NIFA Stakeholder Advisory Committee Meeting

March 30, 2022

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Agenda

- 11:30 to 12:00 – Arrive and get lunch
- 12 to 12:30 – Welcome and Housekeeping (Robyn and Greg)
- 12:30 to 1:30 - Integration of economy, land use/mgmt and ecosystem services
  - Climate regulation update (Yang)
  - Econ land use/mgmt. integration modeling (Elena, Brian, YY)
  - Land mgmt. and heterogeneity (Carrie)
- 1:30 – Break
- 1:45 to 2:05 – Policy integration (Alan, Elena, Brian)
- 2:05 - Outreach and dissemination plans (Jason, Aaron and Robyn)
- 2:35 - Wrap up (Robyn and Kristi)
- 3:00 – Adjourn!

Honorarium Paperwork

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Introductions

Research Team

- Dr. Robyn Wilson – project director
- Dr. Elena Irwin – land use modeling
- Dr. Aaron Wilson – climate modeling
- Dr. Kaiguang Zhao – services modeling
- Dr. Yongyang Cai – economic modeling
- Greg LaBarge - extension
- Dr. Bryan Mark – state climatologist
- Dr. Alan Randall – economic modeling
- Jason Cervenec – educ & outreach
- Dr. Kristi Lekies - evaluator
- Dr. Mary Doidge – behavioral modeling
- Post-docs/GRAs: Carrie Shaffer-Morrison, Khyati Malik, Brian Cultice, Mackenzie Jones, Ziyu Guo, Yang Li, Ziqian Gong, Tongxi Hu

Stakeholder Advisory Team

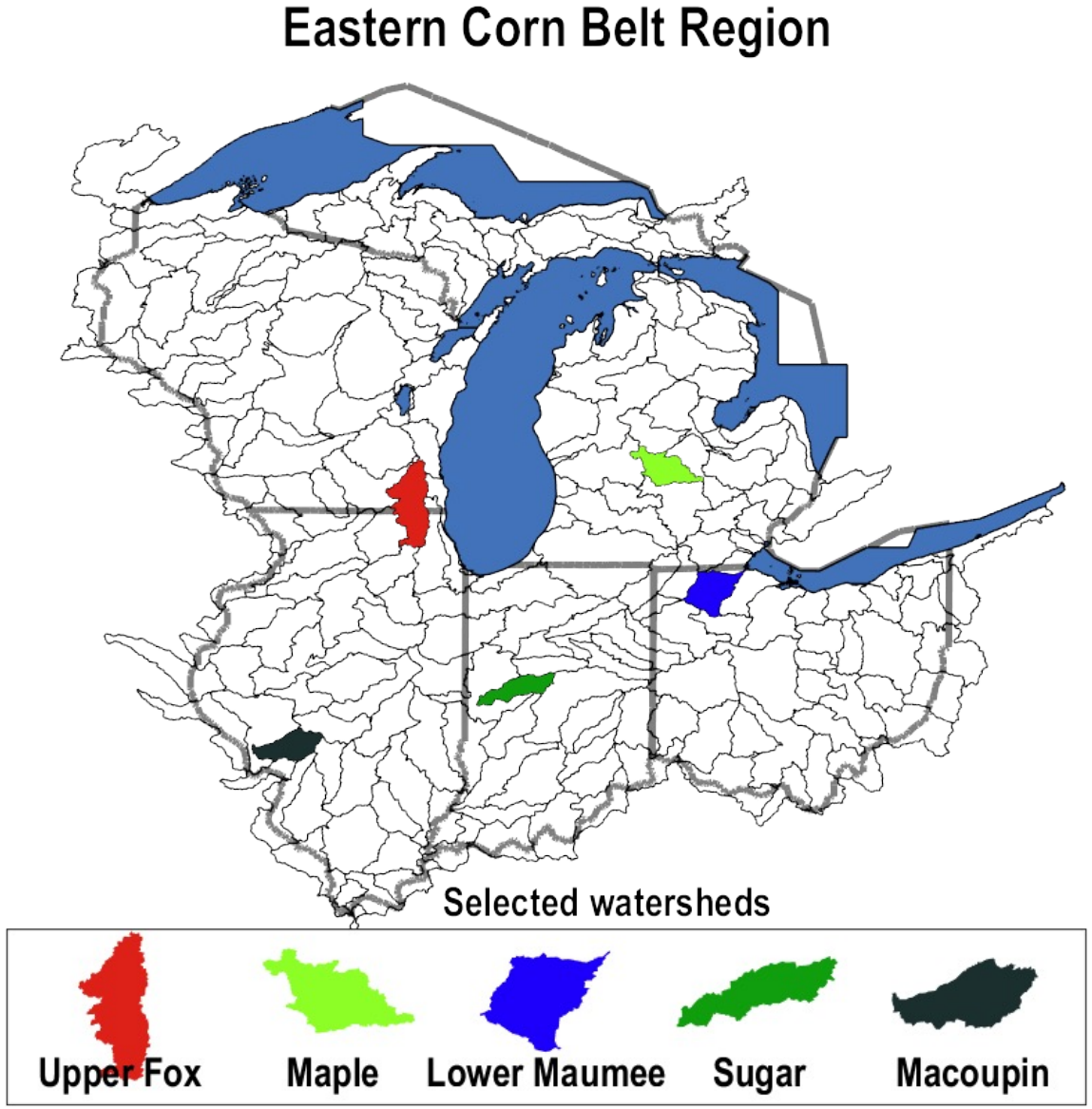
- Kirk Merritt – Ohio Soybean Council
- Dr. Larry Antosch – Ohio Farm Bureau
- Dr. Dennis Todey – USDA Midwest Climate Hub
- Dr. Carl Zulauf – OSU Emeritus Ag Policy
- Steve Emery – Nutrien Ag Solutions
- Mark Apelt – Becks Hybrid
- Nate Andre – Andre Farms
- Luke Crumley – Ohio Corn & Wheat
- Jeff Goetz – The Andersons
- Gail Hesse –National Wildlife Federation
- Kevin Elder – Farmer
- Matthew Adams – Ag Credit
- Tadd Nicholson – Ohio Corn and Wheat

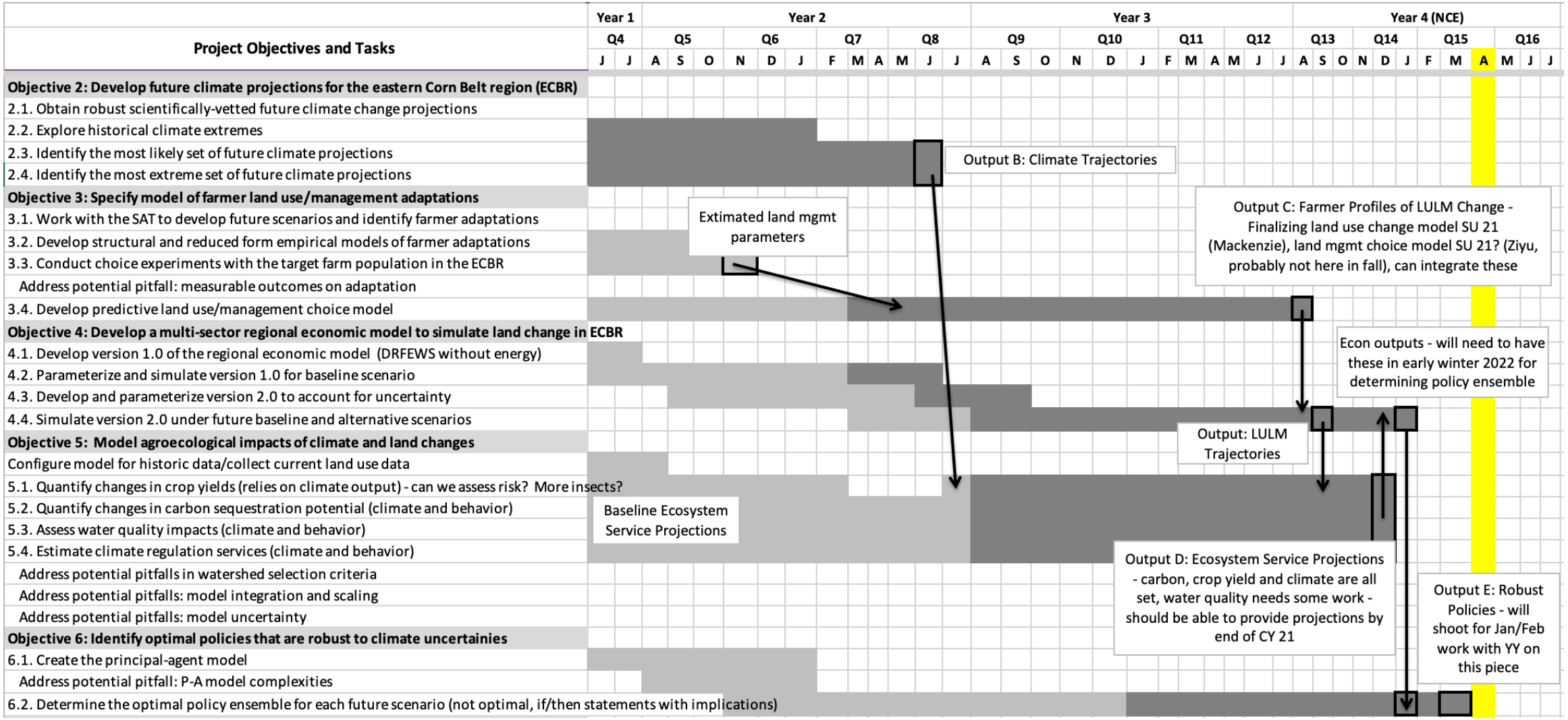
Overall research question

In the face of climate risks and uncertainties that influence farmer adaptations…

What is the right set of policies and programs to achieve **sustainable and resilient agroecosystem management** that balances agricultural production with critical ecosystem services?

- What is the impact of climate and farmer decision making on ecosystem services?
  - Downscaled climate modeling
  - Farmer adaptation survey
  - Ecosystem services model
- Given this spatially explicit understanding, what are the expected regional economic outcomes?
  - Dynamic, regional economic model
- What policies might best promote sustainability and resilience?
  - Optimal policy assessment




Project Objectives and Tasks
Year 1
Year 2
Year 3
Year 4 (NCE)
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J
Objective 2: Develop future climate projections for the eastern Corn Belt region (ECBR)
2.1. Obtain robust scientifically-vetted future climate change projections
2.2. Explore historical climate extremes
2.3. Identify the most likely set of future climate projections
2.4. Identify the most extreme set of future climate projections
Output B: Climate Trajectories
Objective 3: Specify model of farmer land use/management adaptations
3.1. Work with the SAT to develop future scenarios and identify farmer adaptations
3.2. Develop structural and reduced form empirical models of farmer adaptations
3.3. Conduct choice experiments with the target farm population in the ECBR
Extimated land mgmt parameters
Output C: Farmer Profiles of LULM Change - Finalizing land use change model SU 21 (Mackenzie), land mgmt choice model SU 21? (Ziyu, probably not here in fall), can integrate these
Address potential pitfall: measurable outcomes on adaptation
3.4. Develop predictive land use/management choice model
Objective 4: Develop a multi-sector regional economic model to simulate land change in ECBR
4.1. Develop version 1.0 of the regional economic model (DRFEWS without energy)
4.2. Parameterize and simulate version 1.0 for baseline scenario
4.3. Develop and parameterize version 2.0 to account for uncertainty
4.4. Simulate version 2.0 under future baseline and alternative scenarios
Econ outputs - will need to have these in early winter 2022 for determining policy ensemble
Output: LULM Trajectories
Objective 5: Model agroecological impacts of climate and land changes
Configure model for historic data/collect current land use data
5.1. Quantify changes in crop yields (relies on climate output) - can we assess risk? More insects?
5.2. Quantify changes in carbon sequestration potential (climate and behavior)
5.3. Assess water quality impacts (climate and behavior)
5.4. Estimate climate regulation services (climate and behavior)
Baseline Ecosystem Service Projections
Output D: Ecosystem Service Projections - carbon, crop yield and climate are all set, water quality needs some work - should be able to provide projections by end of CY 21
Address potential pitfalls in watershed selection criteria
Address potential pitfalls: model integration and scaling
Address potential pitfalls: model uncertainty
Output E: Robust Policies - will shoot for Jan/Feb work with YY on this piece
Objective 6: Identify optimal policies that are robust to climate uncertainies
6.1. Create the principal-agent model
Address potential pitfall: P-A model complexities
6.2. Determine the optimal policy ensemble for each future scenario (not optimal, if/then statements with implications)

CFAES

Project Object
Objective 2: Develop future climate project
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Output: LULM Trajectories

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Output E: Robust Policies - will shoot for Jan/Feb work with YY on this piece

Year 4 (NCE)

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J	A	S	O	N	D	J	F	M	A	M	J	J			

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Output E: Robust Policies - will shoot for Jan/Feb work with YY on this piece

Ecosystem Services: Climate Regulation

Team: Kaiguang Zhao, Yang Li, and Tongxi Hu

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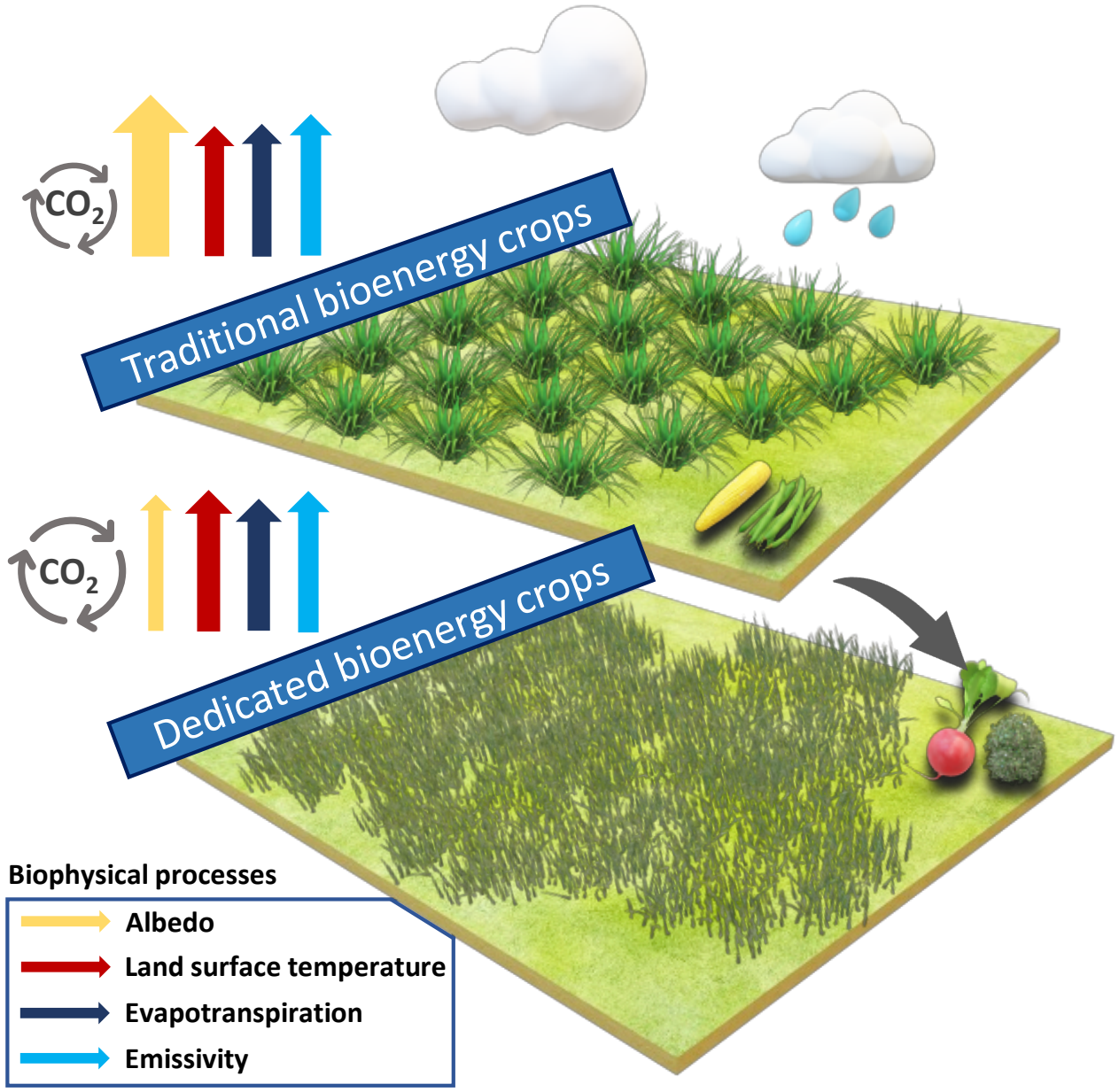
Overview of this sub-task

- Quantify changes in ecosystem services under possible future scenarios
  - Projected climate change
  - Projected land use
  - Project adaptation (management practices)
- Focus on four services
  - Carbon sequestration
  - Food production
  - Water quality
  - **Climate regulation**



Land-use change alters land surface properties:

(1) Albedo

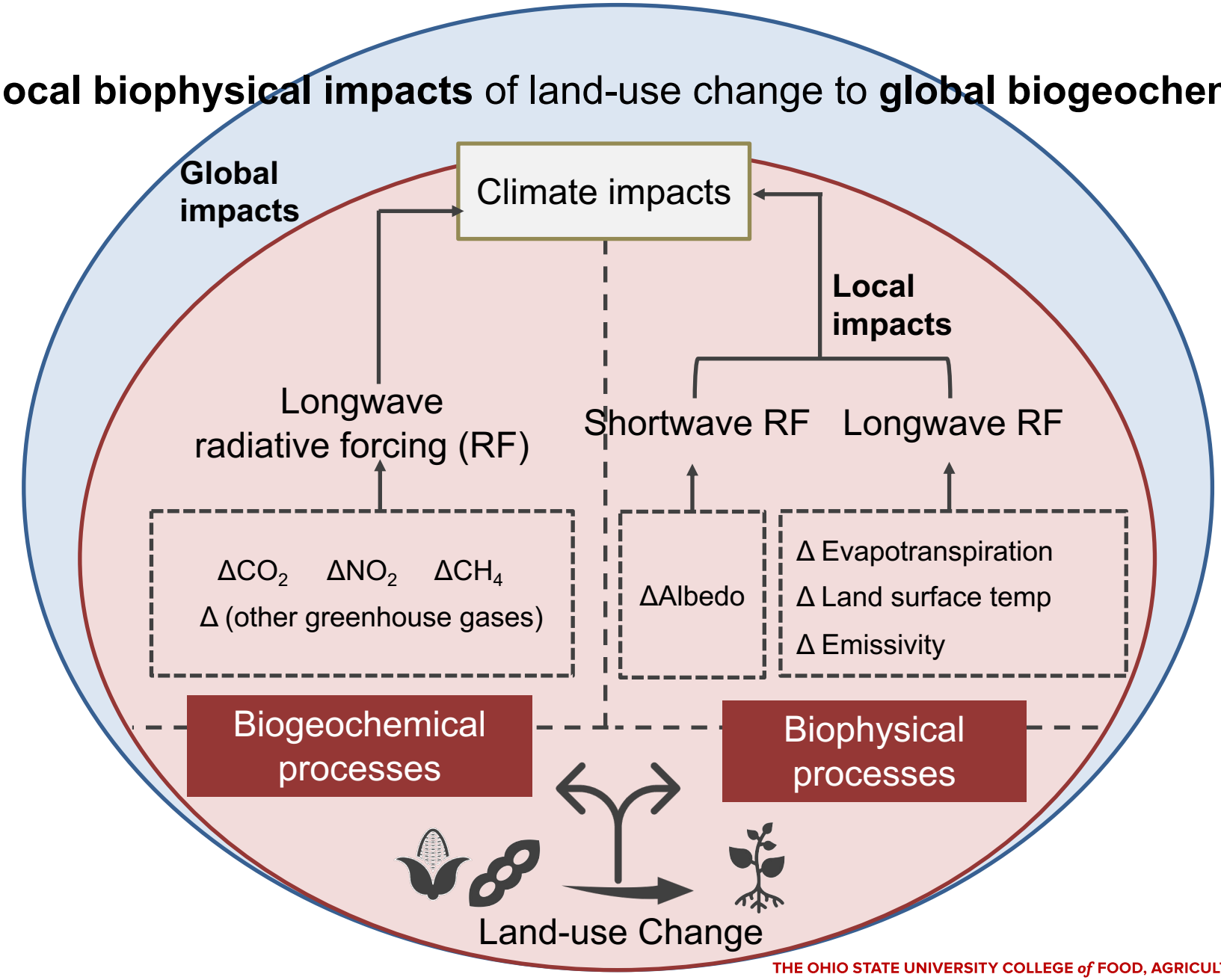
(2) Land surface temperature

(3) Evapotranspiration

(4) Emissivity

…

Comparing **local biophysical impacts** of land-use change to **global biogeochemical impacts**



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Reactions / Suggestions?

