Explaining Changes in Nitrogen and Phosphorus Loads Using Land Management Practice Data and How These Data Can Indicate Where Practices Could Be Targeted in the Future

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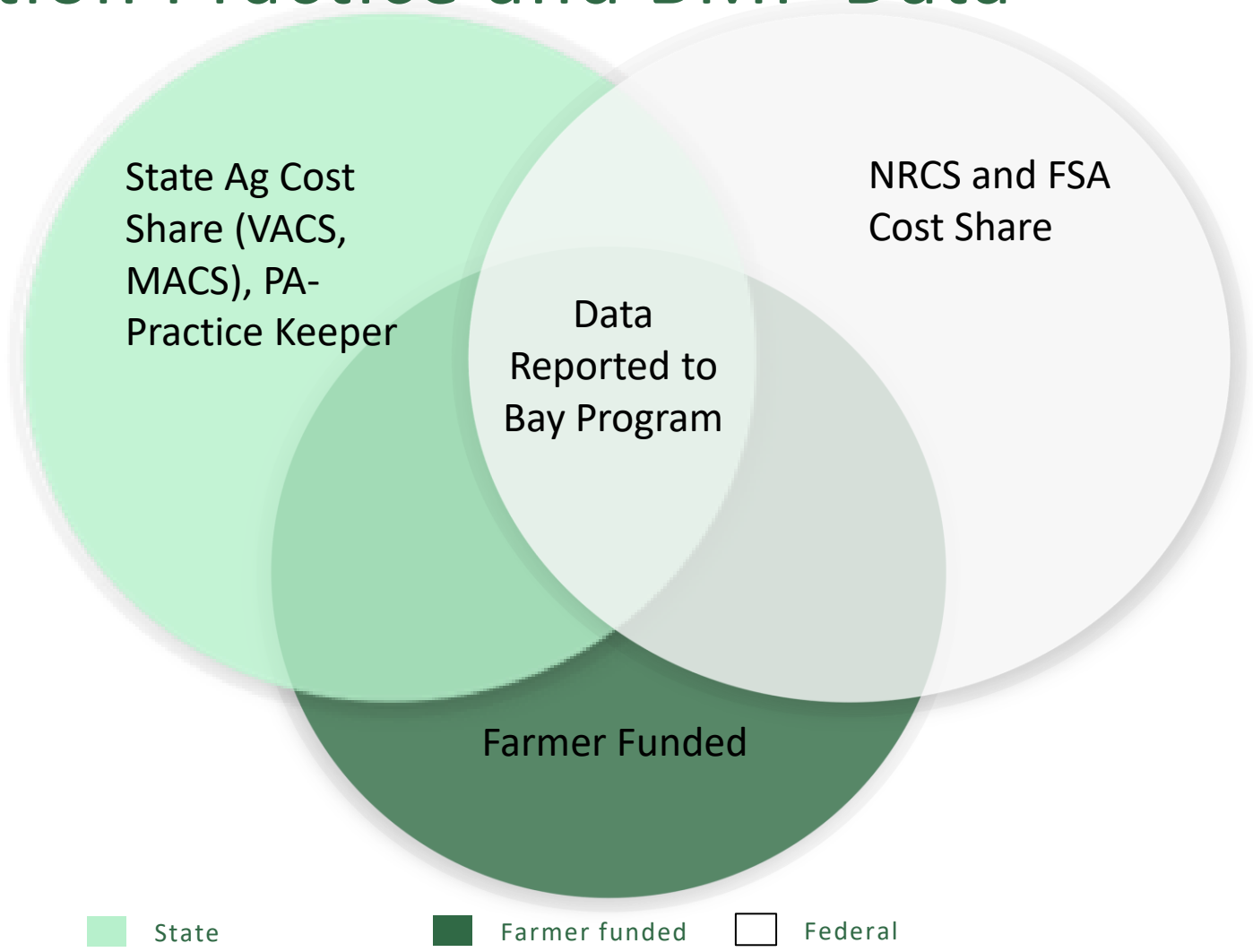
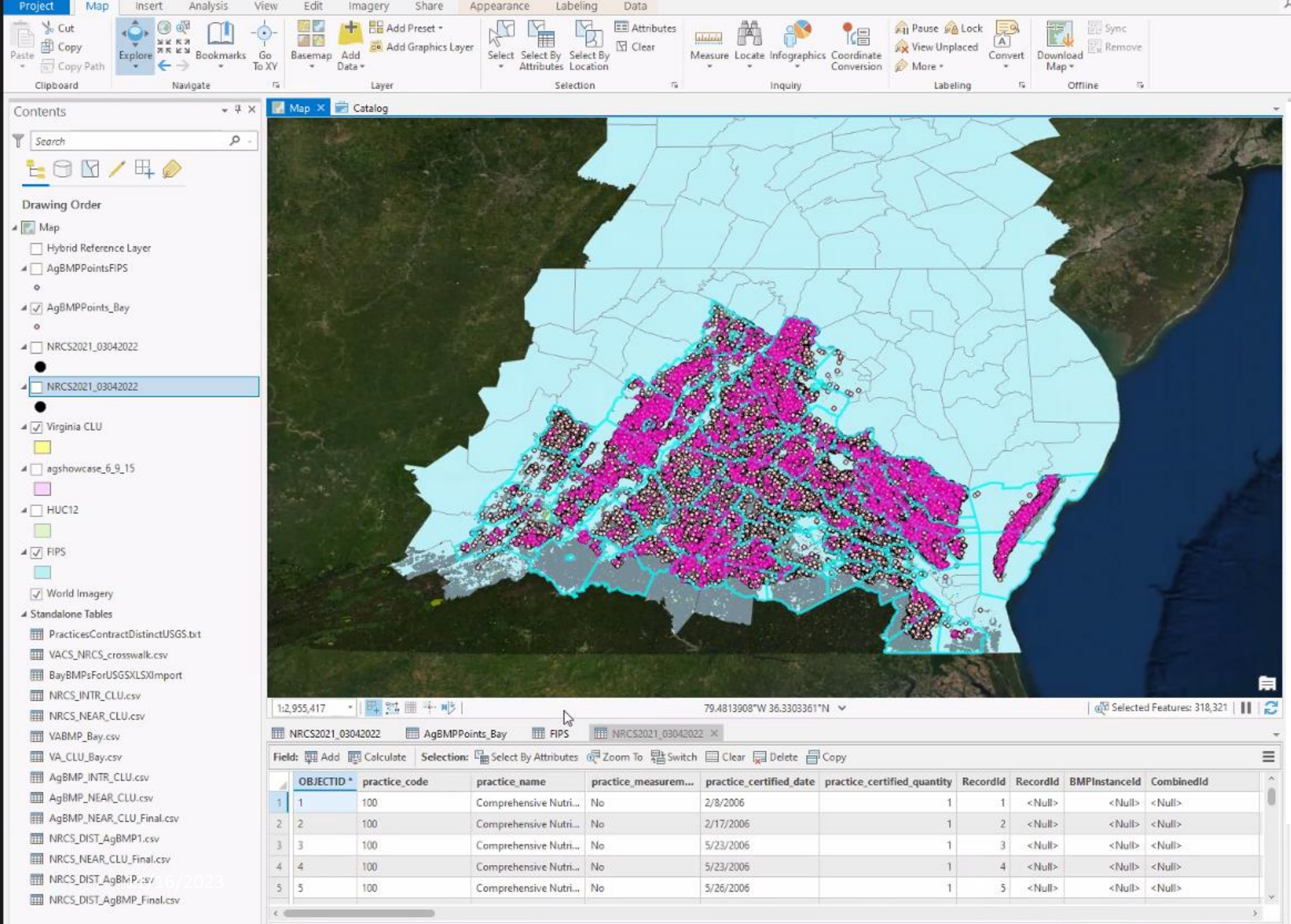
Overview

