Managing the Global Commons for Climate impacts on agriculture

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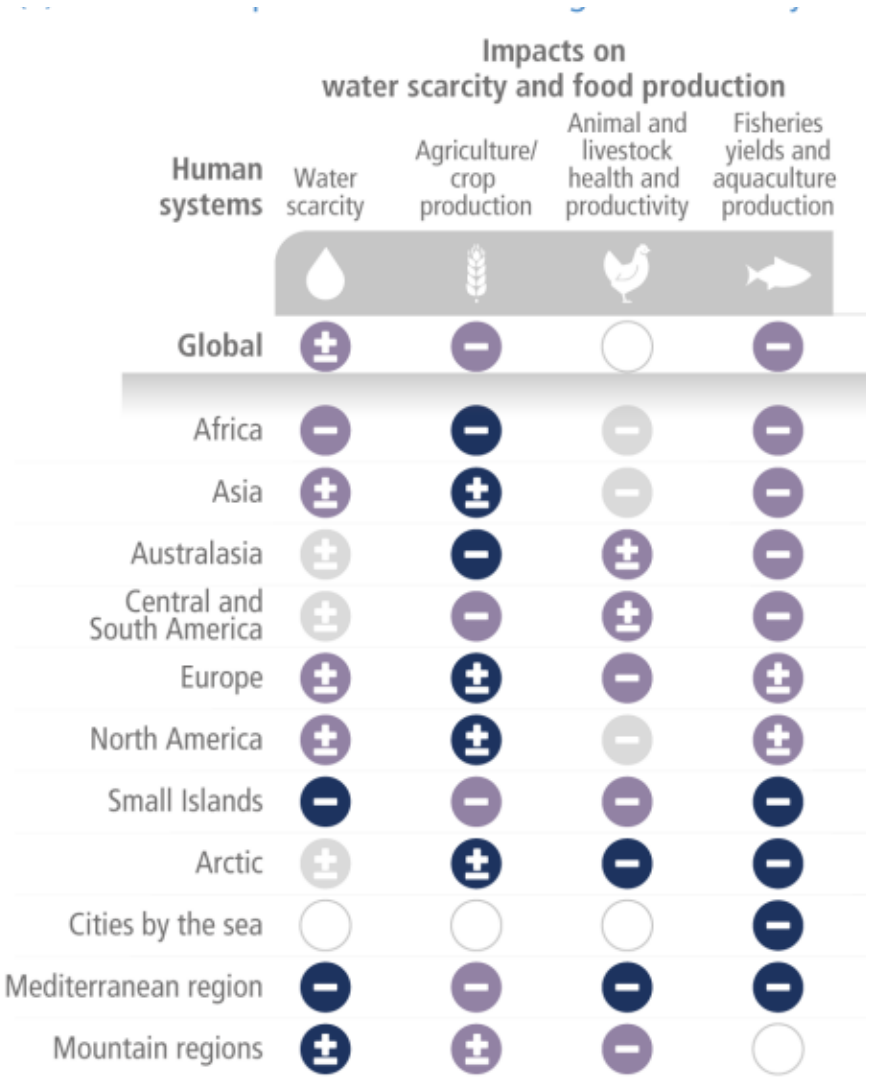
Global-Local-Global Analysis of Systems Sustainability

GLASSNET

An International Network of Networks

Global: IPCC WGII 6th Assessment Report

- Increasing pressure on food production and access, undermining food security and nutrition (high confidence).
- Increases in frequency, intensity and severity of droughts, floods and heatwaves, will increase risks to food security (high confidence).
- Global warming will progressively weaken soil health and ecosystem services such as pollination, and increase pressure from pests and diseases.



Impacts Assessment

BY THE NUMBERS

100 experts

50+ organizations

10+ reports

IN CCIA

Indiana Climate Change Impacts Assessment

Scientists & decision makers participated in developing a series of reports that show how a changing climate will affect state and local interests.

www.IndianaClimate.org

#INCCIA

#INCCIA

IN CCIA Reports

Putting global change into local perspective

Climate

Health

Forest Ecosystems

Urban Green Infrastructure

Agriculture

Aquatic Ecosystems

Tourism & Recreation

Water Resources

Energy

Infrastructure

www.IndianaClimate.org

Growing seasons will be longer….