- What questions do you have?
- What is surprising?
- What is concerning?

Integrated Regional Economic-Land Use Modeling: Overview and Update

Team: Yongyang Cai, Brian Cultice, Ziqian Gong, Elena Irwin, and Mackenzie Jones

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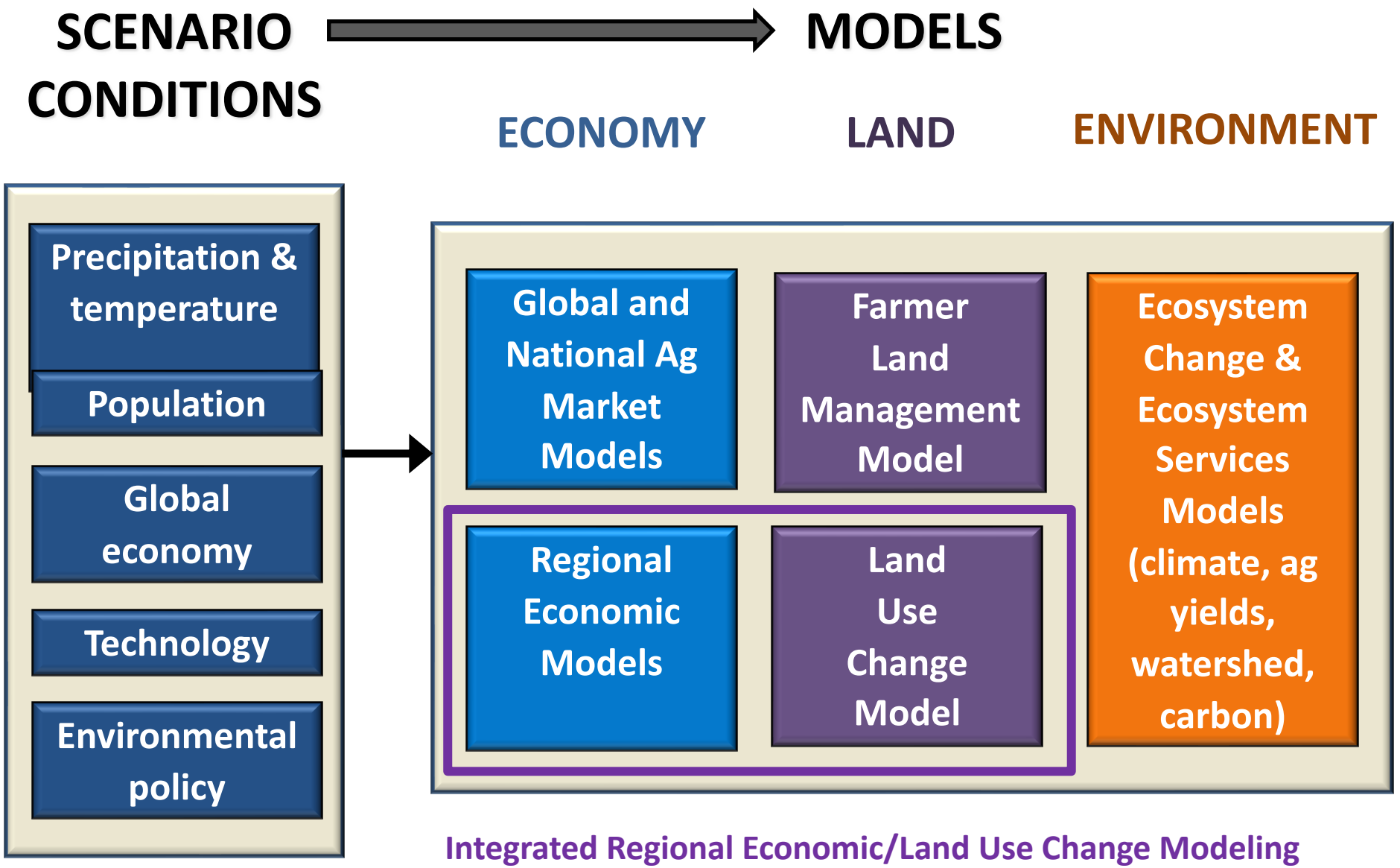
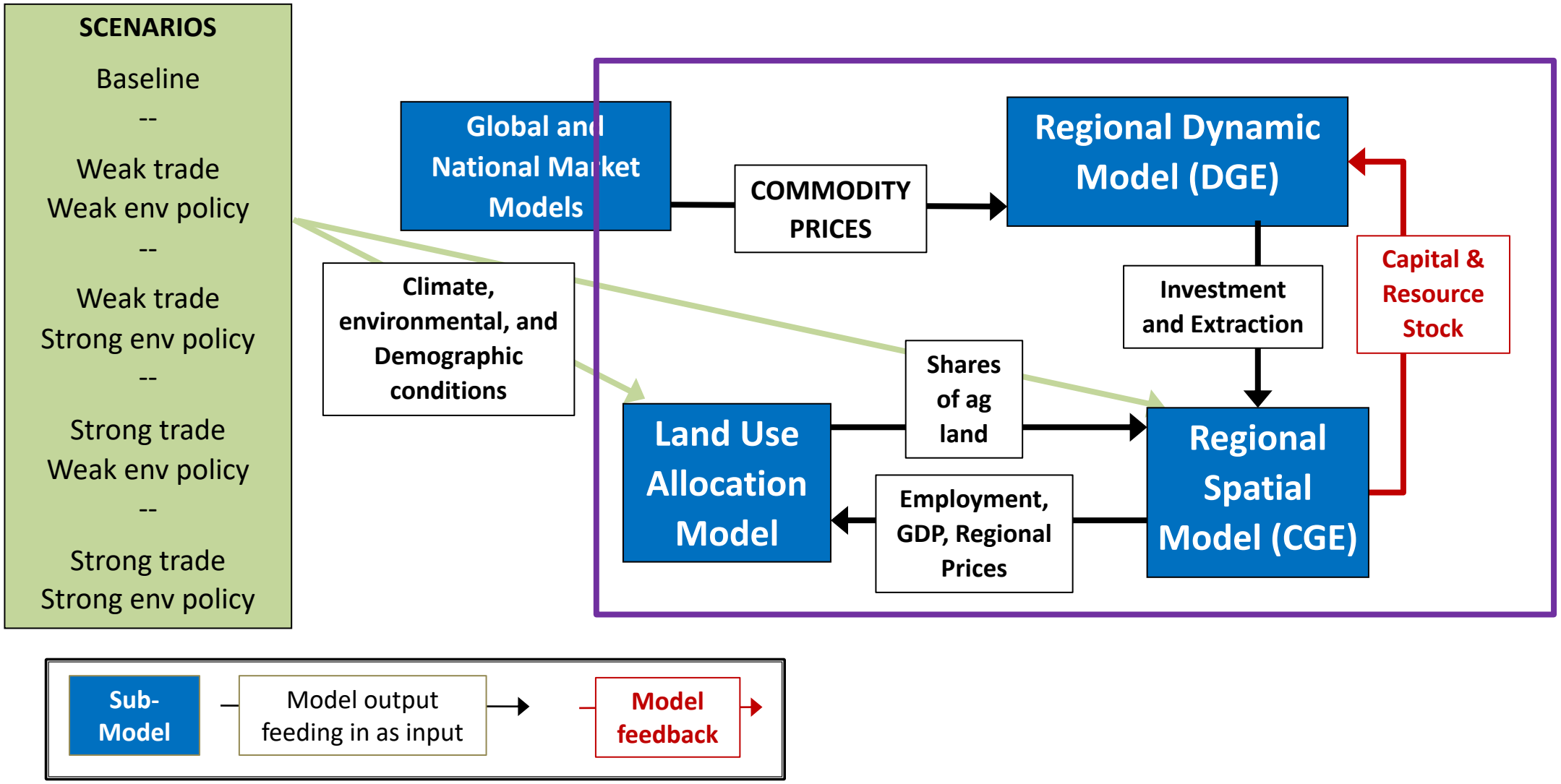
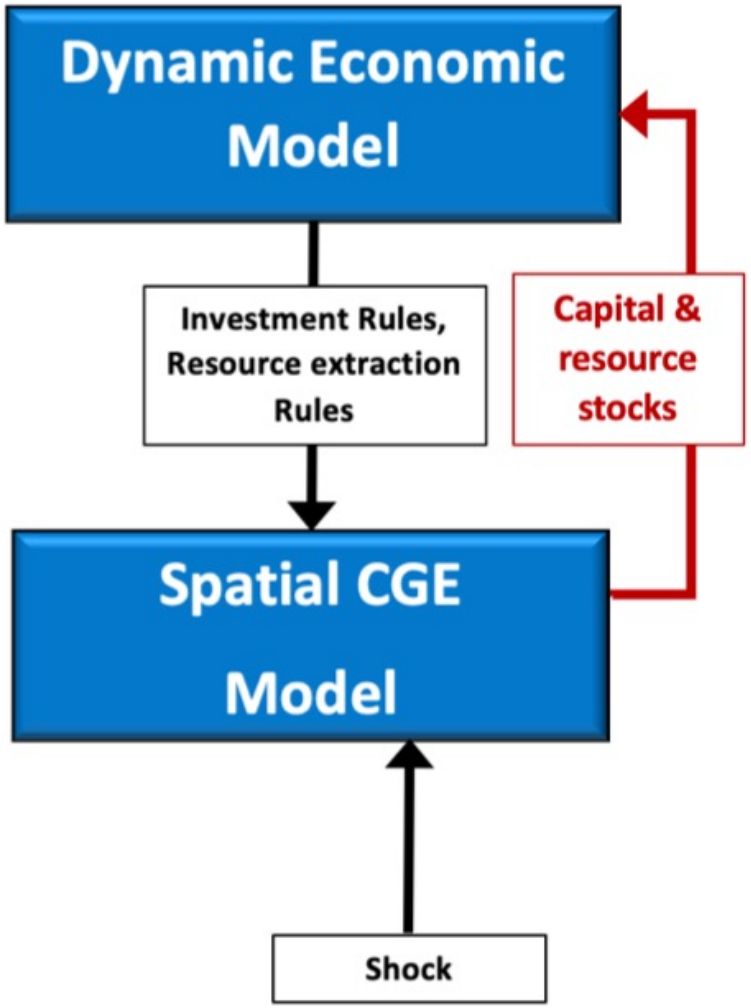
NIFA Model Components



Integrated Regional Economic/Land Use Change Modeling



Dynamic Economic Model: Overview

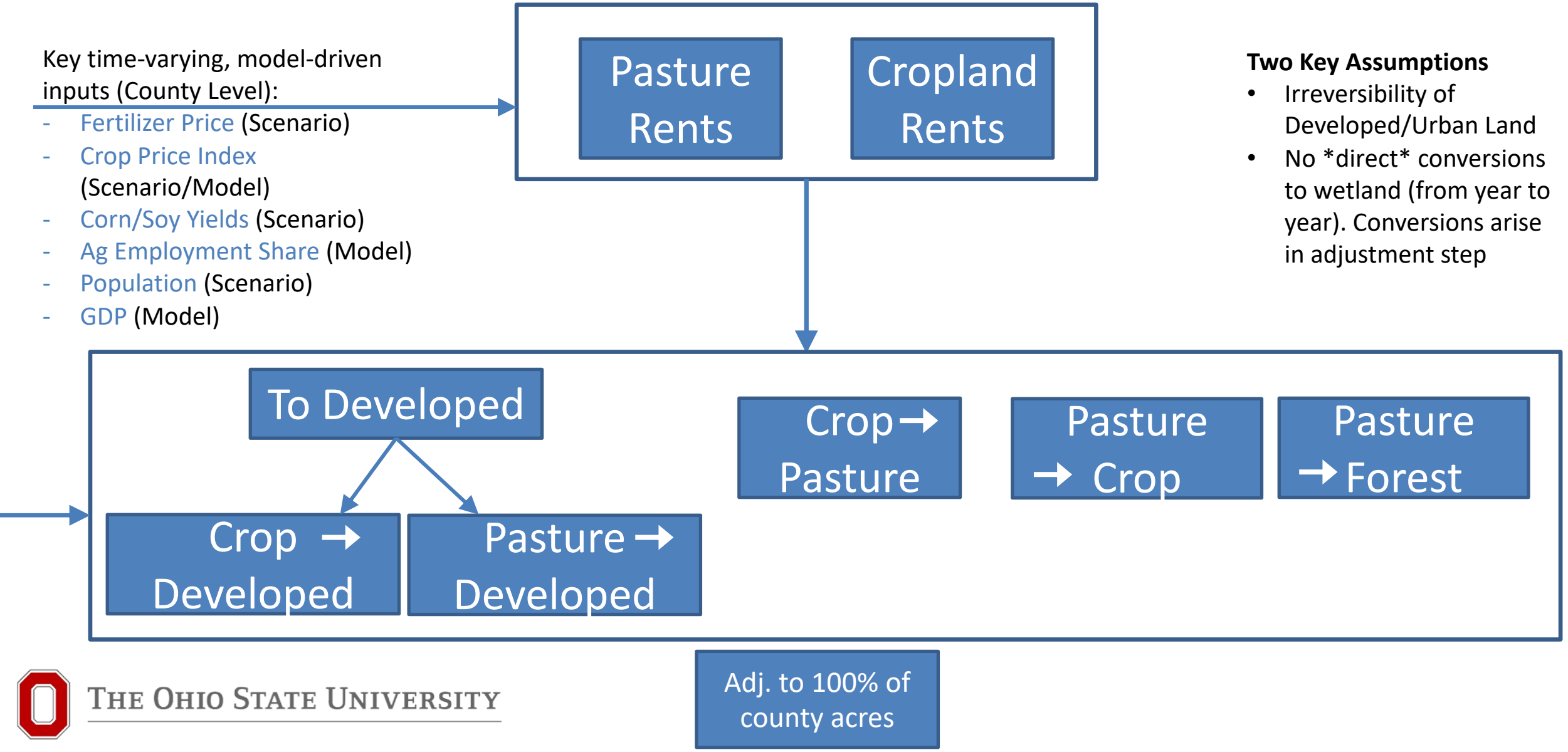


- Process
  - The dynamic economic model will provide intertemporal decisions which are investment rules and resource extraction rules to the spatial CGE model.
  - Spatial CGE model will output the capital and resource stocks, production, and consumption
- Why Two Models?
  - Traditional CGE is static, which can't capture forward looking decisions such as investment
  - One single dynamic five state model is difficult to solve for the global optimal
  - Two models allows for easier introduction of stochasticity (randomness) and can incorporate more spatial detail (counties)

LUC Model Schematic

Key time-varying, model-driven inputs (County Level):

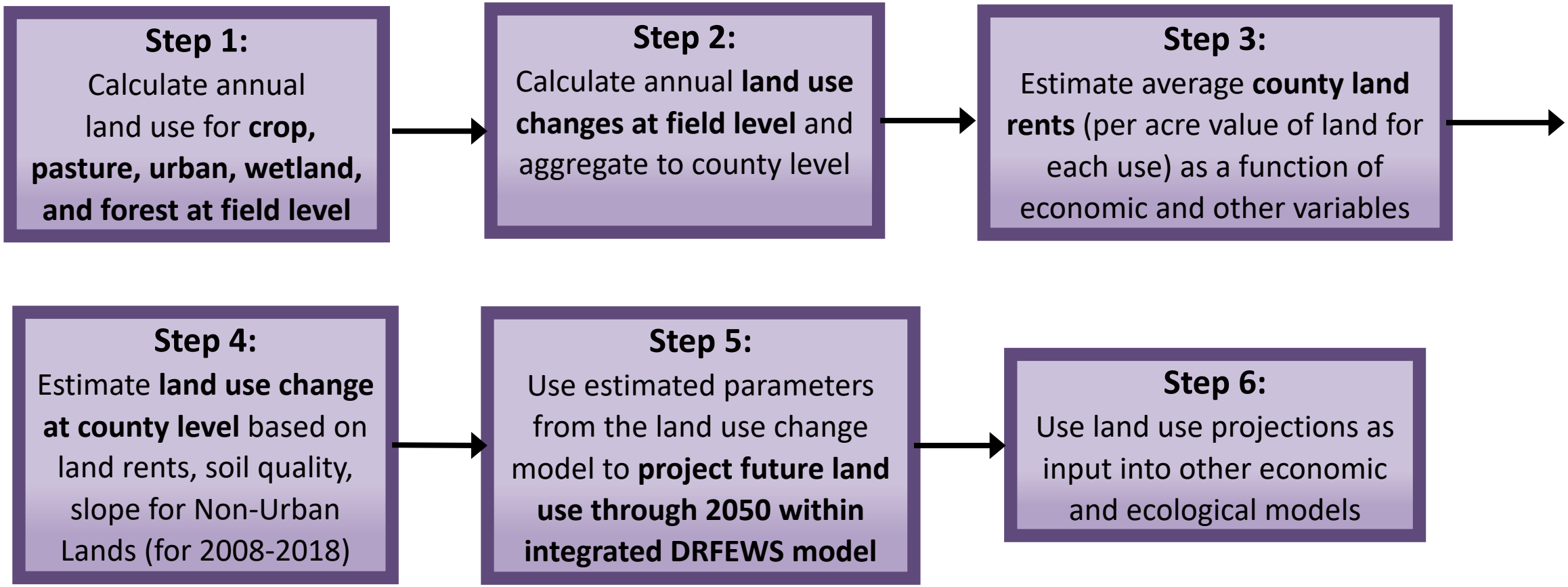
- Fertilizer Price (Scenario)
- Crop Price Index (Scenario/Model)
- Corn/Soy Yields (Scenario)
- Ag Employment Share (Model)
- Population (Scenario)
- GDP (Model)



Two Key Assumptions

- Irreversibility of Developed/Urban Land
- No *direct* conversions to wetland (from year to year). Conversions arise in adjustment step

Land Use Modeling Approach: Overview



LUC Module: Data and Approach

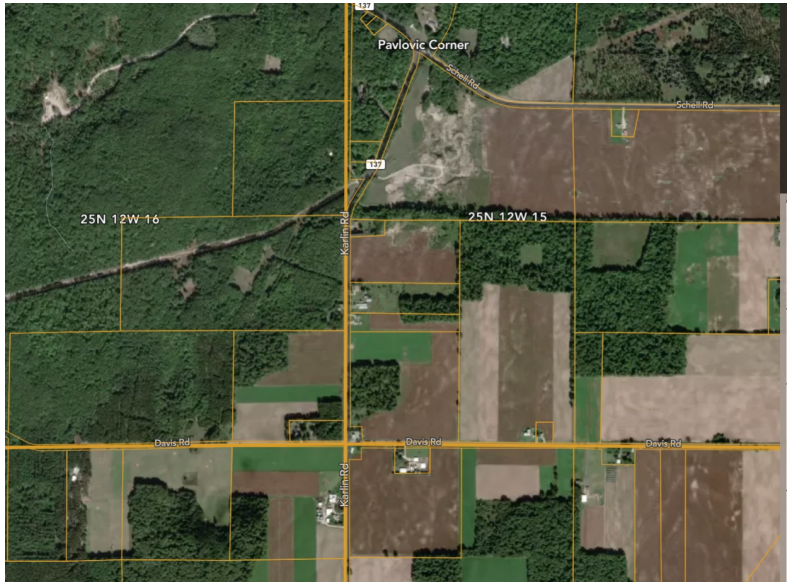
USDA Common Land Unit – Fields Shapefile

- Field shapefile, identified using satellite data and validated via USDA census and survey
- 2008 only for external usage
- Excludes most existing urban/developed areas, extensively forested areas, and protected lands