- Review current data
- Completed: Management Practice Targeting Maps
- In Development: Relating BMP Implementation and Modeled Load Reduction
- Coming Soon: Agricultural Cost Share Targeting Maps

Current Understanding of Conservation Practice and BMP Data

- States and federal can co-cost-share
- Bay Program, CAST, should have VACS and Federal BMPs
- Solely farmer funded is not known





- Map shows VA harmonized dataset
- NRCS data are only available for the Chesapeake Bay watershed counties
- James Colgin developed the methodology for PA
- Andy Fitch optimized and adapted for VA and MD

Four Primary Dimensions of BMP Data

Any one source of BMP data for the Chesapeake Bay Watershed can result in many millions of records of information.

BMP data may be selected/filtered and aggregated according to the following four dimensions

This makes the data directly relevant to your specific research questions

Effect

Which effect(s) are the subject of the research? BMP data pertain to nitrogen, phosphorus, sediment, greenhouse gases, bacteria, pesticides, and more.

Land Use

Is your study area urban, agricultural, natural, or a mix of land uses? BMP data can cover all these land uses.

Scale

What scale is your study area? One or many small watersheds such as a HUC-12, the entire Chesapeake Bay watershed, or another scale?

Time

What time period are you interested in? Is it a single year, trends over time, or seasonal?

Management Practice Targeting Maps

How we created maps for management practice targeting using CAST loads and delivery factors

Goal and Resources

Goal: Create maps that represent both the CAST loads and delivery factors, to be used for management practice implementation targeting

Resources:

- Map Tools & Spatial Data
- Loads Report
- Source Data

Methods

Download the Segmentation from CAST Spatial Data for Download https://cast.chesapeakebay.net/Documentation/MapToolSpatialData

Login to create and download a Loads Report using the most recent (2022) Progress scenario at the land-river segment and sector scale

Download the Source Data and reference the Delivery Factors sheet

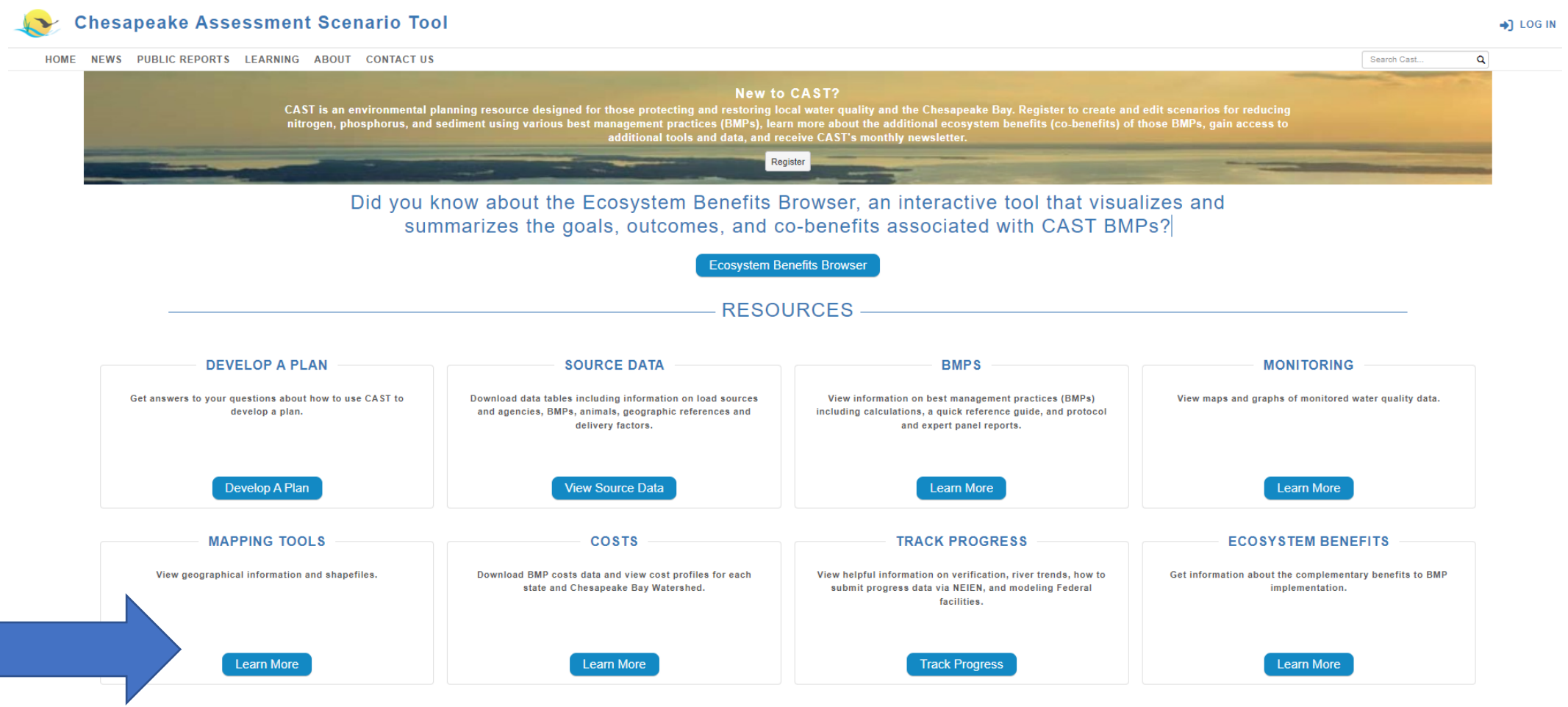
- Multiply all delivery factors (land to water, stream to river, and river to bay) and average the sector load sources for each segment