Average date when soil temperature reaches 50°F

Feb. 6-12

Mar. 4

Future

Historical

21 - 27 days earlier

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Results for the West Central Indiana Crop Reporting District

...but planting may not be much earlier

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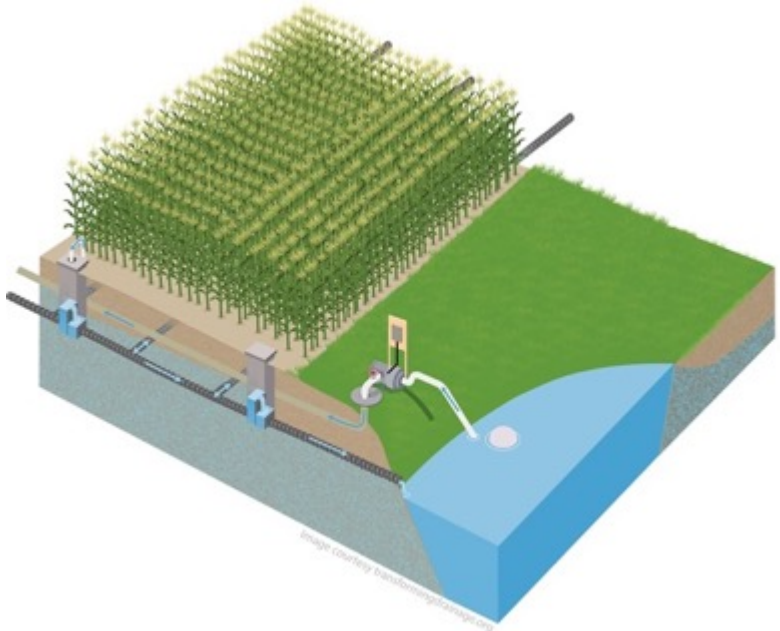
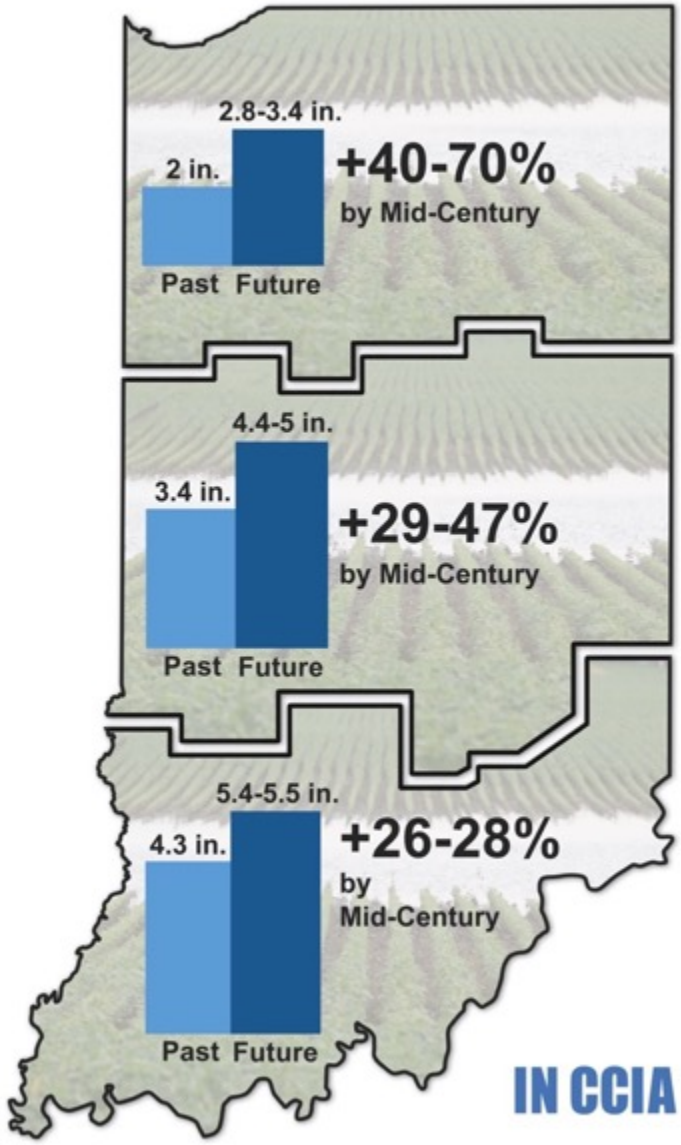
Increased potential for drainage water storage and reuse as an adaptation



Increasing Spring Drainage

Amount of water flowing from subsurface tile drains from March to May



Historical period is from 1981 to 2010. Mid-century represents the period from 2041 to 2070. Range of results based on medium and high emissions scenarios.