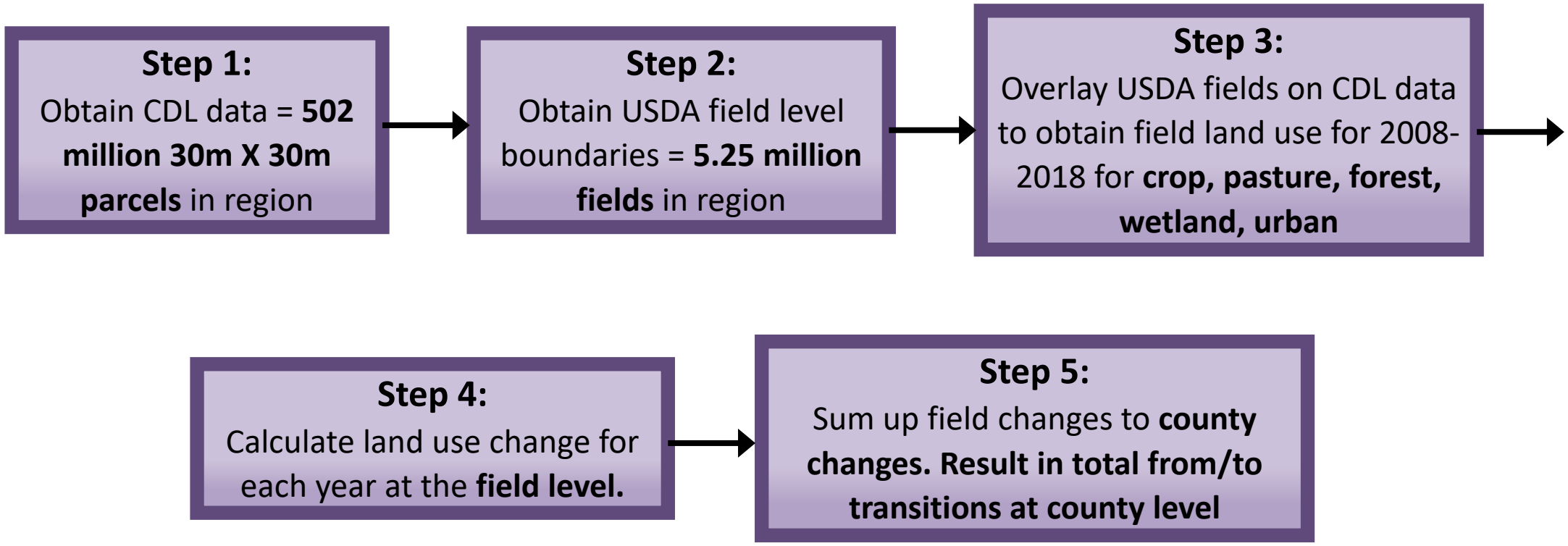
Cropland Data Layer (2008-2018)

- Land use raster, w/ validated crop specific categories
- LU assignment rules validated to minimize discrepancies between aggregate land use and predicted land use

Credit: AcreValue.com

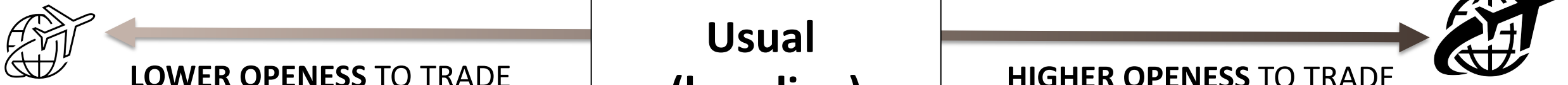


LUC Module: Generating Land Use Data



STRONGER ENVIRONMENTAL SUSTAINABILITY

SCENARIO FRAMEWORK



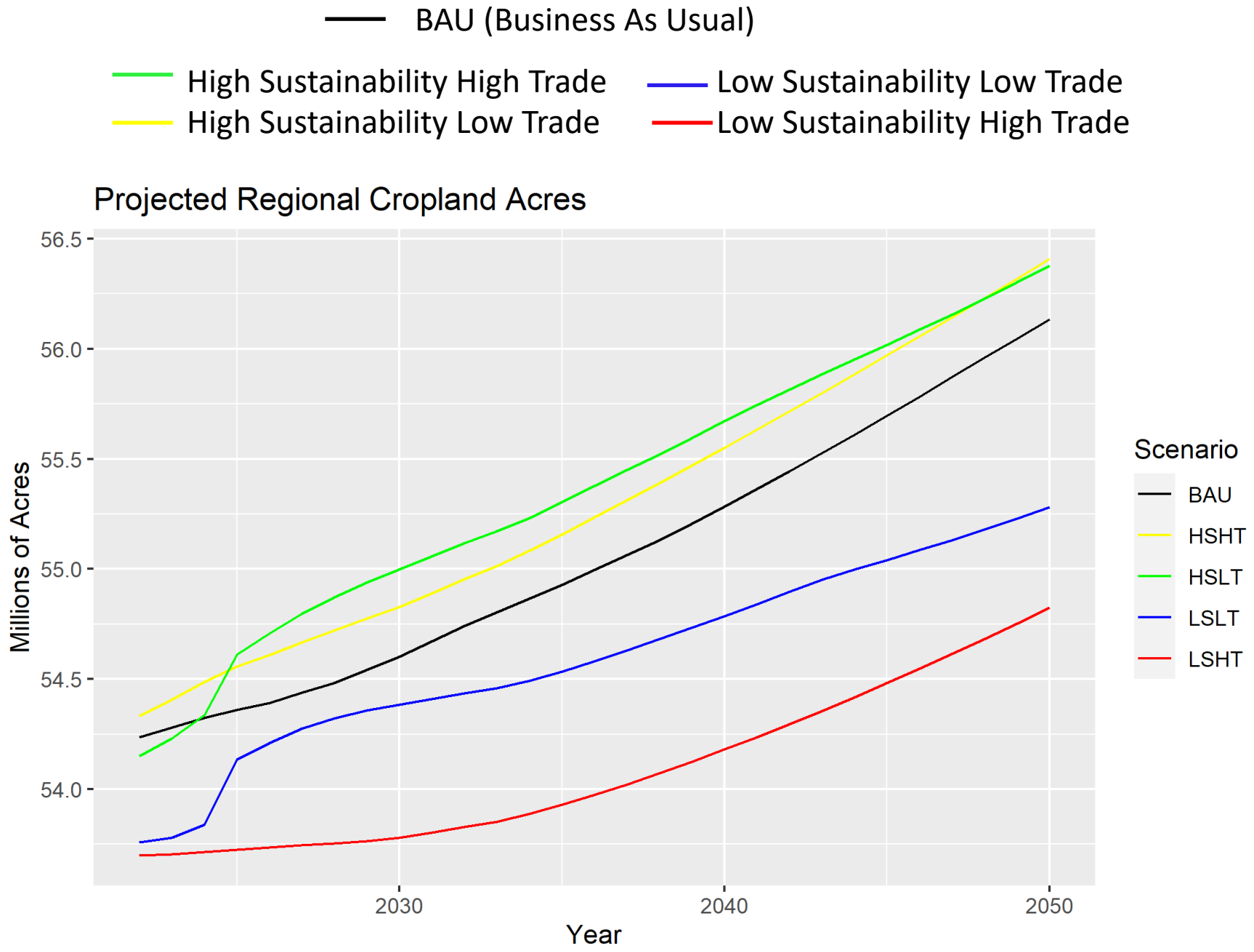
LOWER OPENESS TO TRADE

HIGHER OPENESS TO TRADE

LOOSER ENVIRONMENTAL SUSTAINABILITY

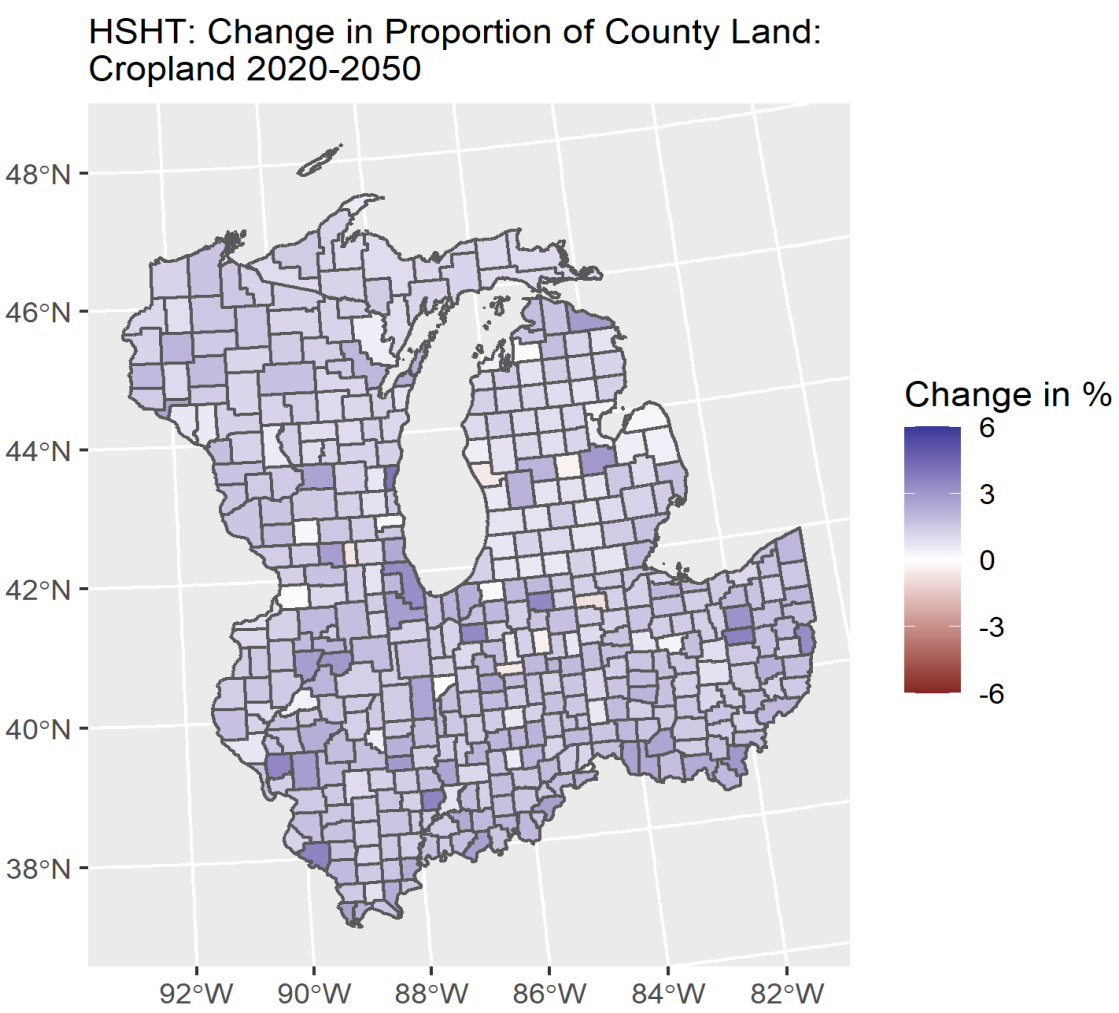
Total Cropland

- Increases in working croplands across all scenarios, however, percentage increase is relatively small and in line with historic changes (~2-5% increase)
- Model currently assumes that conversions to cropland come solely through existing pasture; very little forest -> cropland conversion in region
- Low sustainability scenario assumptions more impactful than trade assumptions

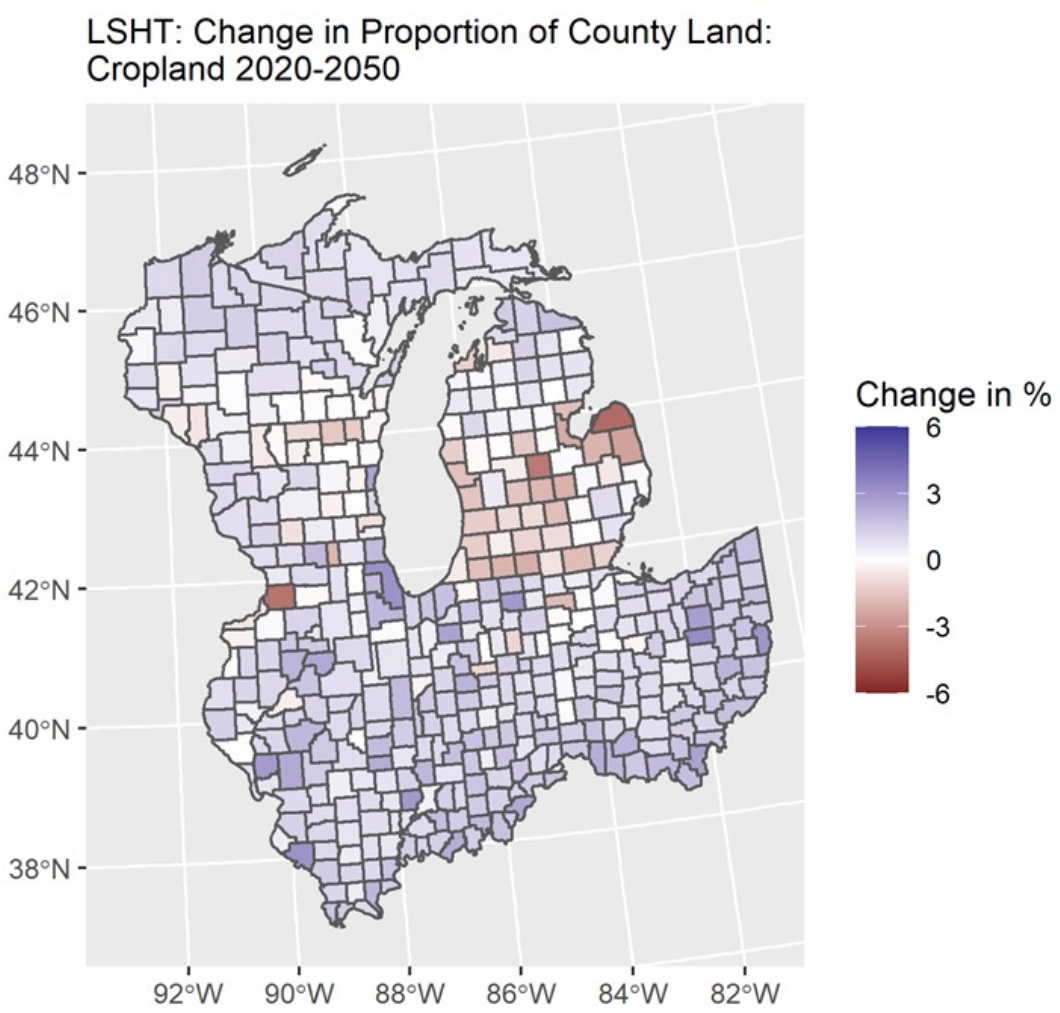


Changes in Cropland Across Counties

High Sustainability Low Trade



Low Sustainability Low Trade



Changes in Cropland Across Counties

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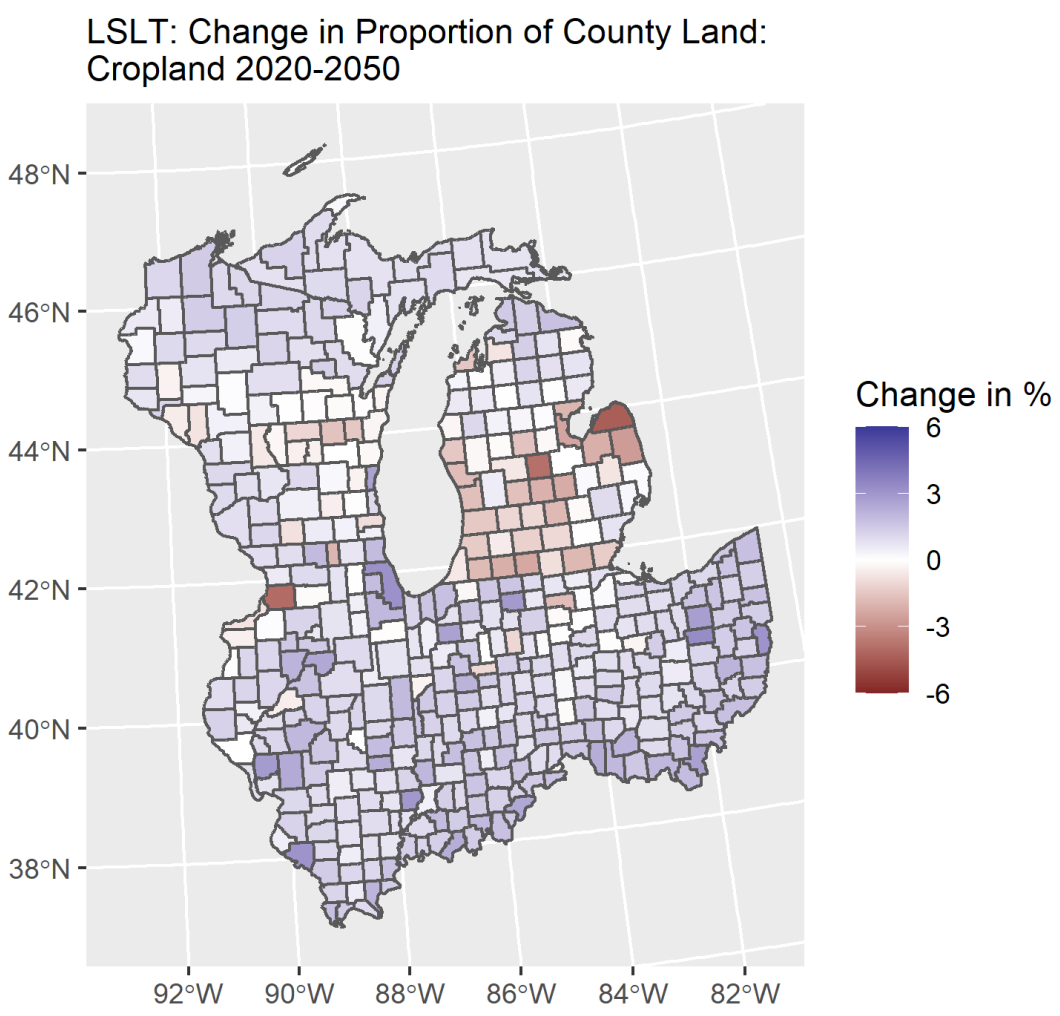
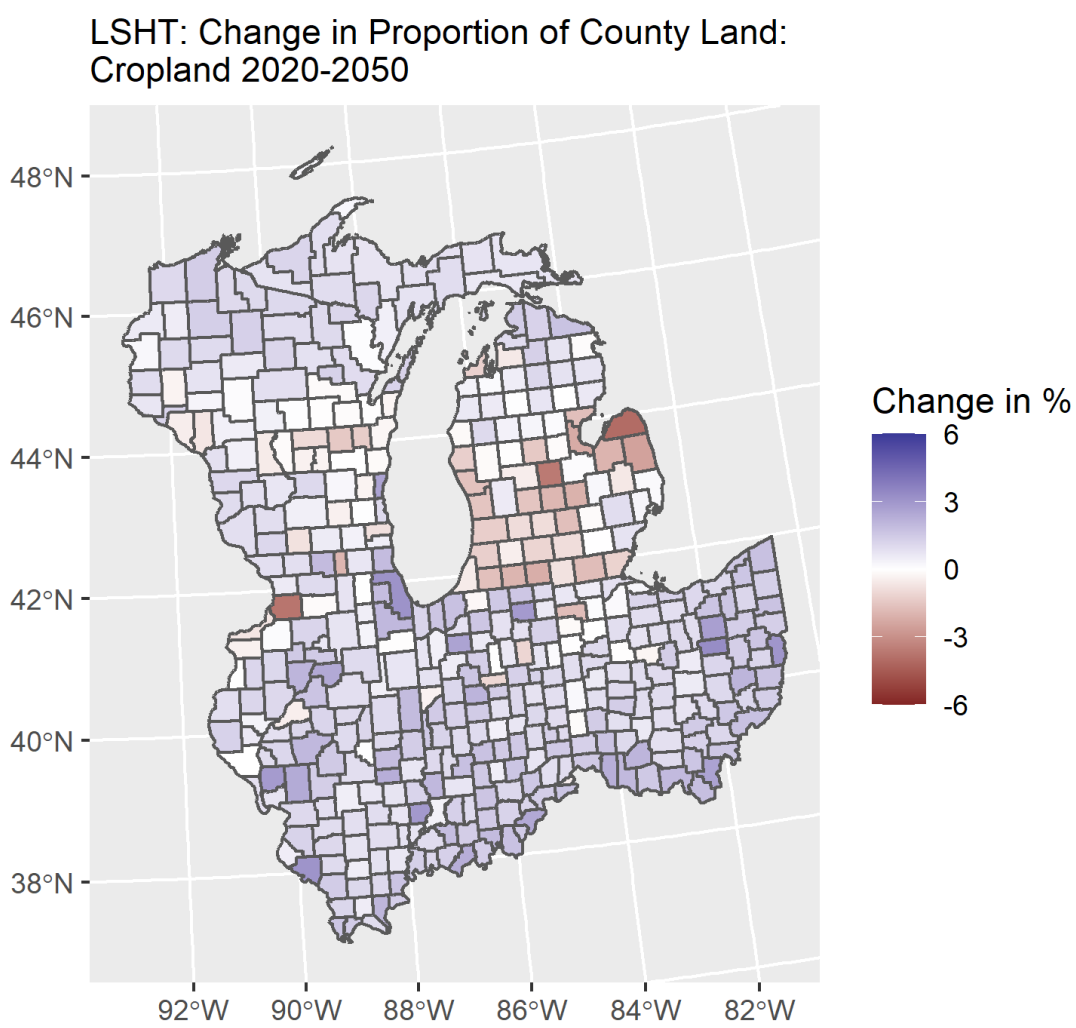
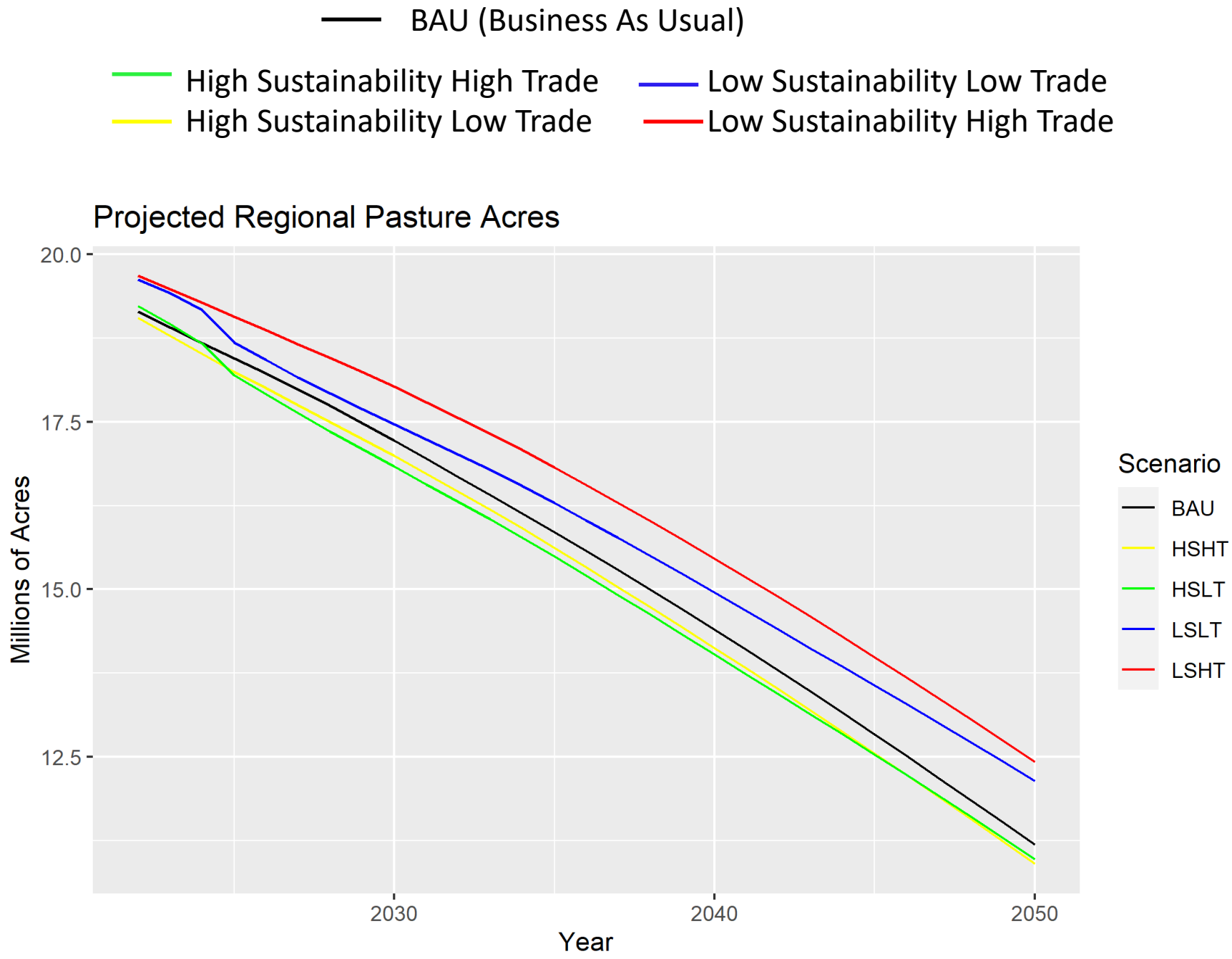