Join the loads and delivery factors to the Segmentation in GIS

Classify the loads and delivery factors for each land-river segment and multiply the layers to create a bivariate choropleth map

BMP Targeting Maps

The BMP Targeting Maps are available on the Map Tools & Spatial Data page



Relating Management Practice Implementation and Modeled Load Reduction

Management Practice Heat Maps: Current efforts to create maps that show the effects of BMPs

Goal and Resources

Goal: Create maps that show the expected effects of management practices in a simplified way

Resources:

- Source Data
- Map Tools & Spatial Data
- Loads Report
- BMP Submitted vs. Credited Report

Methods

Using the CAST Source Data, find the Efficiency BMPs spreadsheet and group the agricultural MPs by those with lower vs higher effectiveness

→

Create 3 scenarios to isolate the low, high, and animal MPs from a baseline (2009) and the most recent (2022) Progress scenarios

→

Download the Segmentation from CAST Spatial Data for Download https://cast.chesapeakebay.net/Documentation/MapToolSpatialData

→

Login to create and download Loads Per Unit reports using those scenarios at the land-river segment and sector scale

- These reports are used to determine the loading rate change over time for each low, high, and animal MP scenario using the formula: (2022-2009)/2009

↓

Create and download a BMP Submitted vs. Credited report using the most recent (2022) Progress scenario at the land-river segment scale

- This report needs to be aggregated so that the low effectiveness, high effectiveness, and animal MPs are separated and combined by group
- Then, find the percent of total ag with MPs for each (low, high, and animal) using the formula: (MP acres or AU)/(total ag acres or total available AU)