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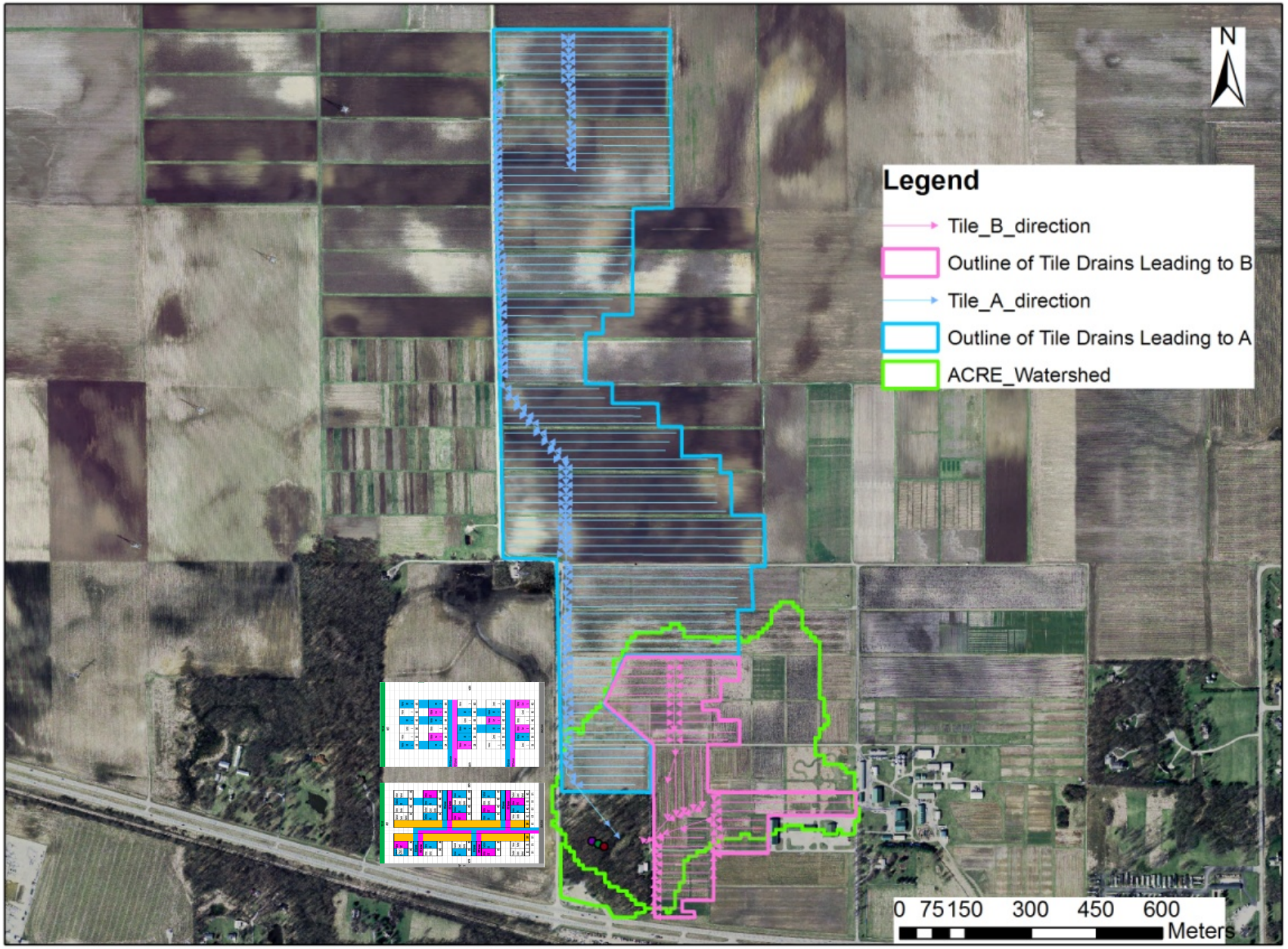
