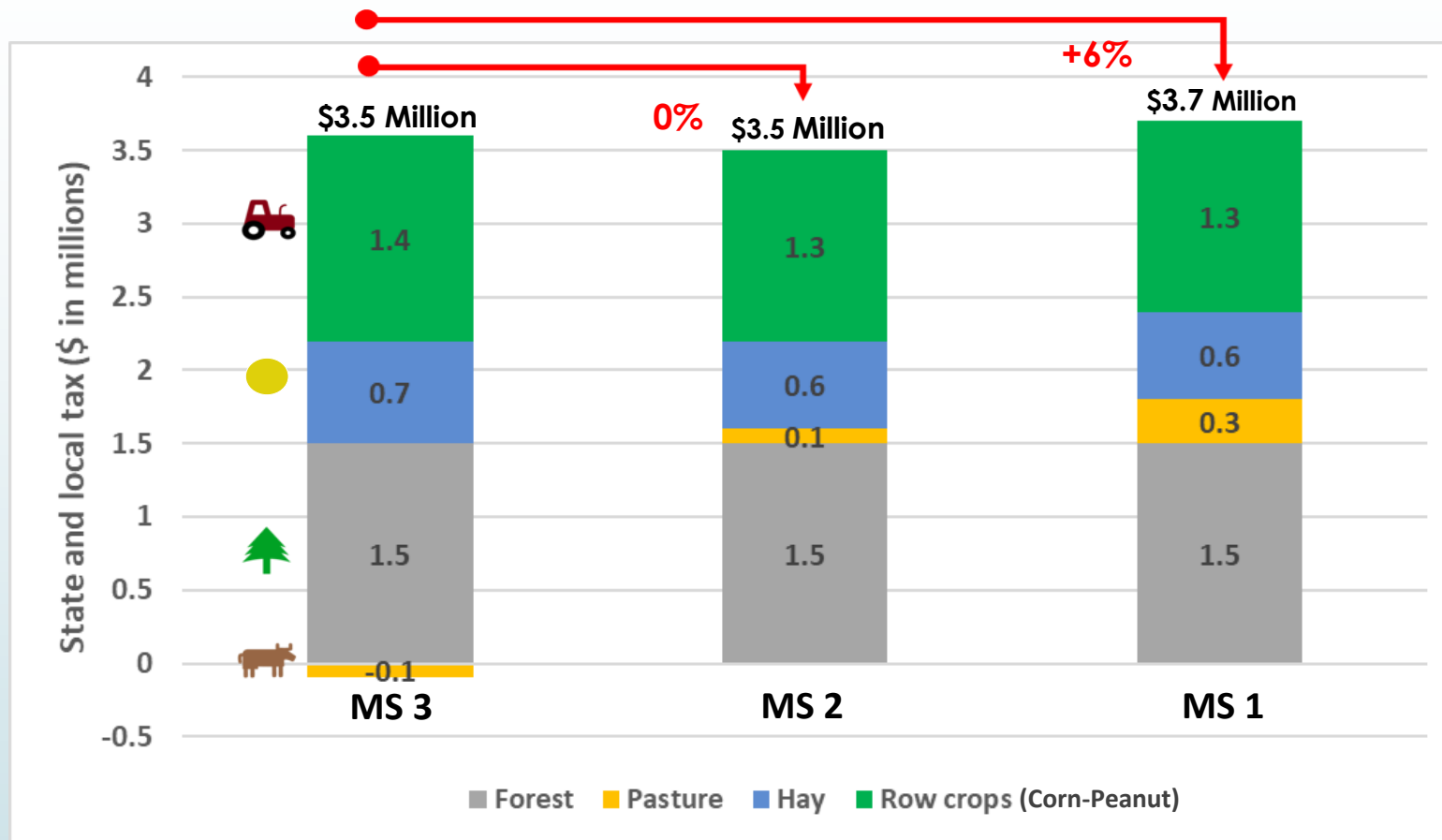
- Row crops contributed the highest number of jobs in the region. MS3 slightly more than MS 1&2
- Hay showed large decrease in employment from MS 3 to MS 1 (due to reduced # cuttings)

FL Simple Scenarios: Regional Economy (Value-Added)



- Pasture contributed the highest value-added in the region.
- Hay showed decrease in value-added from MS 3 to MS 1

FL Simple Scenarios: Regional Economy (State/local tax)



- Tax revenue generated for state and local government from employee compensation, proprietor income, production and imports, households, and corporations.
- Slightly higher tax generation under MS1 as compared to MS 2&3.

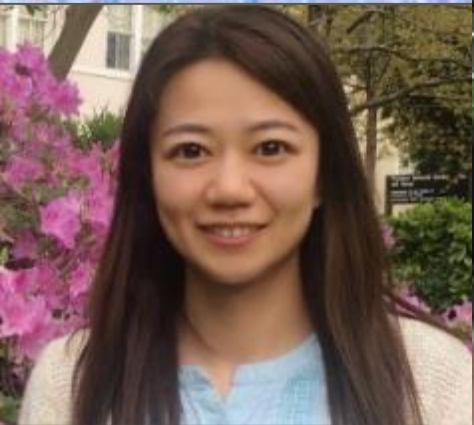
Summary

RECALL: ROW CROPS=
CORN-PEANUT

	Metric	% change All Ag MS3 ->All Ag MS2	% change All Ag MS3 ->All Ag MS1	% change All Ag MS3 ->forest
WATER QUALITY	Total Nitrate Leaching load	-19	-38	-64
	Nitrate Concentration in Devil Mills Complex Springs	-18	-43	-68
WATER QUANTITY	Aquifer pumping	-29	-31	-57
	Net recharge	1	0.8	-5
	Streamflow	1.1	1	-4.7
REGIONAL ECONOMY	Employment	-7	-17	TBD
	Value added	-1	-5	TBD

FACETS

Floridan Aquifer Collaborative Engagement for Sustainability



For more information <http://Floridanwater.org>



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The Floridan Aquifer Collaborative Engagement for Sustainability (FACETS) project is a Coordinated Agricultural Project funded by the USDA National Institute of Food and Agriculture. The FACETS project brings scientists and stakeholders together in a participatory process to develop new knowledge needed to explore tradeoffs between the regional agricultural economy and environmental quality; understand changes needed to achieve agricultural water security and environmental protection; and to implement desired changes.