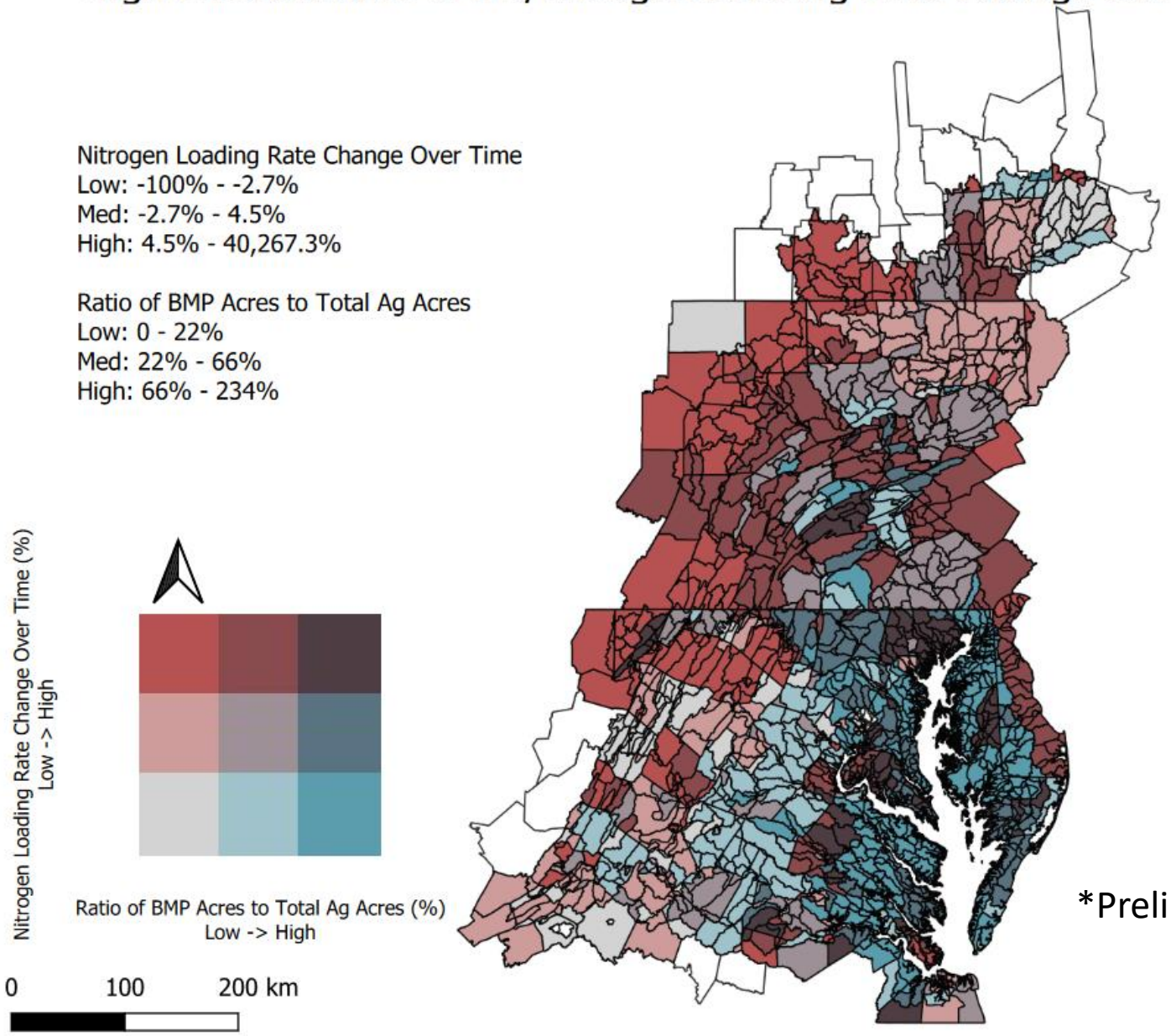
→

Join the loading rate change over time and ratio of MPs to the Segmentation using GIS

→

Classify the loading rate change over time and ratio of MPs for each land-river segment and multiply the layers to create a bivariate choropleth map

Chesapeake Bay Watershed Agricultural Best Management Practices Heat Map
High Effectiveness BMPs/Nitrogen Loading Rate Change Over Time (2009-2022)



- Agricultural, land-based practices
  - Does NOT include animal management practices
- Agricultural TN loading rate change over time (2009-2022)
- Ratio of agricultural management practice acres/total agricultural acres
- Used to simplify the relationship between management practices and expected loads