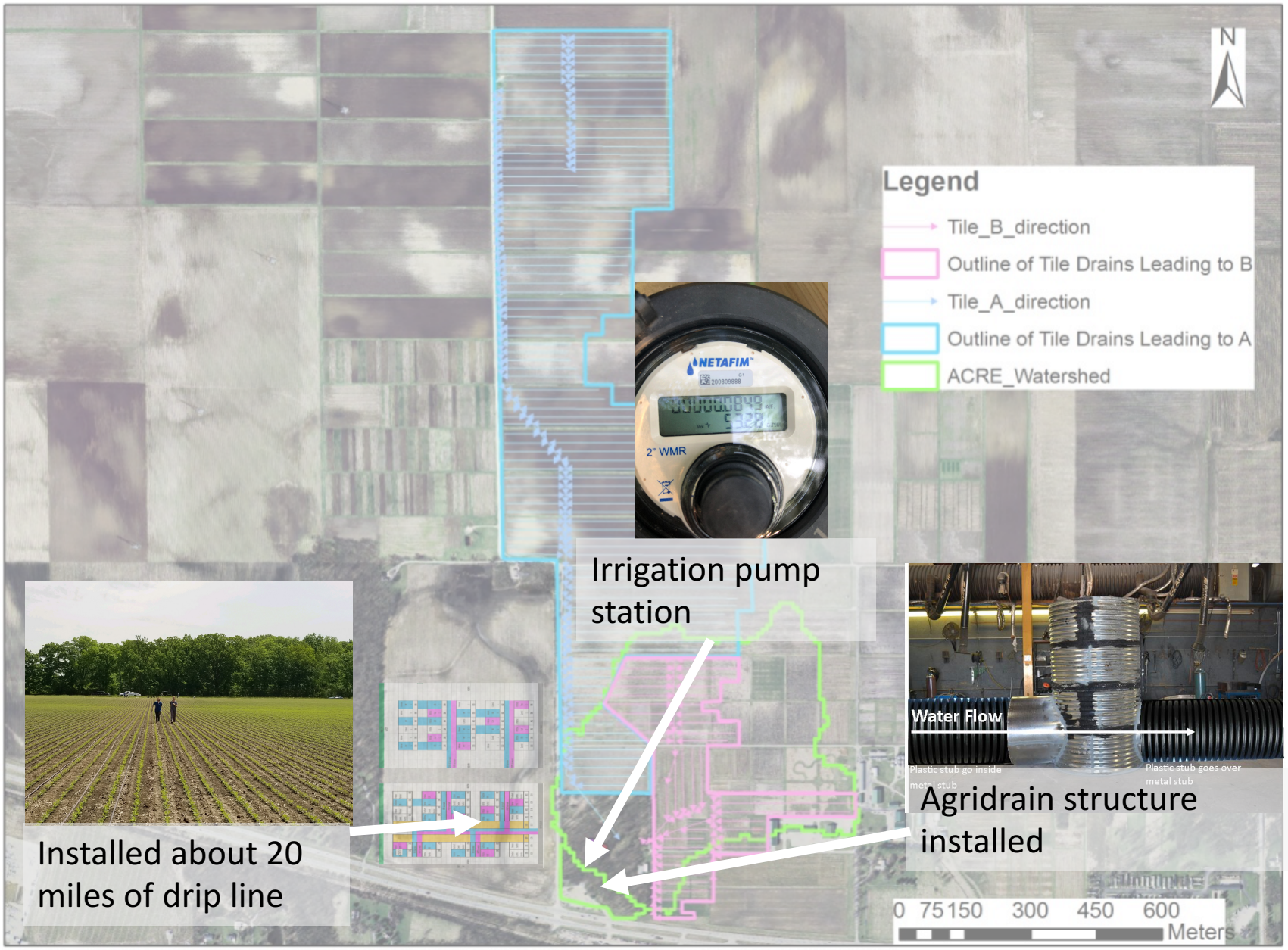
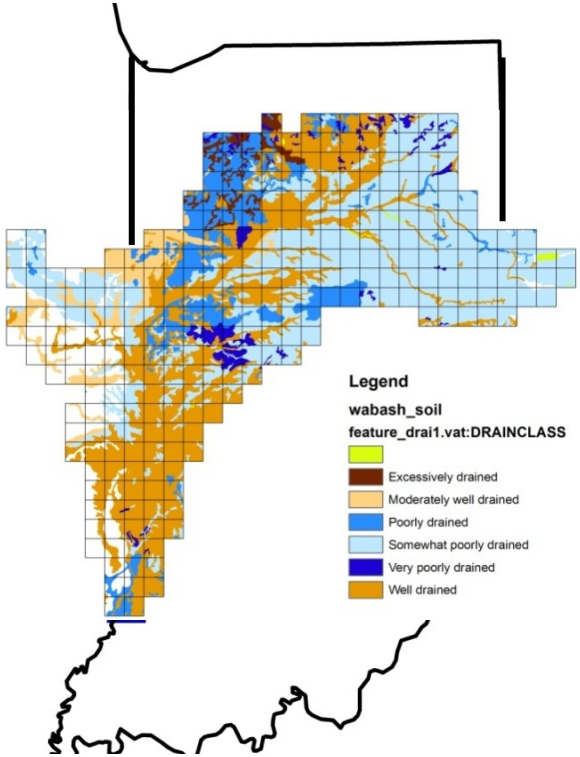