Low Sustainability High Trade



Total Pasture

- Deep declines in pasture/hay lands across all scenarios
- Caused by conversions to Urban/Suburban use, cropland, and reforested lands
- Future efforts to improve connections between pasture/hay land and livestock demand, but current version predicts decline resulting from urban and forest conversions



Changes in Pasture Across Counties

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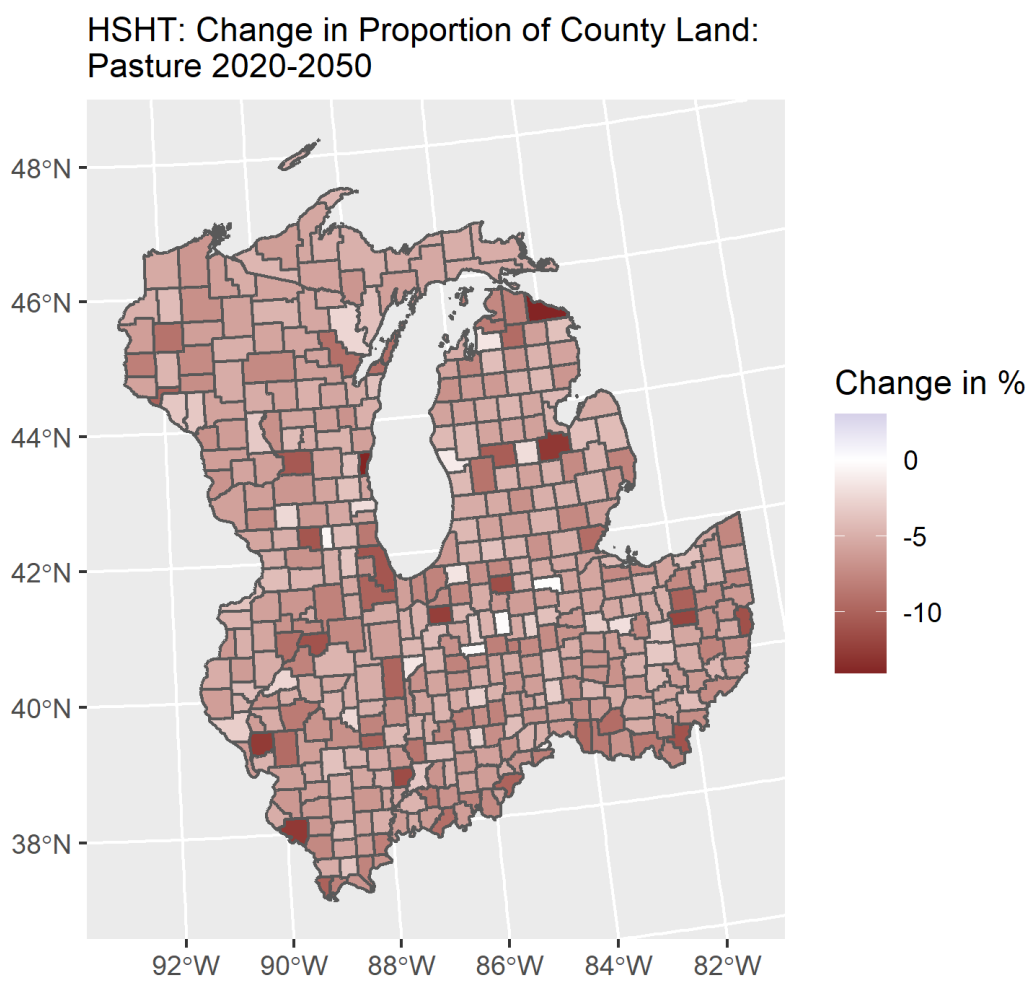
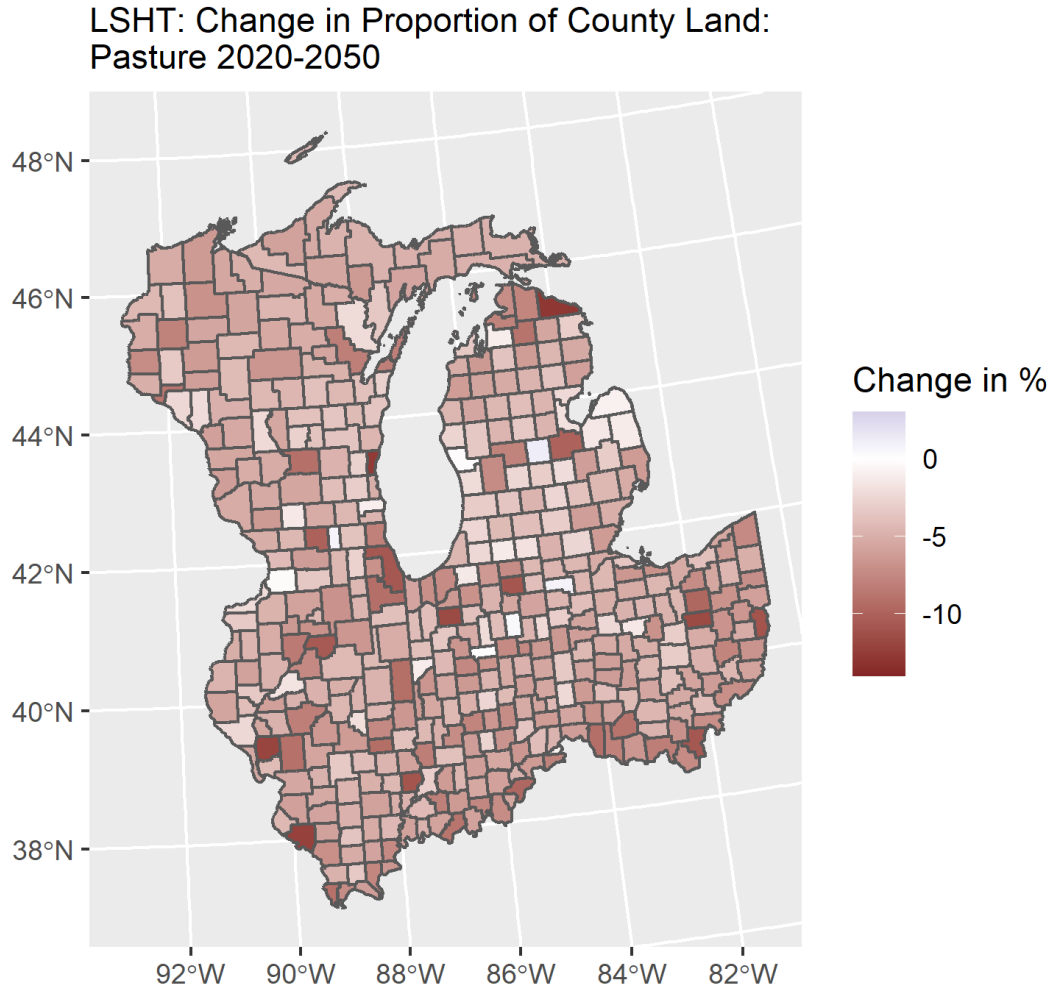


Low Sustainability Low Trade



Changes in Pasture Across Counties

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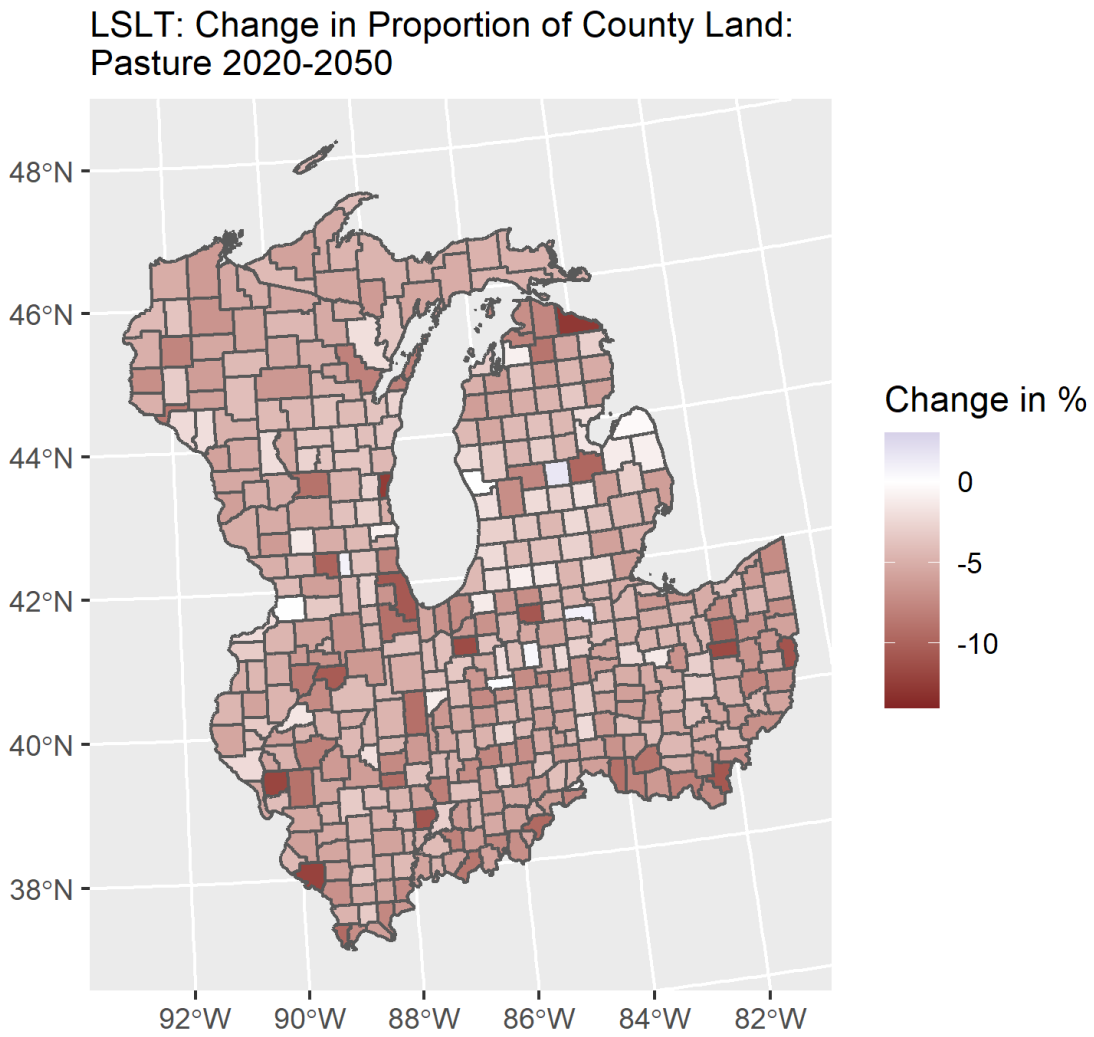
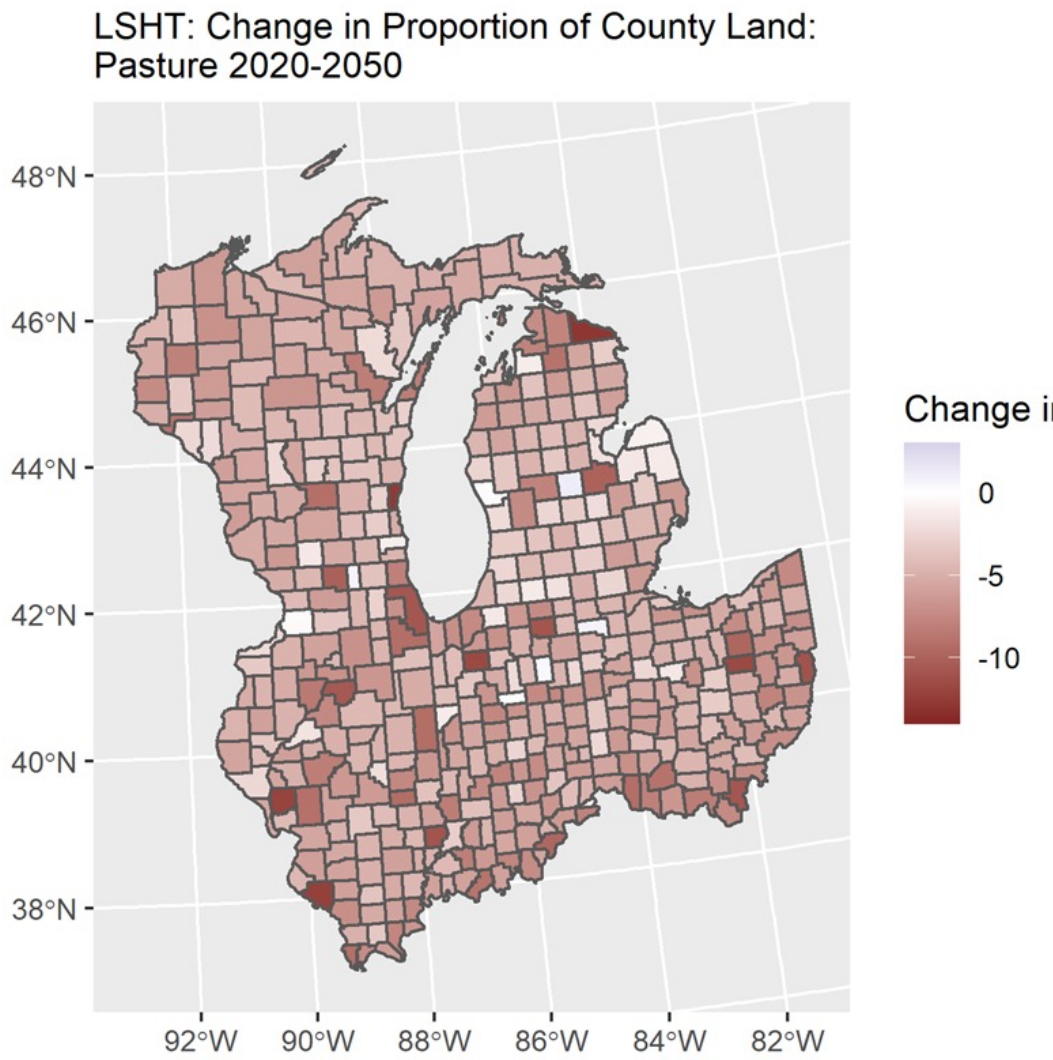


Low Sustainability High Trade



Next Steps

- “Endogenize” Forest Rents → include wider range of payments for forest in land use model
- Adjust LUC functions to better incorporate within-state differences in terrain, forest, etc.
- Improve pasture rental projections (e.g. payoffs to pasture land)
- Estimate LUC model at more granular scale (e.g. fields, grid-cells) to better link to field-level ecosystem service models (e.g. carbon sequestration) and farmer behavior

Reactions / Suggestions?

What questions do you have?

Do predicted BAU trends make sense?

What is surprising?

What is concerning?