*Preliminary Information – Subject to Revision

Source: CAST.chesapeakebay.net

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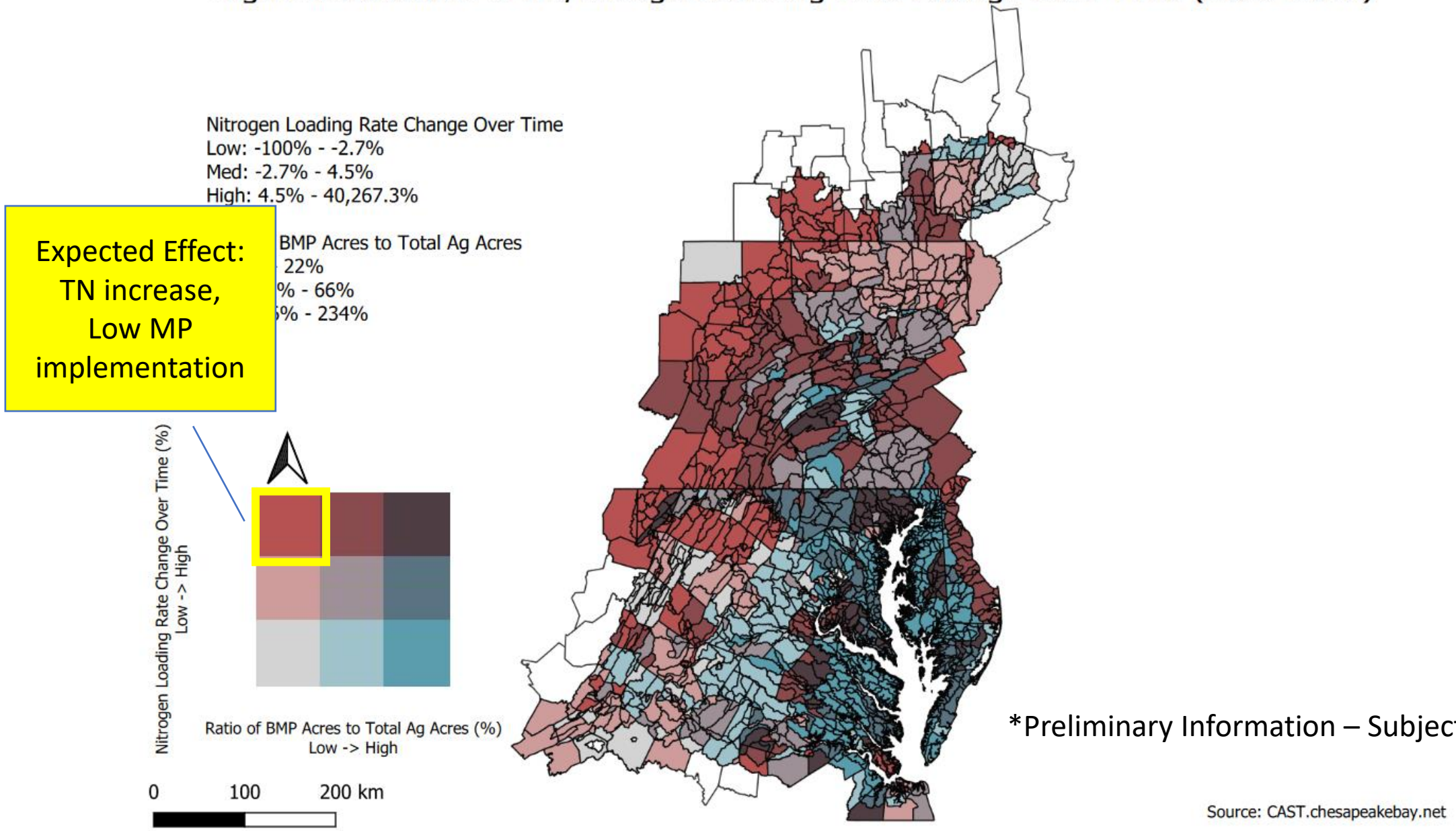