N
Legend
Tile_B_direction
Outline of Tile Drains Leading to B
Tile_A_direction
Outline of Tile Drains Leading to A
ACRE_Watershed
0 75 150 300 450 600
Meters


N
Legend
Tile_B_direction
Outline of Tile Drains Leading to B
Tile_A_direction
Outline of Tile Drains Leading to A
ACRE_Watershed
NETAFIM
2" WMR
Irrigation pump station
Water Flow
Plastic stub go inside metal stub
Plastic stub goes over metal stub
Agridrain structure installed
Installed about 20 miles of drip line
0 75 150 300 450 600
Meters

Local -> Global Feedbacks: Flooding

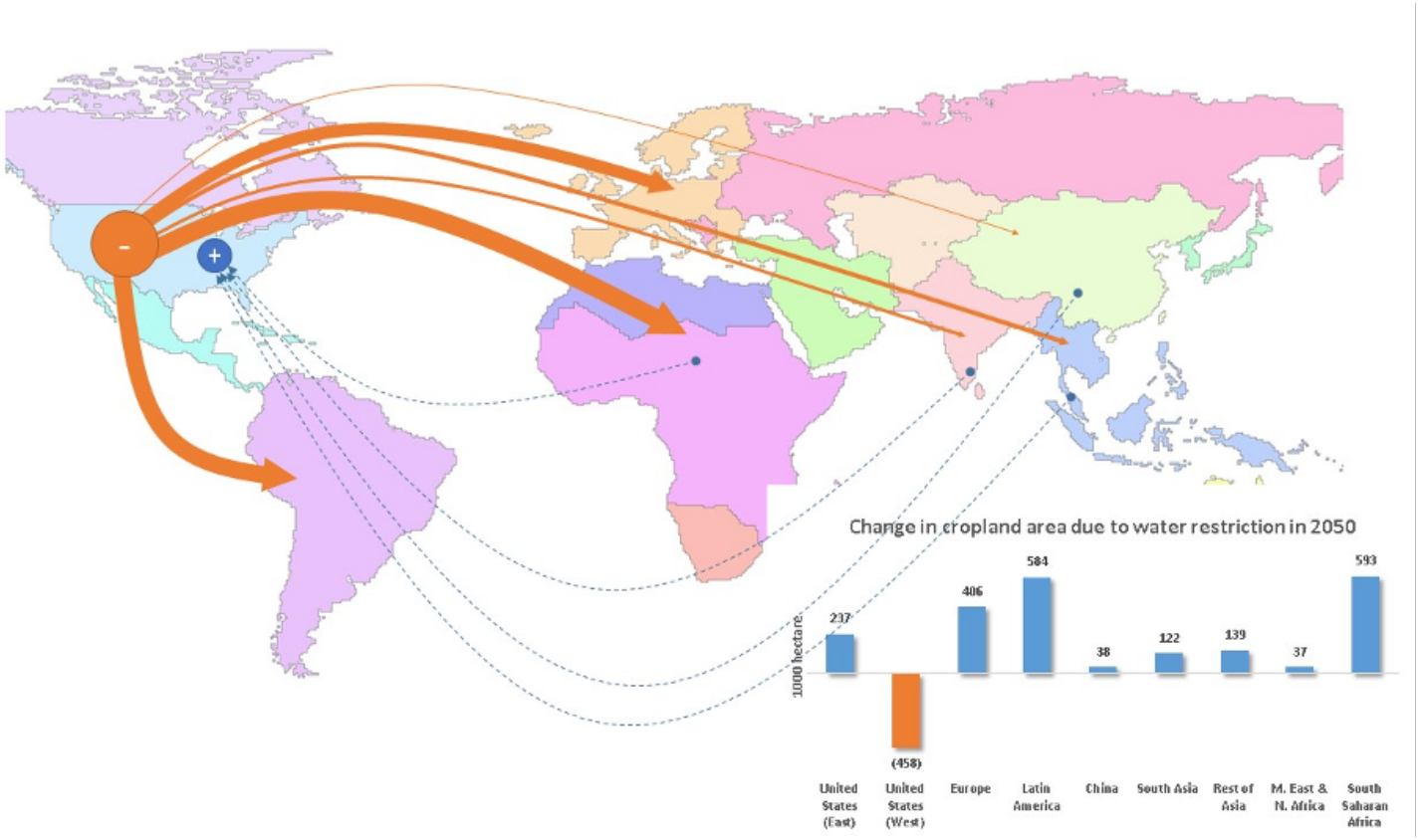


Wabash River at Riverton

- Evaluated potential of reintroducing storage in depressional wetlands
- Decreases:
  - Mean flow by <1%
  - Mean annual flood by 4%
  - Flashiness by 10%