Identifying Farmer ‘Types’ in Survey Data

Team: C. Dale Shaffer-Morrison, Khyati Malik, Brian Cultice

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Farmer Management Decisions and Regional Outcomes

Integration w/ DRFEWS model

- Land-based conservation practices are key factors in agricultural impacts on ecosystem services
- Global and regional factors change the conditions in which farmers make decisions regarding conservation practices
- We wish to understand how farmers will behave in response to external conditions (e.g. scenarios, prices, etc.) to predict future conservation practices

Farmer Management Decisions and Regional Outcomes

Integration w/ DRFEWS model

- Keeping farmer behavior consistent with other model outputs requires integrating farmer behavior with:
  - commodity prices
  - conservation payments
  - and other scenario-dependent outcomes
- **Key challenge: Farmers vary in their willingness to adopt conservation practices**

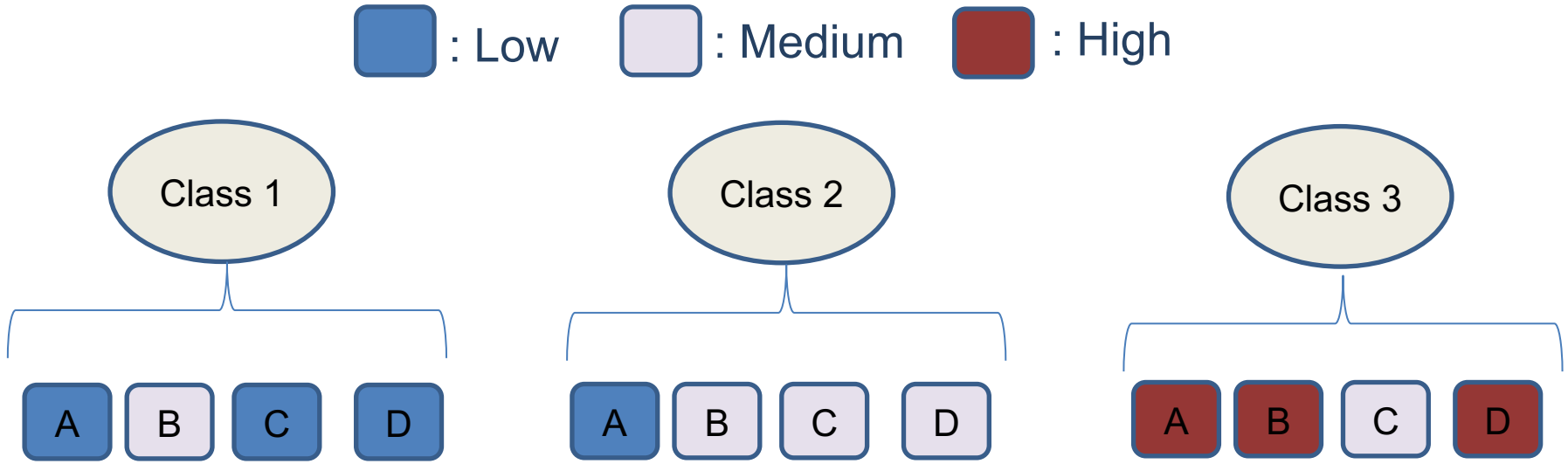
Latent Class Analysis: Overview

- **Goal:** Classify farmers into different *types* based on survey data
- **Research Question**: What is the pattern of conservation behaviors among different types of farmers?
- **Data:** "Farmer Land Use Decisions in the Great Lakes Basin" – DRFEWS Great Lakes Region farmer survey

Latent Class Analysis: Main Idea

- Individuals belong to “inherent classes” (latent classes)
- These classes form a pattern of behaviors/outcomes

Example: Suppose there are 4 measured behaviors: A, B, C, D with 3 values



Latent class analysis is a statistical technique to classify individuals into classes

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Latent Class Analysis: Behaviors/Outcomes

1. Conservation identity:
   From Good Farmer Scale (A good farmer is one who…)
2. Percent of acres draining to filter strips
3. Nutrient-reducing behaviors:
   Index of tillage practices, cover crops, small grains
4. Willingness to put land in conservation:
   Across five hypothetical scenarios

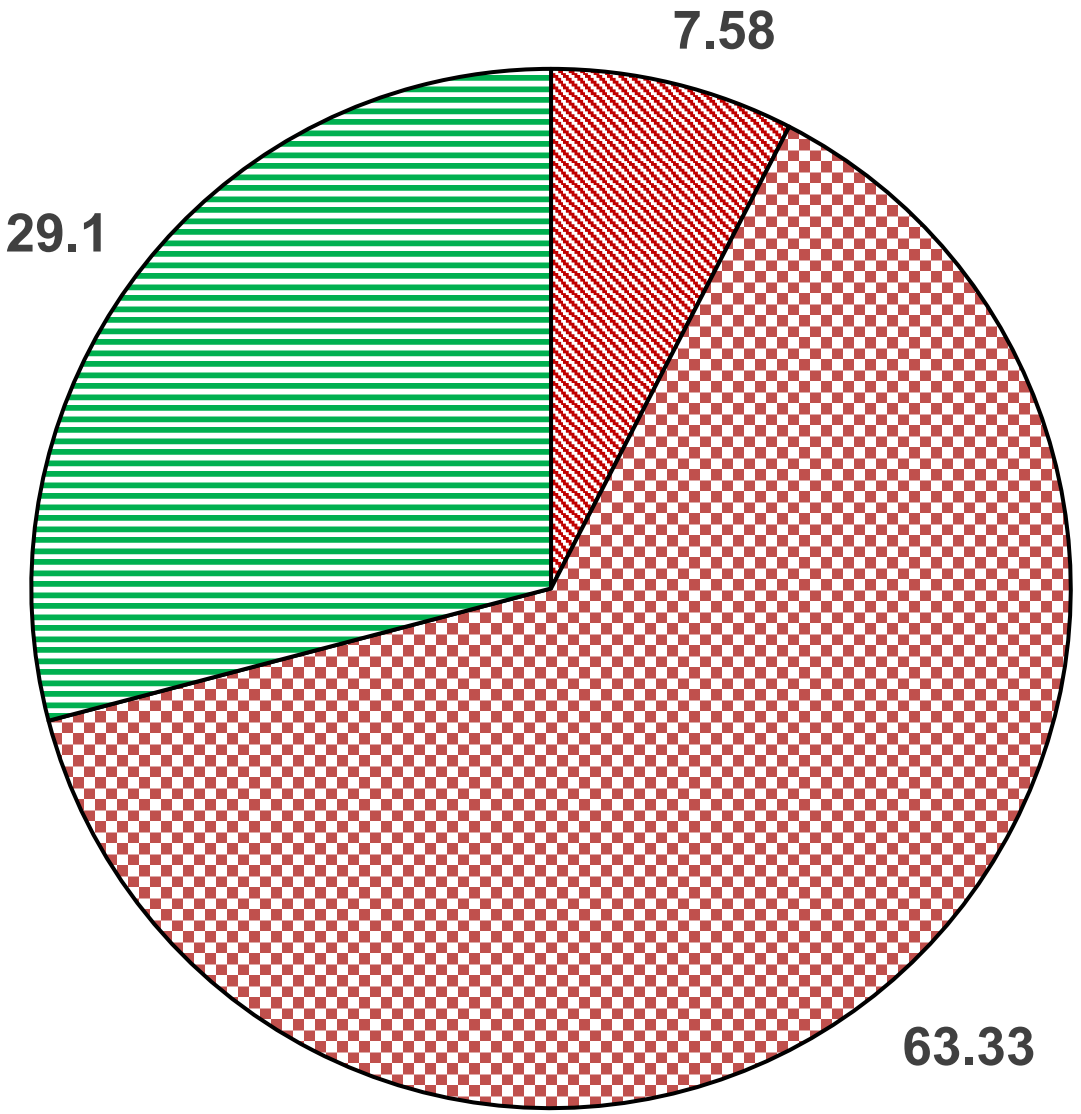
Latent Class Analysis: Results

Class 1: Low Conservationists

Class 2: Moderate Conservationists

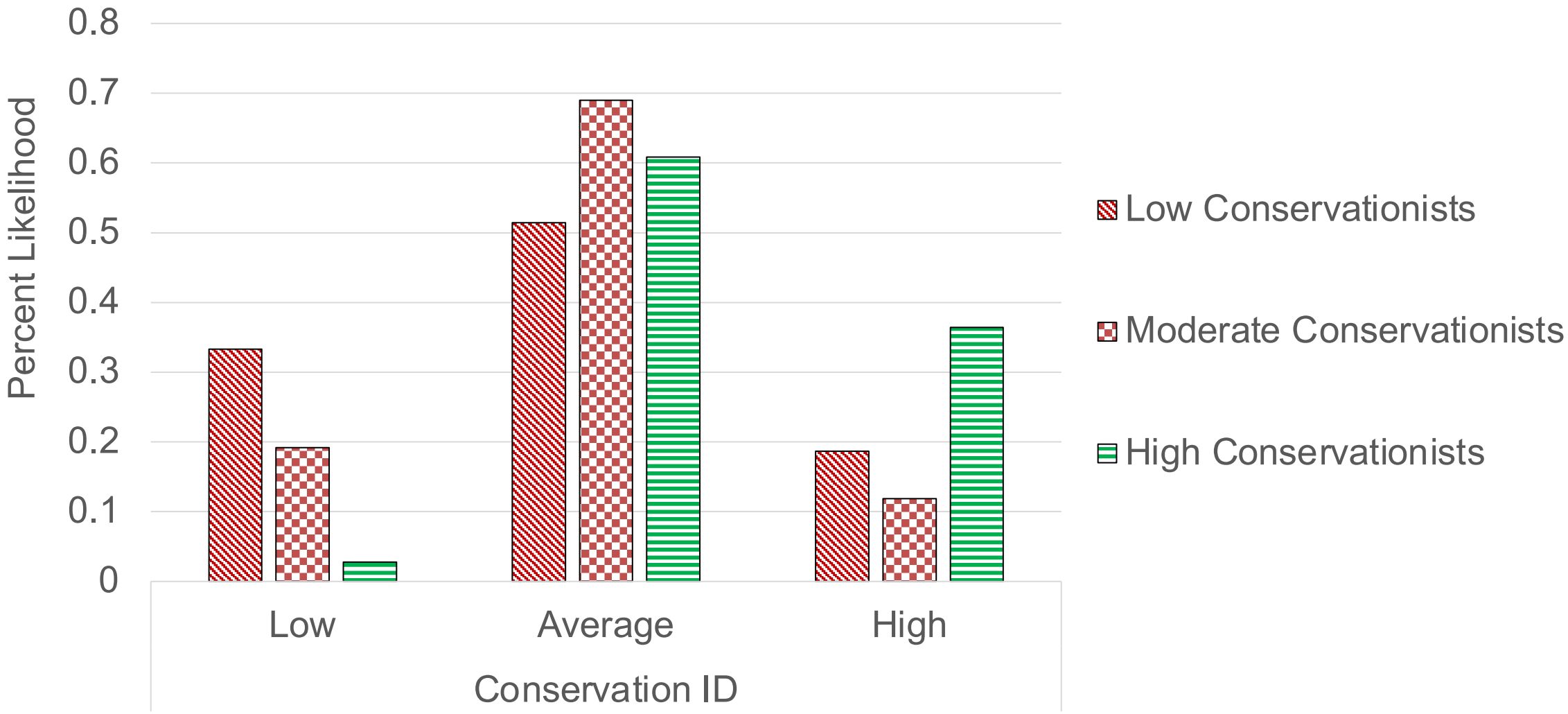
Class 3: High Conservationists

Percent in Each Class



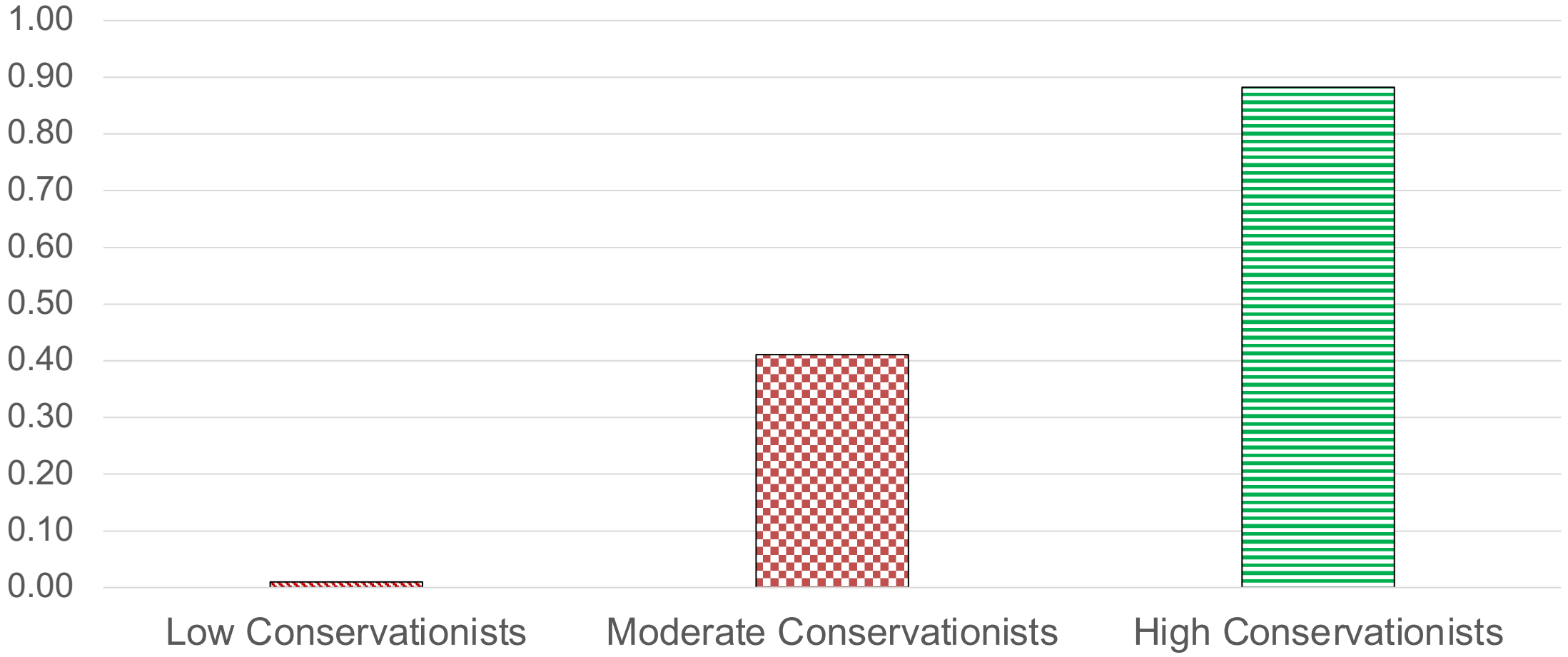
- Low Conservationists
- Moderate Conservationists
- High Conservationists

Conservation Identity

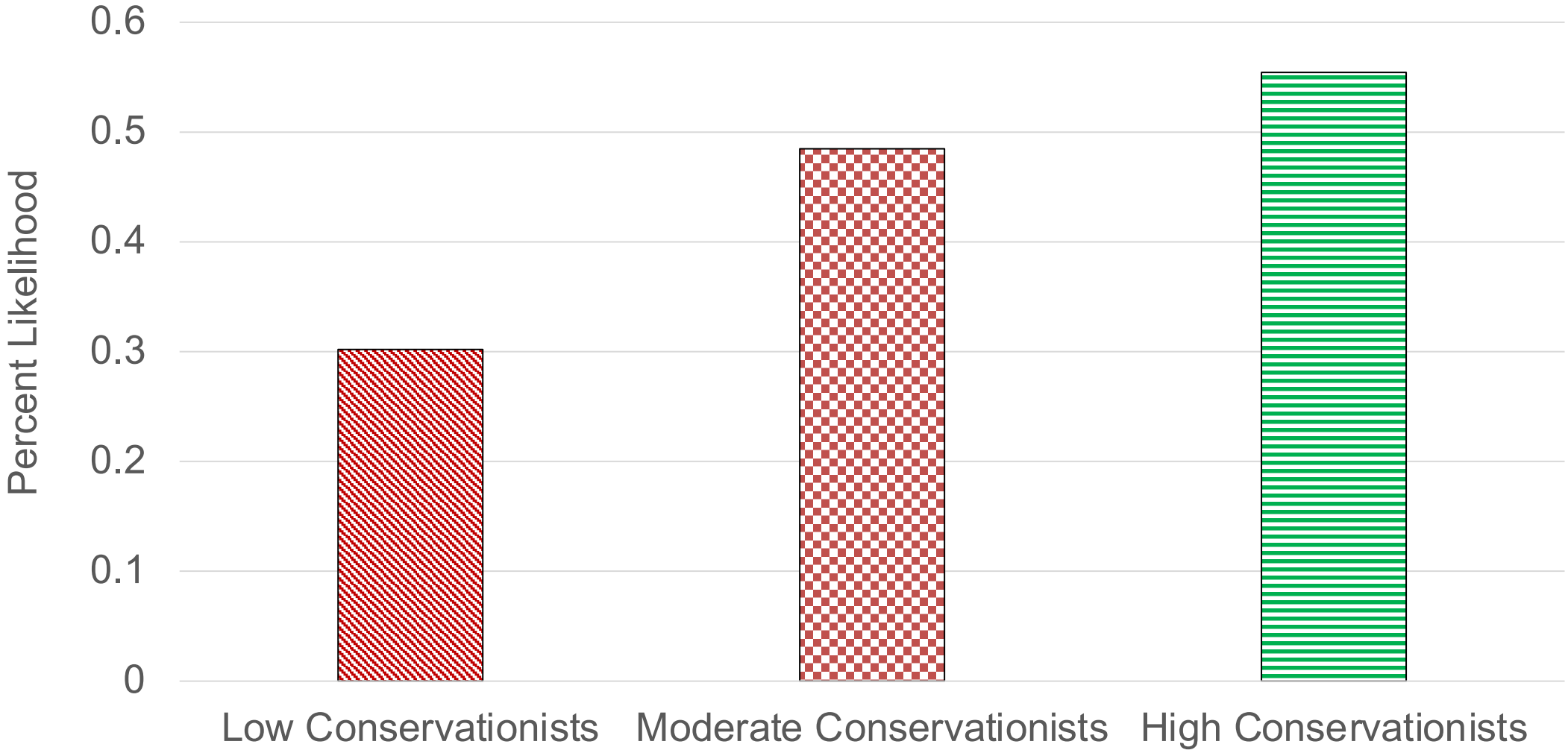


Percent Acres Draining to Filter Strips

Average Nutrient Reduction Practices (tillage, cover crops, small grains)

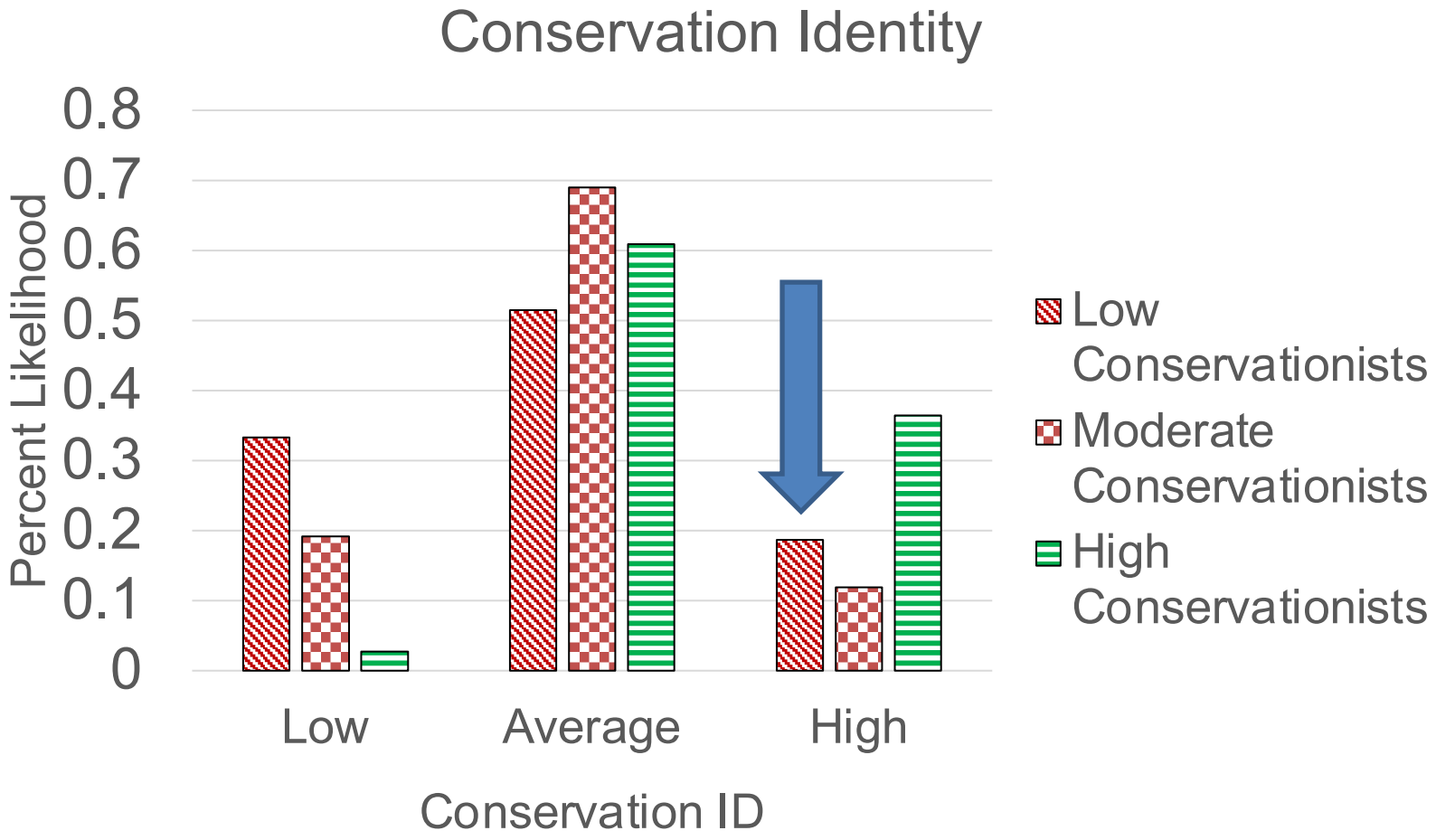


Willingness to Put Land in Conservation



What do you think?

- Do these classes make sense?
- If conservation identity is high, but actual practices are low, how do we encourage moderate conservation?