Expected Effect:
TN increase,
Low MP
implementation

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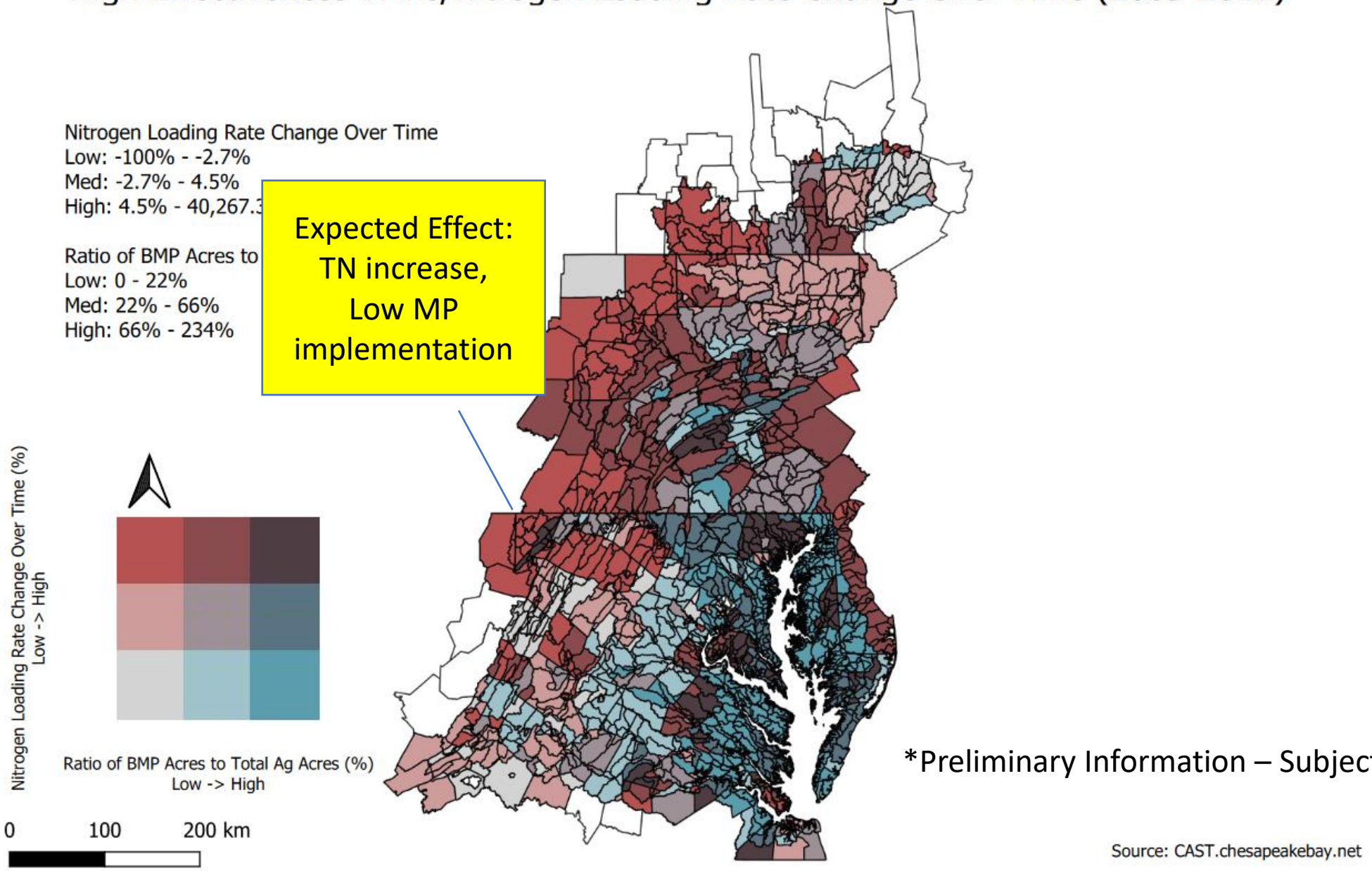