Local -> Global Feedbacks: Yield

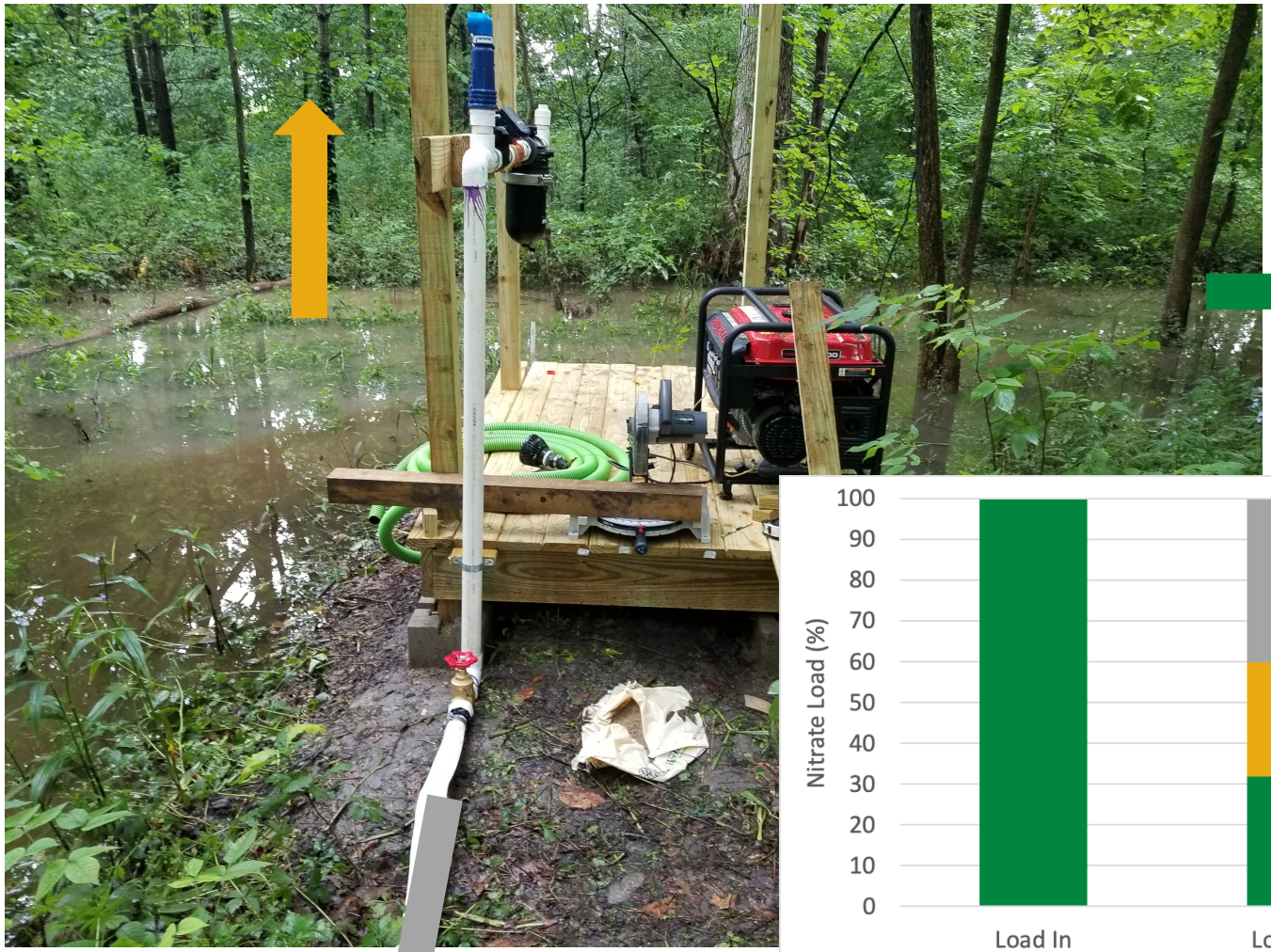
Reverse experiment: crop exports due to groundwater sustainability restriction



Haqiqi et al. (2018) "Global Drivers of Land and Water Sustainability Stresses at Mid-century," *Purdue Policy Research Institute (PPRI) Policy Briefs*: Vol. 4 : Iss. 1, Article 7.