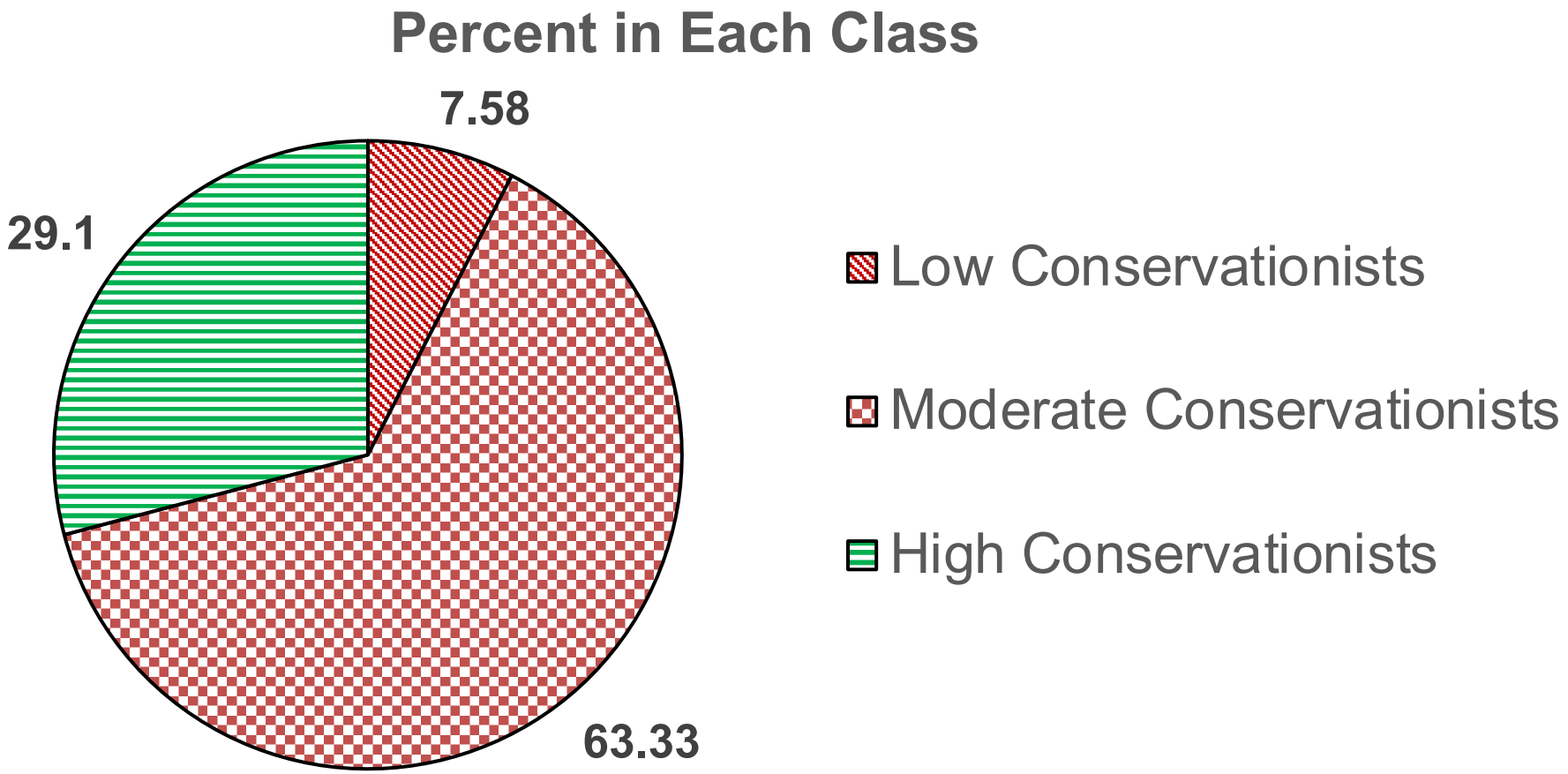


Using Classes as a "Lever" to model changing conservation practices

In future scenarios…

- Under high sustainability: More farmers in "High Conservationist" class
- Under low sustainability: More farmers in "Low Conservationist" class

How do you think the distribution of these classes could change in the future? What might change this?



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Reactions / Suggestions?

- What questions do you have?
- What is surprising?
- What is concerning?

15-minute break

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Policy Integration

Team: Alan Randall, Elena Irwin

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Modeling Alternative Policies and Strategies
Scenarios provide the Context

Scenarios are representations of

- The status quo (Business As Usual)
- The trends and drivers that could shape the future (alternative scenarios)

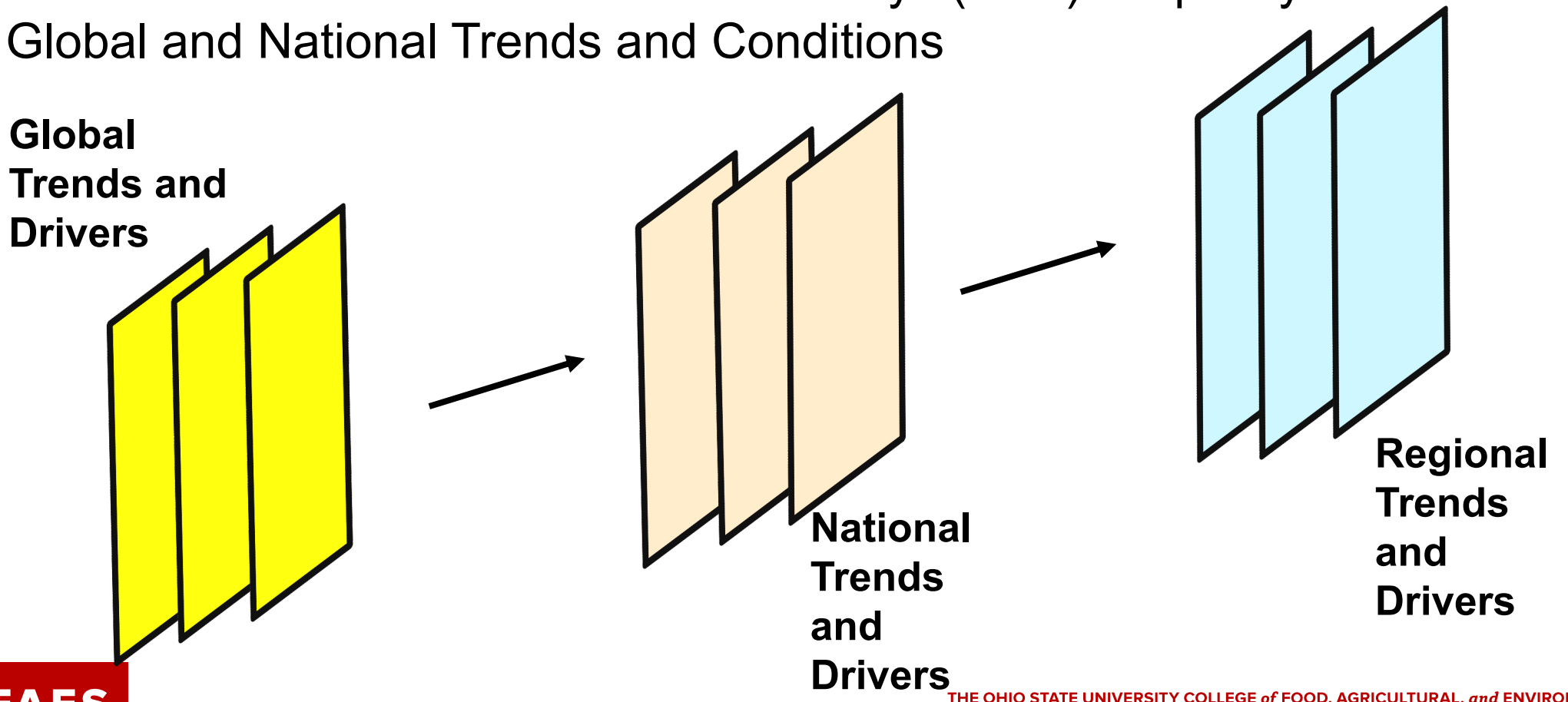
Scenarios define plausible conditions at national and global scales. Global policies are embedded but local and regional policies are distinguished

- We can use the model to investigate how policies could:

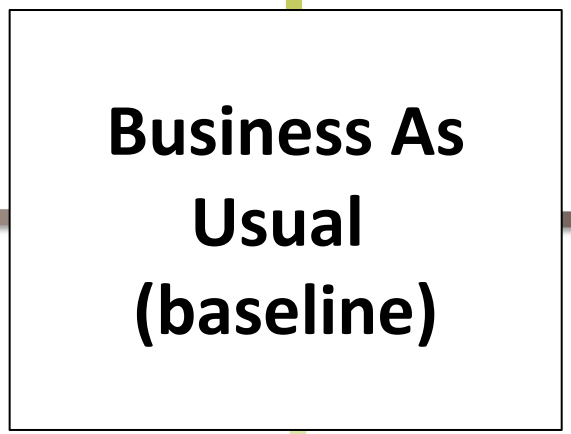
(i) mitigate problems that might emerge given a scenario and/or
(ii) open-up opportunities for betterment

Our Region is Nested in the Nation and the World

- Looking forward, several different futures are possible for the world, the nation, and our region
- Draw on Shared Socioeconomic Pathways (SSP) to specify Global and National Trends and Conditions



STRONGER ENVIRONMENTAL SUSTAINABILITY



LOOSER ENVIRONMENTAL SUSTAINABILITY

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SSP Summaries

SSP4: Inequality

Globally connected, high consumption by elites; global inequality; focus on local enviro in high income countries; less focus on global issues; benefit political and business elites; invest in energy tech; low cost low carbon tech; increased nuclear and renewables; Diversified investments including energy; low/med carbon and energy intensity fossil fuel constraints, high price volatility

Higher Sustainability

SSP1: Sustainability

Connected markets, lower population growth & material consumption, improved local/global policy coordination, policy focus on sustainable development, effective national & international institutions, tech change away from fossil fuels toward renewables; low carbon and energy intensity, improved environmental conditions

Lower Trade

SSP2: Middle of the Road

Semi-open globalized economy; moderate consumption moderate meat; weak focus on sustainability concern for local pollutants, but only moderate success at implementation Some investment in renewables, but continued reliance on fossil fuels

Higher Trade

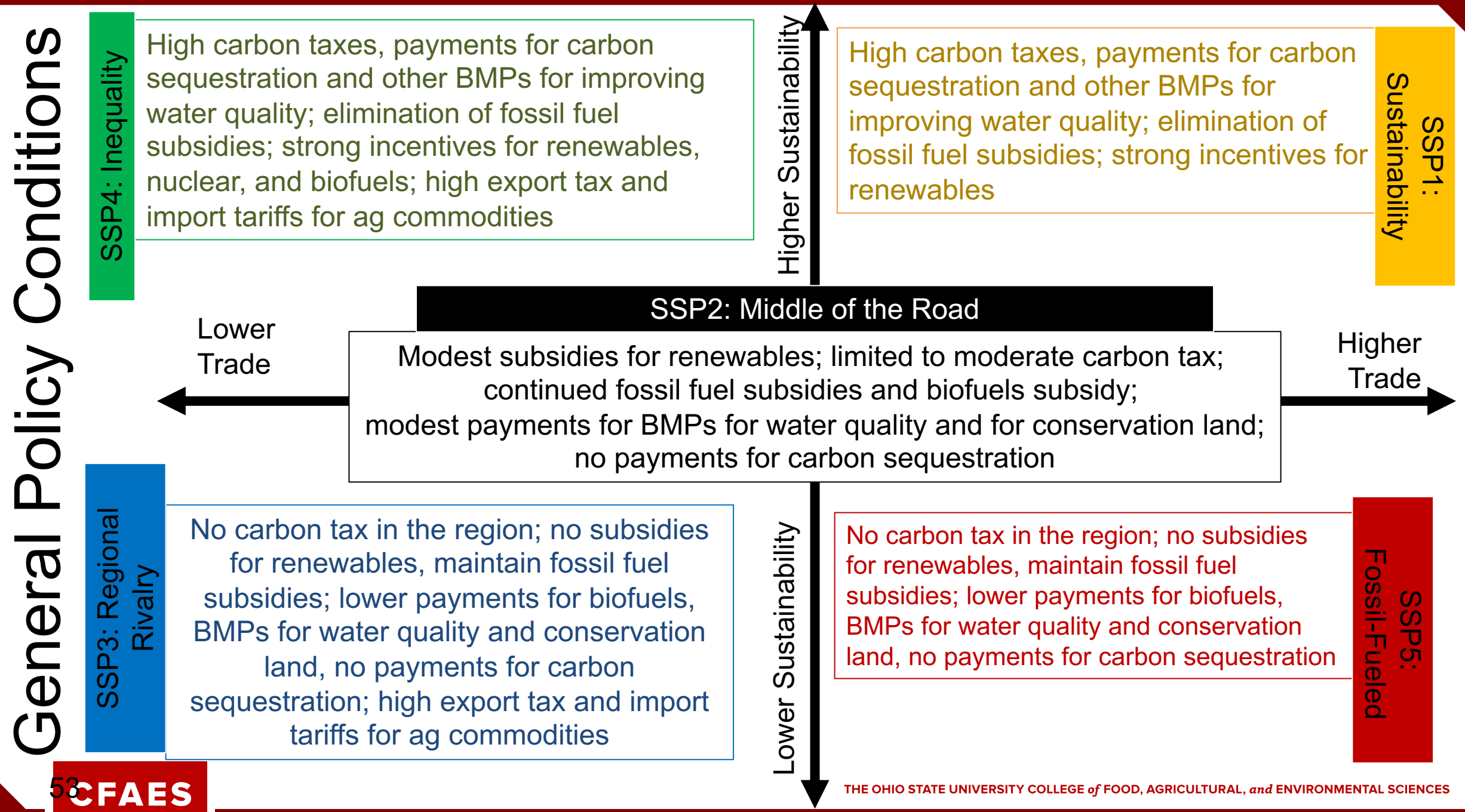
SSP3: Regional Rivalry

Deglobalizing, regional focus, material intensive consumption, higher export tax & import tariffs Low priority for environmental issues weak global institutions, slow tech change, directed to domestic energy sources, high energy and carbon intensity in areas w/ fossil fuels, unconventional sources for domestic supply

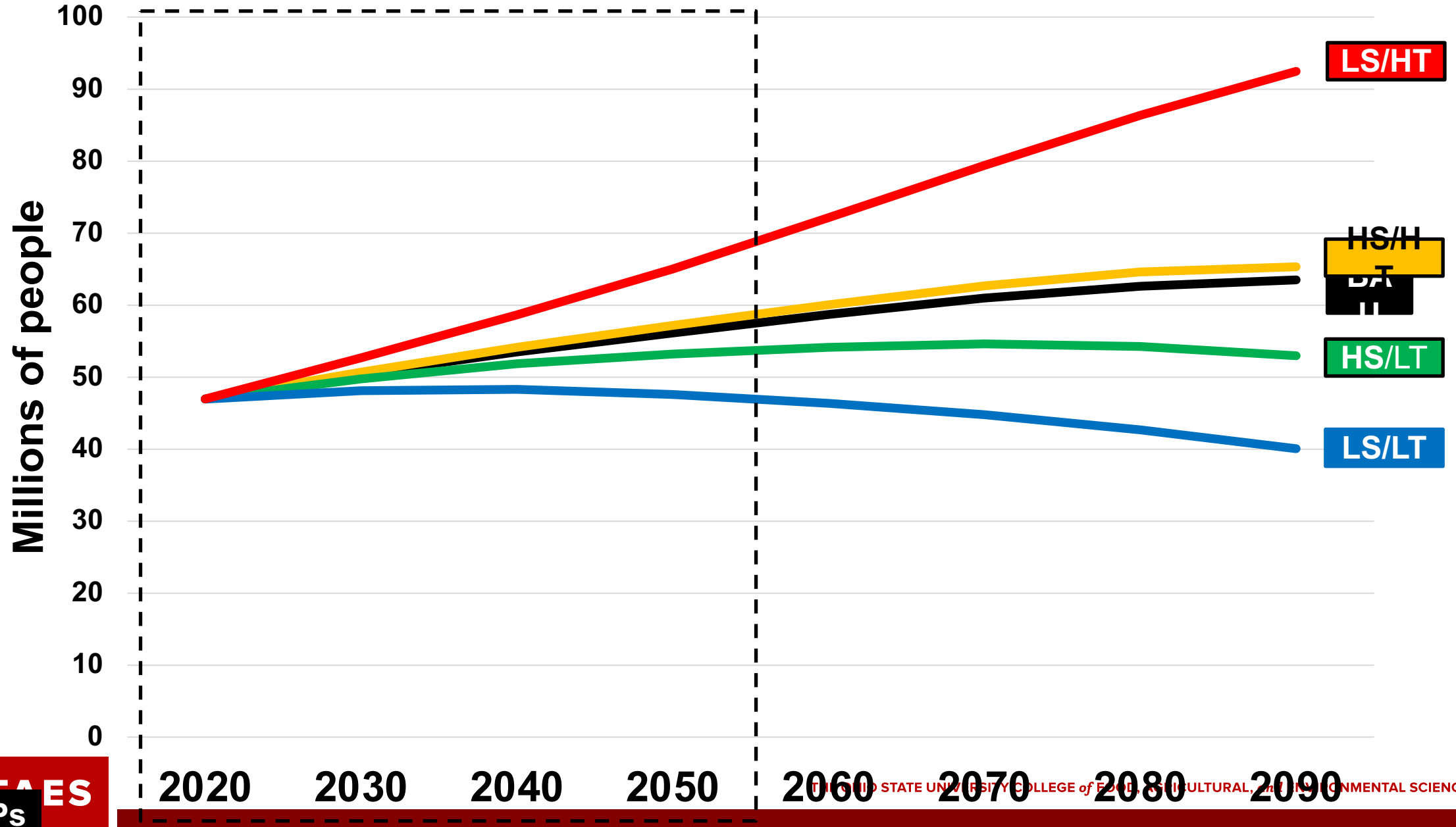
Lower Sustainability

Strongly globalized, materialism & status consumption meat-rich diets, free market emphasis, directed toward fossil fuels. Alternative sources of energy not actively pursued, high carbon intensity deteriorating enviro conditions

SSP5: Fossil-Fueled

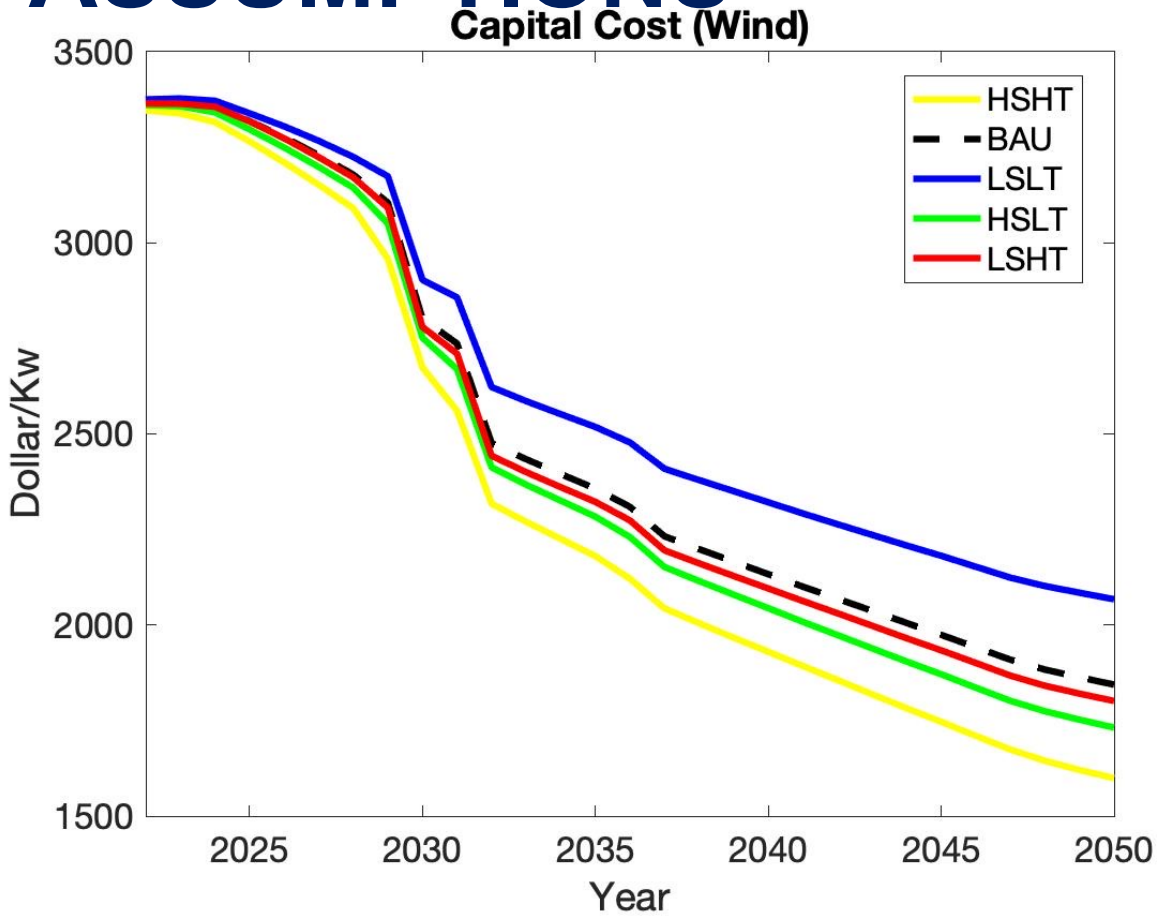

General Policy Conditions
SSP4: Inequality
High carbon taxes, payments for carbon sequestration and other BMPs for improving water quality; elimination of fossil fuel subsidies; strong incentives for renewables, nuclear, and biofuels; high export tax and import tariffs for ag commodities
Higher Sustainability
High carbon taxes, payments for carbon sequestration and other BMPs for improving water quality; elimination of fossil fuel subsidies; strong incentives for renewables
SSP1: Sustainability
SSP2: Middle of the Road
Lower Trade
Modest subsidies for renewables; limited to moderate carbon tax; continued fossil fuel subsidies and biofuels subsidy; modest payments for BMPs for water quality and for conservation land; no payments for carbon sequestration
Higher Trade
SSP3: Regional Rivalry
No carbon tax in the region; no subsidies for renewables, maintain fossil fuel subsidies; lower payments for biofuels, BMPs for water quality and conservation land, no payments for carbon sequestration; high export tax and import tariffs for ag commodities
Lower Sustainability
No carbon tax in the region; no subsidies for renewables, maintain fossil fuel subsidies; lower payments for biofuels, BMPs for water quality and conservation land, no payments for carbon sequestration
SSP5: Fossil-Fueled