Local -> Global Feedbacks: Water Quality

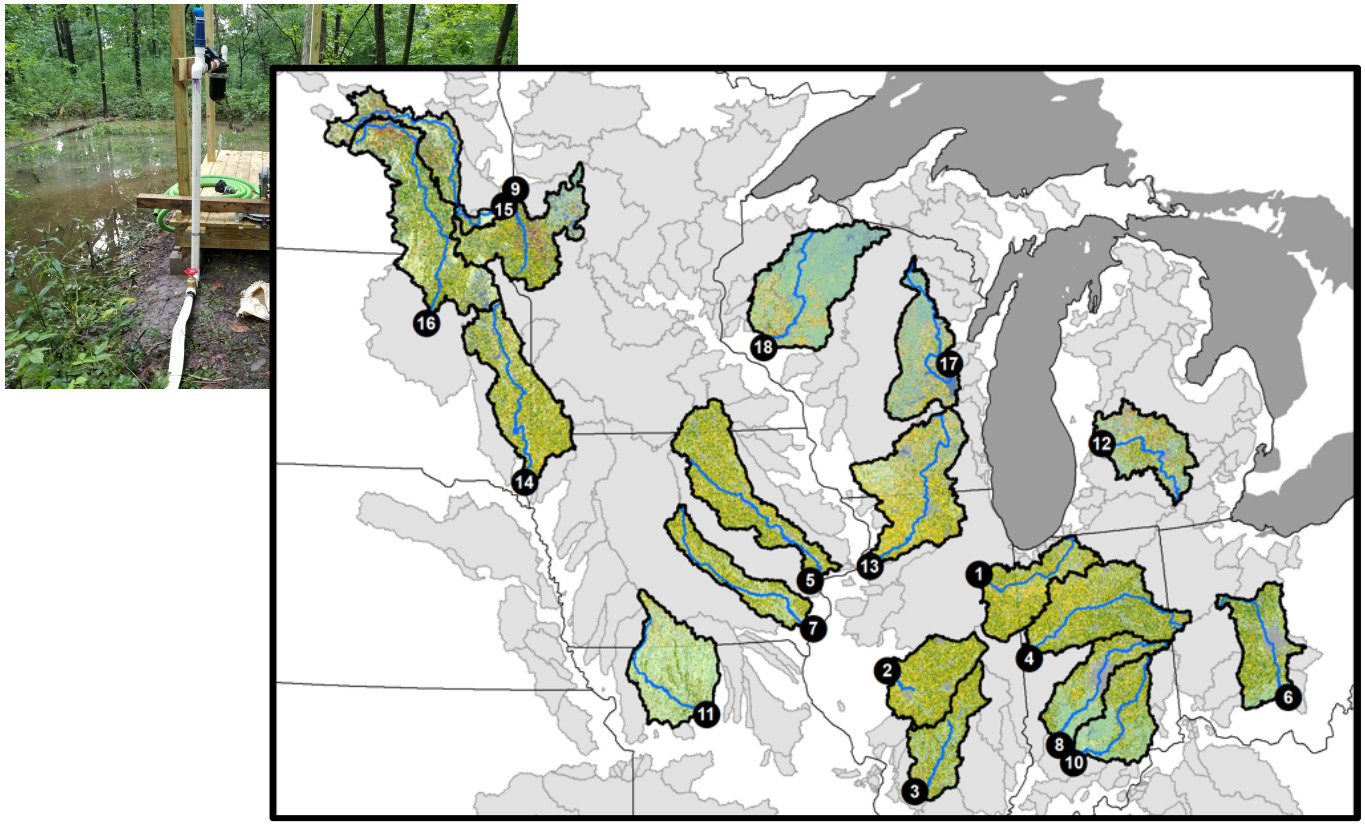
Load in from fields



Load out to stream

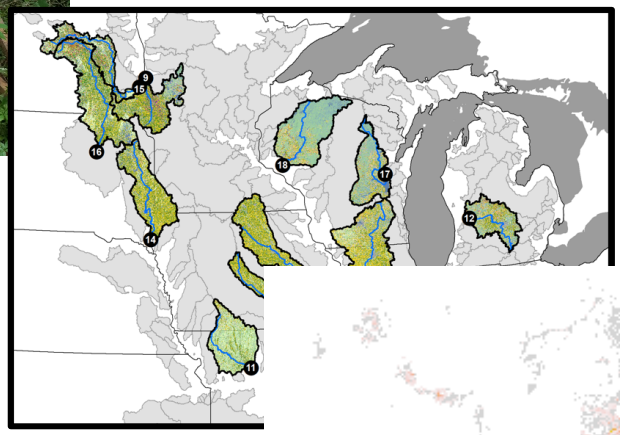
Applied to fields

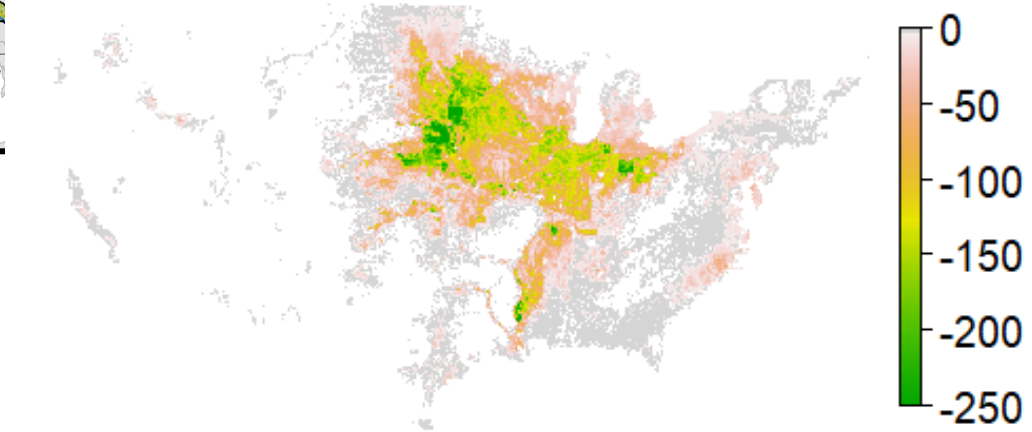
Local -> Global Feedbacks: Water Quality



Hydrologic model simulations to show potential reduction throughout the Upper Mississippi

Local -> Global Feedbacks: Water Quality





SIMPLE-G
Nitrate load reduction in tons per grid cell

Research Questions

- What are the limits of breeding and genetics for climate change adaptation?
- What local information is needed to **identify** and **initiate** beneficial local adaptations?
- How will **producer adaptations** feed back to the atmosphere, to downstream ecosystems and the global economic system?

Warming winters put perennials at risk

Average date of first hard freeze (25°F)

Nov. 11

Nov. 19-21

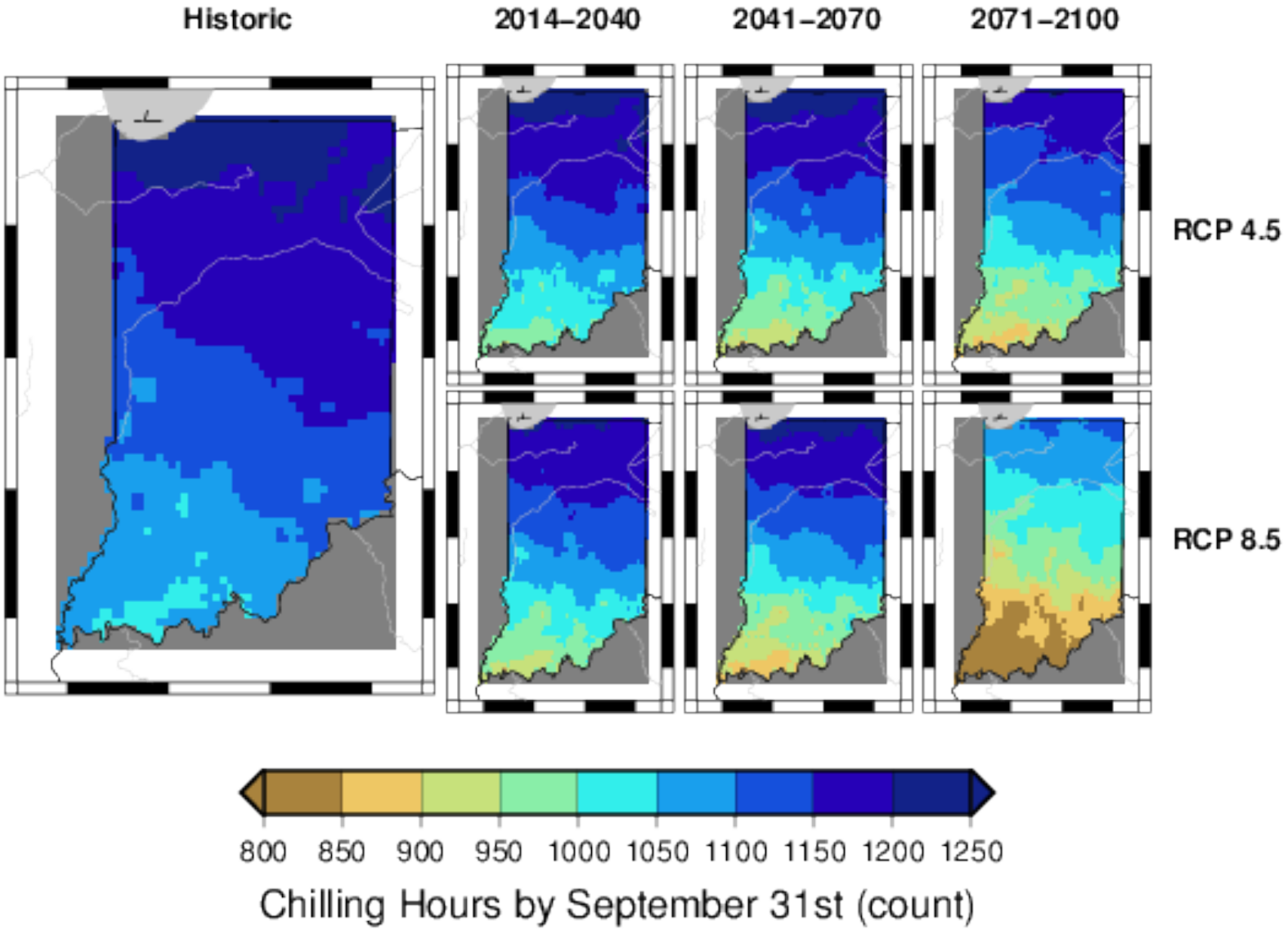
Historical

Future

10 - 12 days later

Results for West Central Indiana. Crop Reporting District

#INCCIA


Historic
2014–2040
2041–2070
2071–2100
RCP 4.5
RCP 8.5
800 850 900 950 1000 1050 1100 1150 1200 1250
Chilling Hours by September 31st (count)