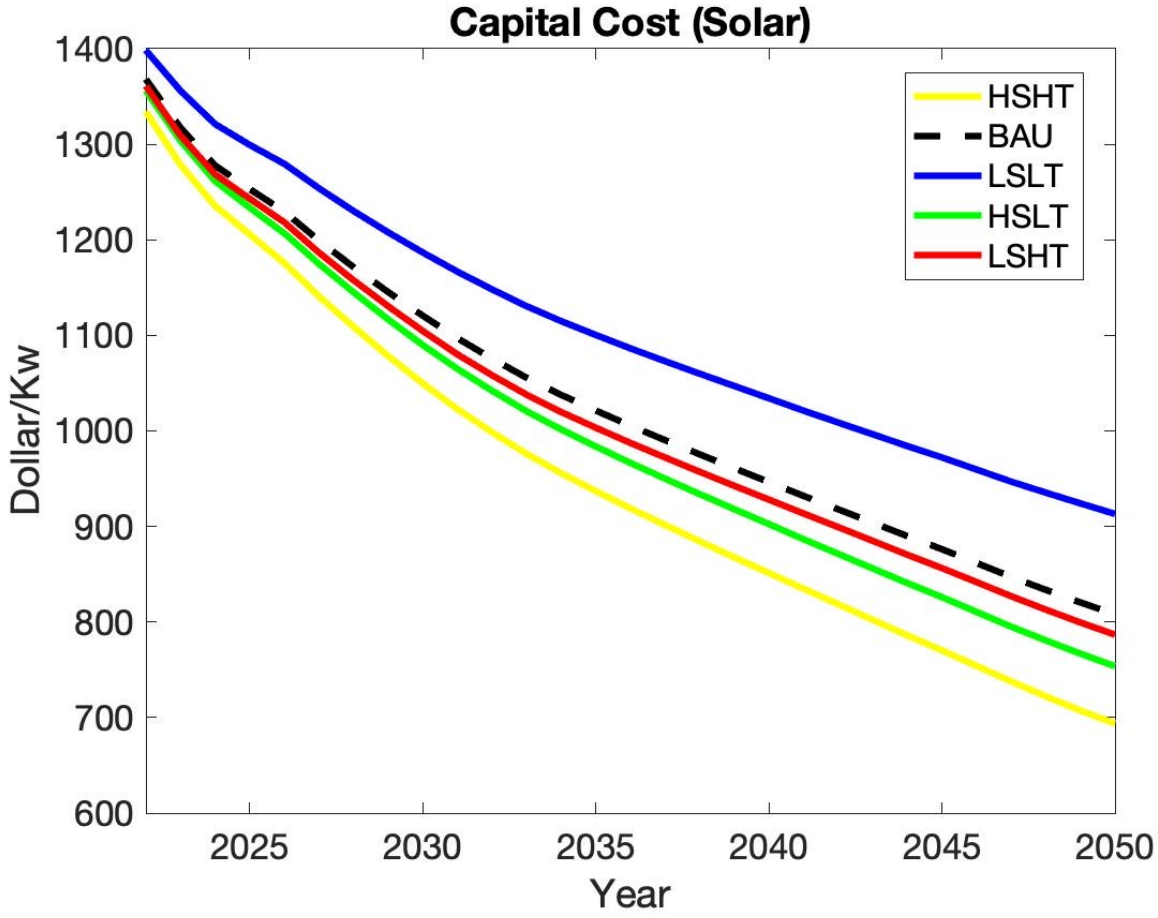
Projected Population in 5-State Region



From SSPs

KEY ECONOMIC MODEL ASSUMPTIONS





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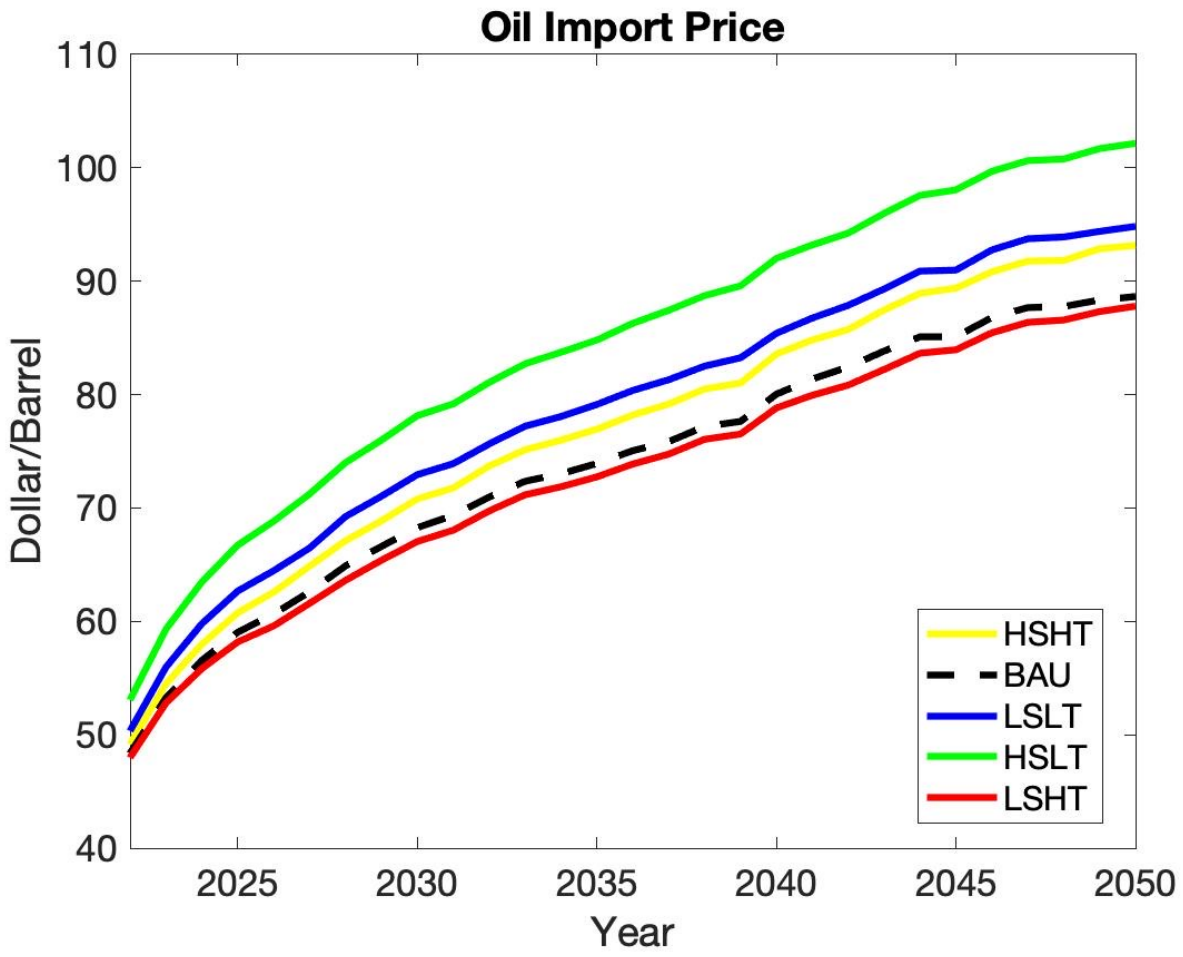
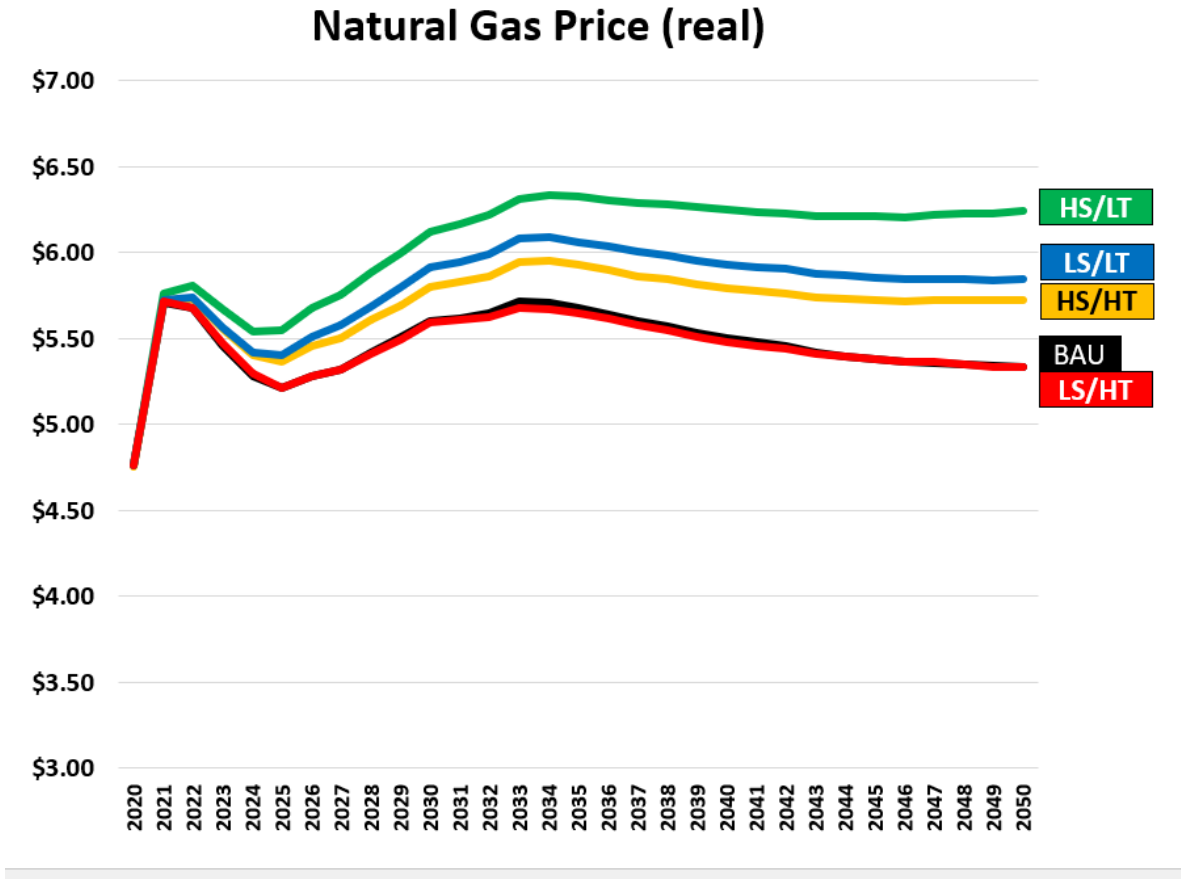
KEY ECONOMIC MODEL ASSUMPTIONS





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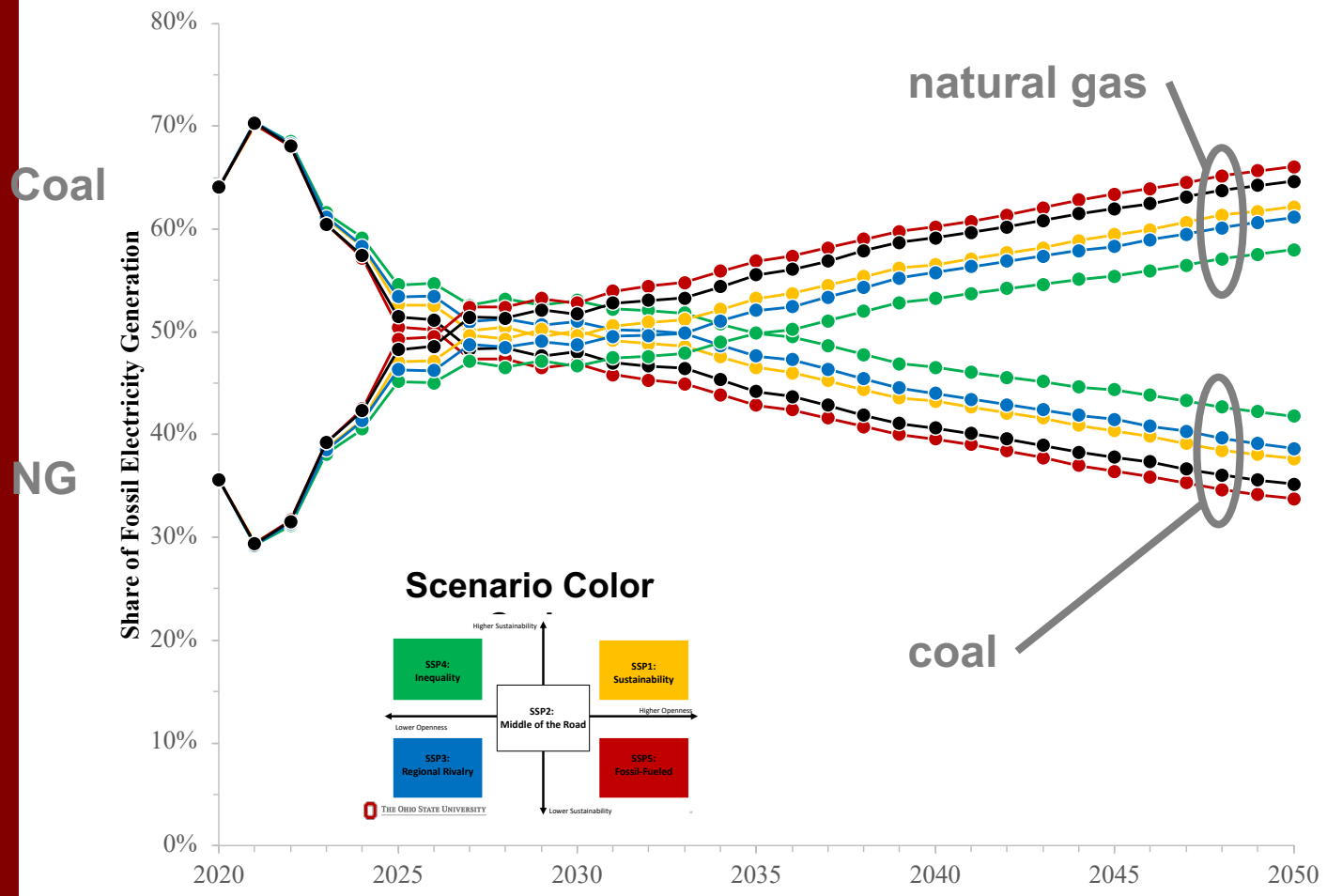
Share of E- Generation from Coal vs Nat Gas



Model: rely on historical calibrations to project fossil and renewable demand.

Scenarios: partition fossil and renewable demand by resource (e.g., natural gas, wind, solar)

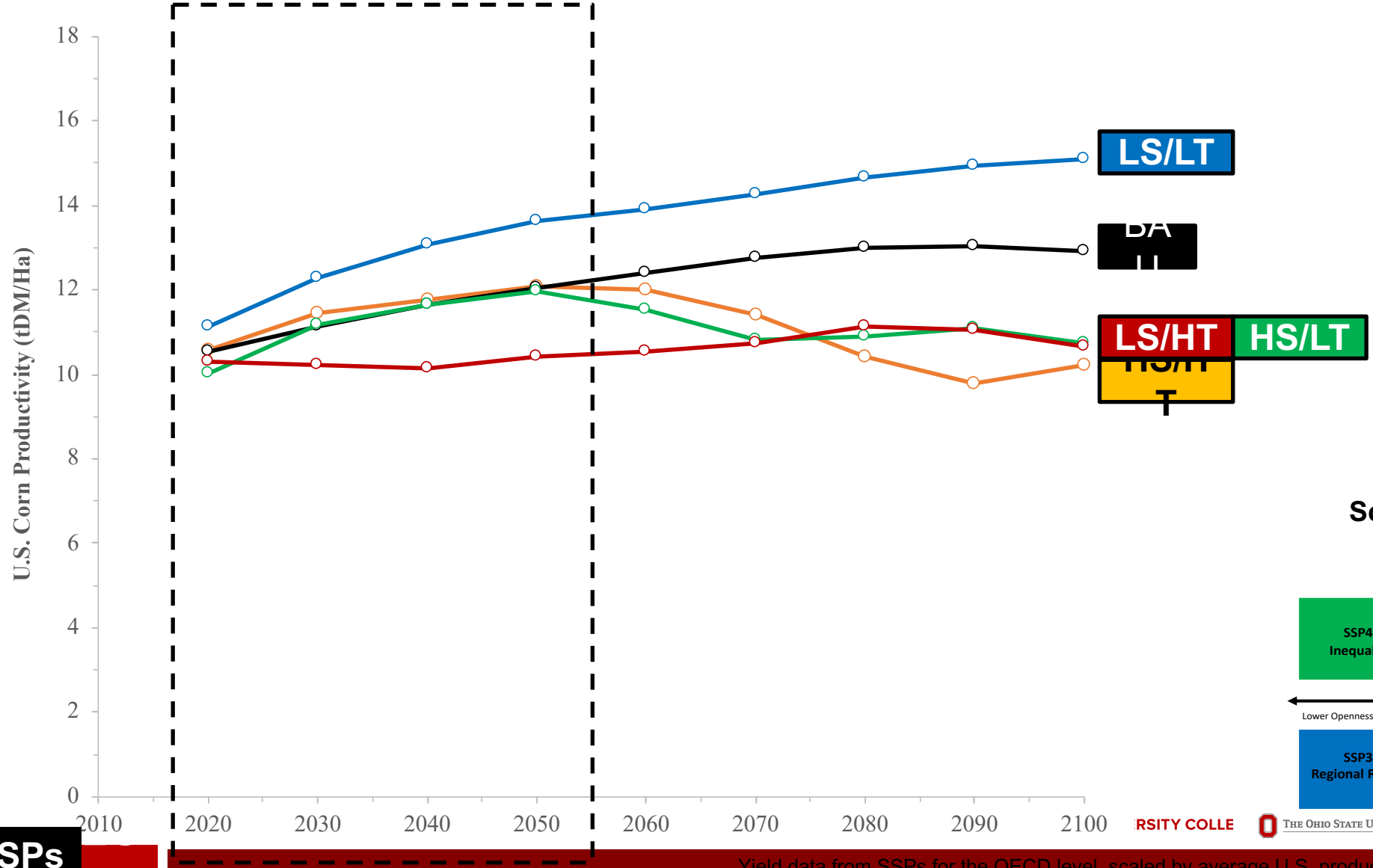
Trade favors natural gas

Sustainability appears to favor coal over NG (but less coal overall)

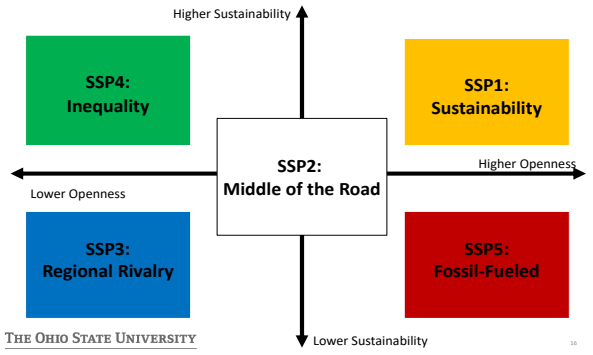
Technology is confusing.

Results of combining AEO (2021) case assignments to our scenarios with AEO (2021) projections

Corn Yield



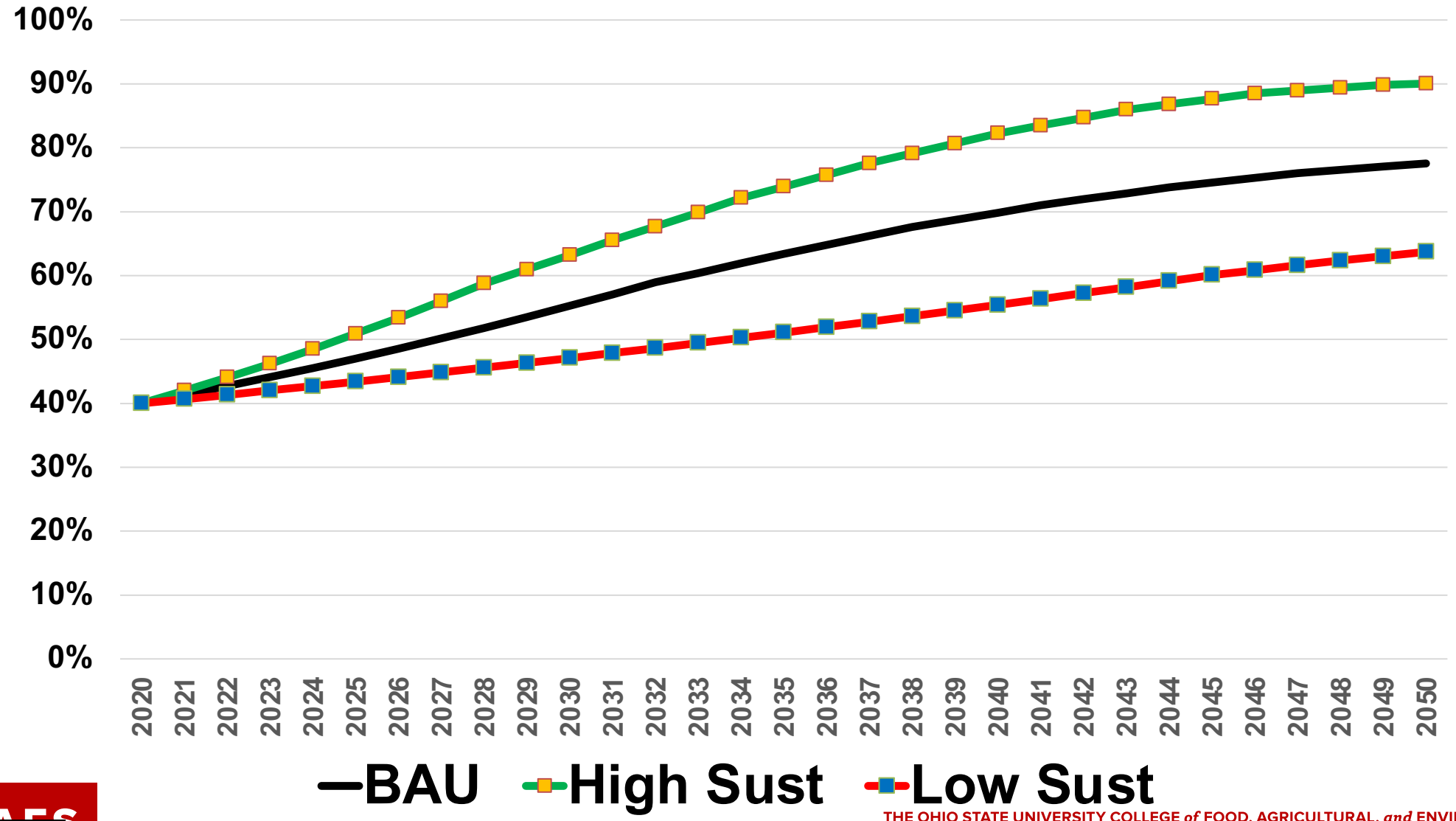
Scenario Color Code



From SSPs

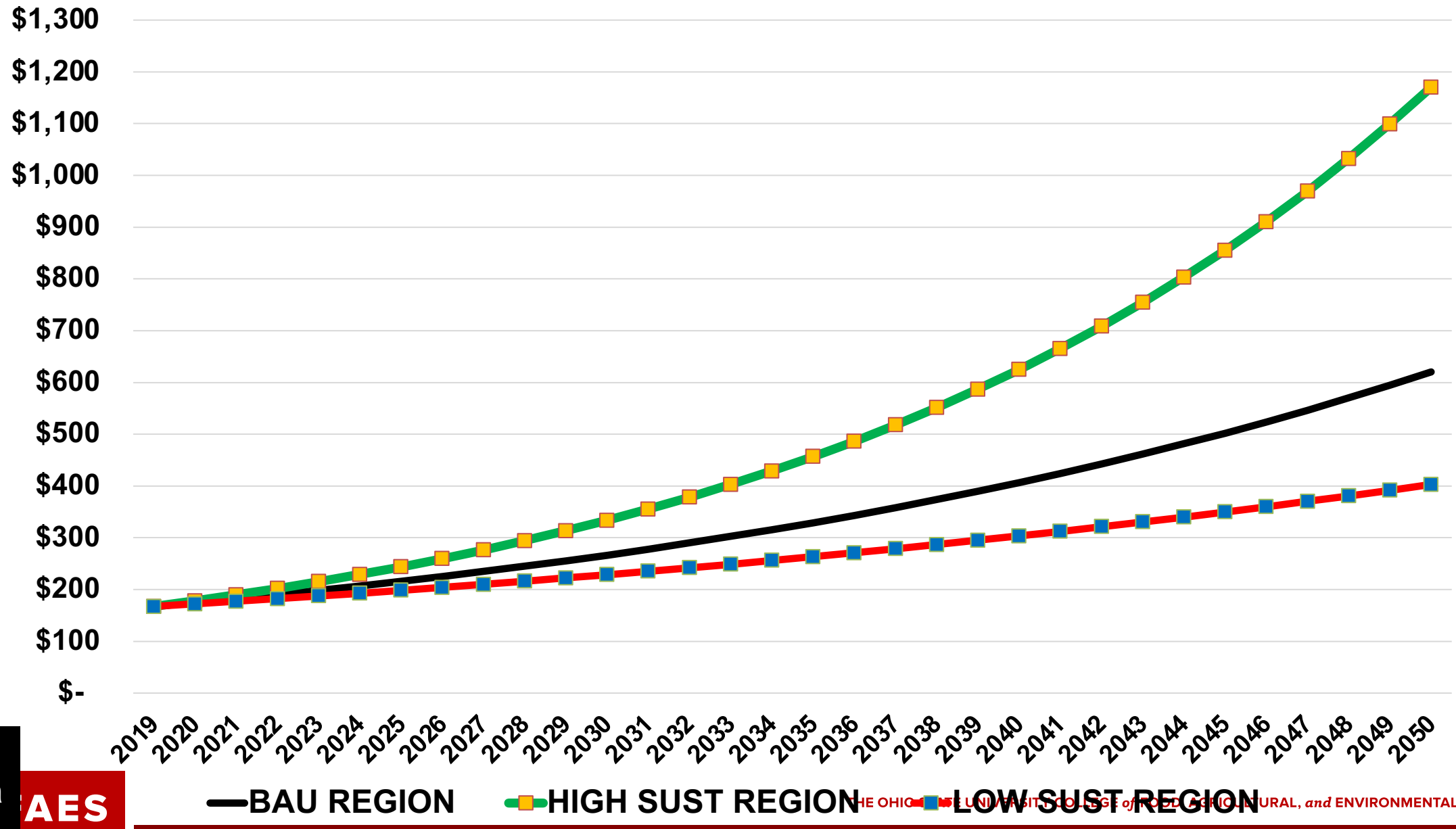
Yield data from SSPs for the OECD level, scaled by average U.S. productivity relative to average OECD productivity

% Farmers Using Subsurface Fertilizer Placement



From surveys

CRP Payment Rate / Acre



From historical trends

Discussion

- What local or regional policy and behavioral conditions could we associate with each scenario to project land management outcomes?
  - What policies and behavioral (farm and farmer) characteristics will influence land management and adaptation decisions in each of the scenarios?

Local/regional policy and behavioral conditions?

SSP4: Inequality

Higher Sustainability

SSP1: Sustainability

SSP2: Middle of the Road

Lower Trade

Modest subsidies for renewables; limited to moderate carbon tax;
continued fossil fuel subsidies and biofuels subsidy;
modest payments for BMPs for water quality and for conservation land;
no payments for carbon sequestration

Higher Trade

SSP3: Regional Rivalry

Lower Sustainability

SSP5: Fossil-Fueled

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Tabletop Exercise

Team: Jason Cervenec and Aaron Wilson

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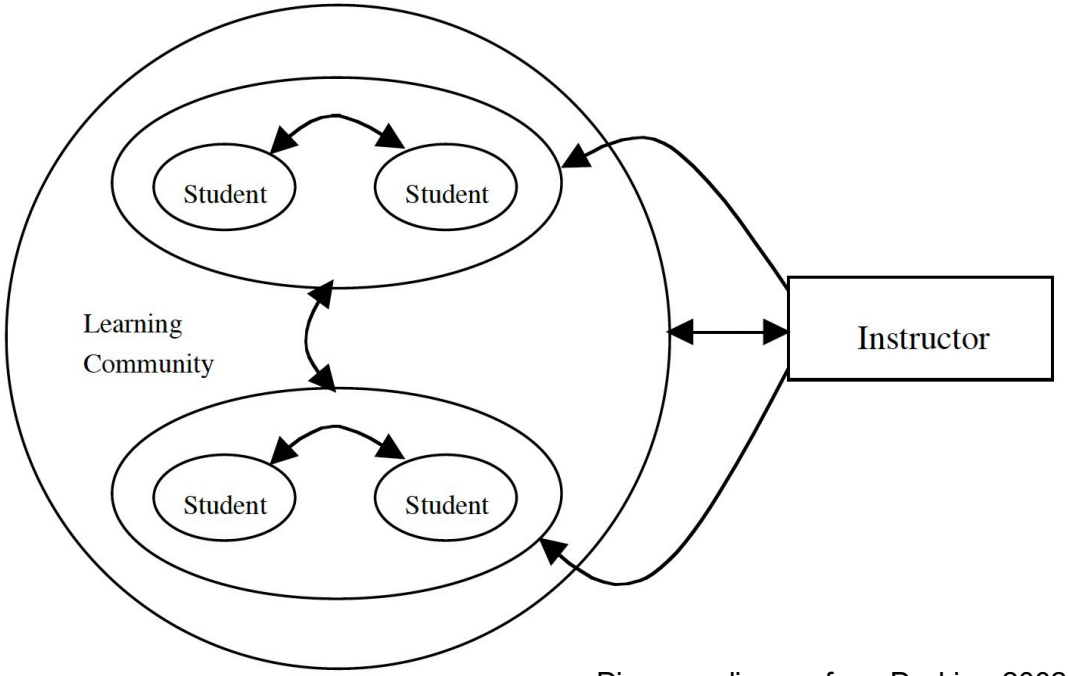
Overview

- Allow project team to learn more about audience thinking
- Share accurate and timely information with audience
- Allow audience opportunities to discuss local impacts with peers
- Promote audience learning and retention through dialogue



Discourse diagram from Desbien, 2002

Part 1

As a group, list four weather conditions that are critical to your operation. Identify how those four conditions might change by the middle of this century.

If there are any sticking points or questions that come up, please write them below.

Sticking Points/Questions:

Weather Conditions:

1.

Changes?

2.

Changes?

3.

Changes?

4.

Changes?

Part 2

Based on the weather conditions that your group thinks are likely to change, what are the greatest concerns that you have for your operation, family, and community?

Operation over the next 5 years	Family over the next 5 years	Community over the next 5 years
20 years and beyond	20 years and beyond	20 years and beyond

Part 3

Aaron’s Talk

Part 4

Your group has been given a card describing your farm operation. You have some additional cards listing actions that you can make in your operation to prepare for the changes you have drawn and concerns you have listed. Agree on the two to three most impactful actions you could take/have already taken and the two least impactful actions that you could take for the farm operation you have been given. List any factors that played a major role in your decision.

Most Impactful

Least Impactful

Factors that played a major role

Part 4

Action Cards

Put more land in conservation programs

Change my rotation to allow for double cropping

Increase cover crops

Invest in new or additional irrigation

Install more drainage tile

Adjust pest management practices
Describe:

Change insurance coverage
Circle one from each row:
- Yield Insurance/Revenue Insurance
- Increase coverage/Decrease Coverage

Increase use of no-till/conservation tillage

Participate in carbon markets

Not make any of these changes

Increase land leased for energy production
Circle one :
- Yield Insurance/Revenue Insurance

Change technology used
(for instance, larger or smaller fieldwork equipment)
Describe:

Other
Describe:

Part 4

Farm Operation Matrix

Farm Type 1: INSERT FARM. It's been in the family for three generations, and you intend to pass it on to your child, who has shown interest in farming. Your yield, per acre, has been consistent with other farms in the county.

Farm Type 2: INSERT FARM. Over the last decade, you have experienced two springs with extreme weather that have significantly altered production and cut into your yield. Your yield, per acre, has otherwise been consistent with other farms in the county.

Farm Type 3: INSERT FARM. Conversations with two neighboring farmers, recent articles in trade magazines, and a seminar at a regional growers meeting has you considering the balance between immediate profit and longer-term soil health/water quality. Your yield, per acre, has been consistent with other farms in the county.

	You operate a medium-acreage family farm.
INSERT FARMS	You operate a medium-acreage commercial farm.
	You are a tenant on a medium-acreage family farm.

Moving Forward…

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Next Steps…

- Project is extended to May 2023
- Continued quarterly SAT meetings
- Finalize integration
  - Quantify changes in ecosystem services (carbon sequestration)
  - Simulate the economic model under future baseline and alternative scenarios
  - Identify optimal policies robust to climate uncertainties
- Engage farmers and agricultural system stakeholders
  - Develop final set of products around optimal policies (fall 2022)
  - Finalize tabletop exercise for educators (spring 2022)
  - Conduct a policy/stakeholder workshop (summer 2023)
  - Final NC3 webinar (summer 2022)
  - CORN newsletter article (x2) (spring 2022, spring 2023)
  - Factsheet (x2) - for farmers and policymakers (winter 2023)
  - Final pitch to journalists (spring 2023)
  - Presentations at NCSE 2022, FSR 2022, Extension Conf 2022, Commodity Policy Mtg 2022, EPN 2023

Wrap-up and Evaluation

https://tinyurl.com/NIFAEval

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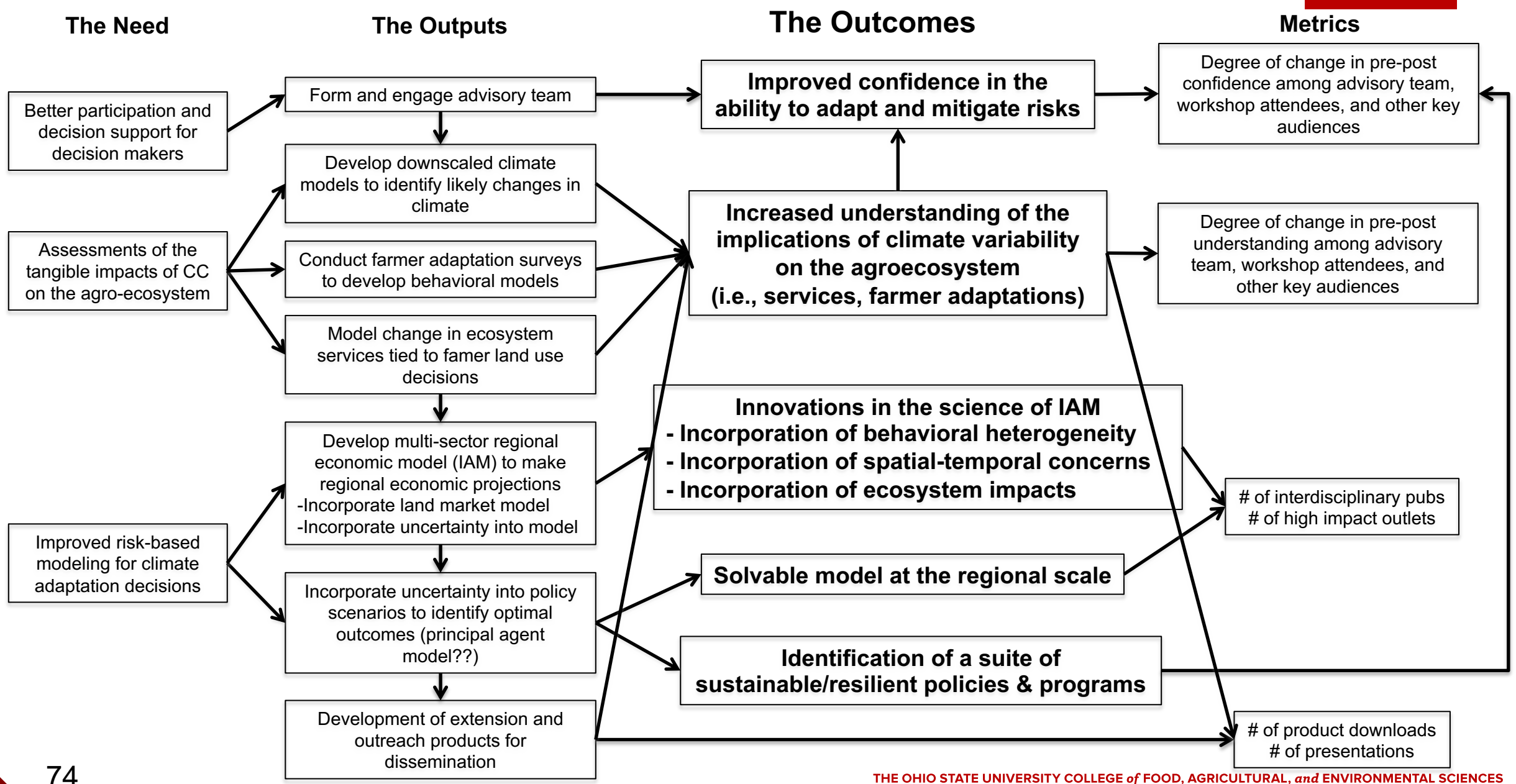
The Need
The Outputs
The Outcomes
Metrics
Better participation and decision support for decision makers
Assessments of the tangible impacts of CC on the agro-ecosystem
Improved risk-based modeling for climate adaptation decisions
Form and engage advisory team
Develop downscaled climate models to identify likely changes in climate
Conduct farmer adaptation surveys to develop behavioral models
Model change in ecosystem services tied to famer land use decisions
Develop multi-sector regional economic model (IAM) to make regional economic projections
-Incorporate land market model
-Incorporate uncertainty into model
Incorporate uncertainty into policy scenarios to identify optimal outcomes (principal agent model??)
Development of extension and outreach products for dissemination
Improved confidence in the ability to adapt and mitigate risks
Increased understanding of the implications of climate variability on the agroecosystem (i.e., services, farmer adaptations)
Innovations in the science of IAM
- Incorporation of behavioral heterogeneity
- Incorporation of spatial-temporal concerns
- Incorporation of ecosystem impacts
Solvable model at the regional scale
Identification of a suite of sustainable/resilient policies & programs
Degree of change in pre-post confidence among advisory team, workshop attendees, and other key audiences
Degree of change in pre-post understanding among advisory team, workshop attendees, and other key audiences
# of interdisciplinary pubs
# of high impact outlets
# of product downloads
# of presentations

Discussion

- How well do you understand the information provided?
- How well do you feel farmers will understand it?
- What do you find most interesting or exciting?
- Are there specific topics, visuals, or results that are unclear?
- How can the results of this project be disseminated to farmers and others who can use it?
- What groups specifically do you feel can benefit from this work that we may not be reaching?
- What role do you see for yourself in disseminating information from the project?

Thank you!!!!

https://tinyurl.com/NIFAEval

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Notes

- Climate regulation – concerns about how different crops are represented (corn vs. soy vs. corn), and how things like cover crops are integrated; also about solar installations and the relative impact or rural vs. urban areas
- Integrated modeling - ??
- LCA – Curious about differences in age, and teasing out the difference between willingness and ability; thought that moving the moderate people to high was the way to go; concerns about filter strips as an unfair metric of being a conservationist (not everyone needs them or can install them given where waterways exist); thought that ability (real or perceived) was a real barrier to people acting on their (high) motivation (e.g. the paperwork/time to sign up for govt programs and the restrictions on land mgmt. in those programs is a big barrier). People were curious what research we had done to increase efficacy and motivate conservation adoption.
  - We could model futures where efficacy is higher, not just due to incentive payments, but other efficacy related barriers
  - Could come back to this for more discussion at next quarterly meeting

Notes

- Policies/Scenarios - what policies are important/missing from our initial brainstorm?
  - Not sure if anything blatant is missing, but what about impacts of politics (e.g., power shifts, Ukraine/Russia)? Helps to think of recent events to imagine each quadrant, shifts in sustainability impacted by administrations or Russian power moves influencing trade. Could also look at COVID related data to think about shocks.
  - What if the western world quit buying fossil fuels from Russia? And we produced more energy here?
  - Interest in shocks and policies as we follow scenario trajectories out into the future
  - Worldwide deforestation – where does this come into play? Is embedded in the SSPs at a global scale.
  - Shifts in cropping systems – renewable diesel would require ramping up soybean acres
- Tabletop Exercise
  - Perhaps focus farm types on small, medium, large and perhaps off-farm income (or not)
  - Drop commercial and tenant – but bring in the rented question elsewhere?
  - Maybe collect data to build profiles at the beginning