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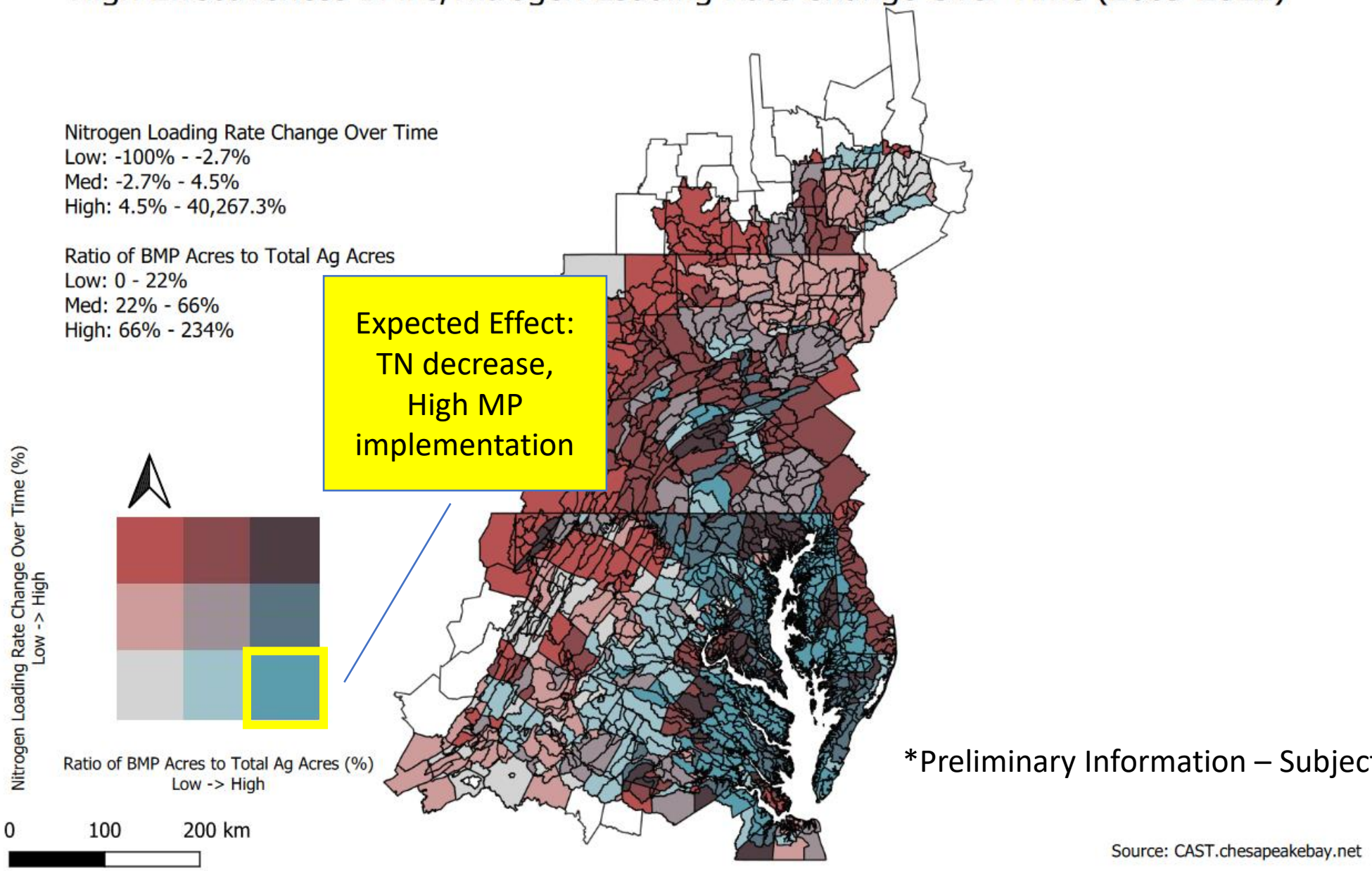

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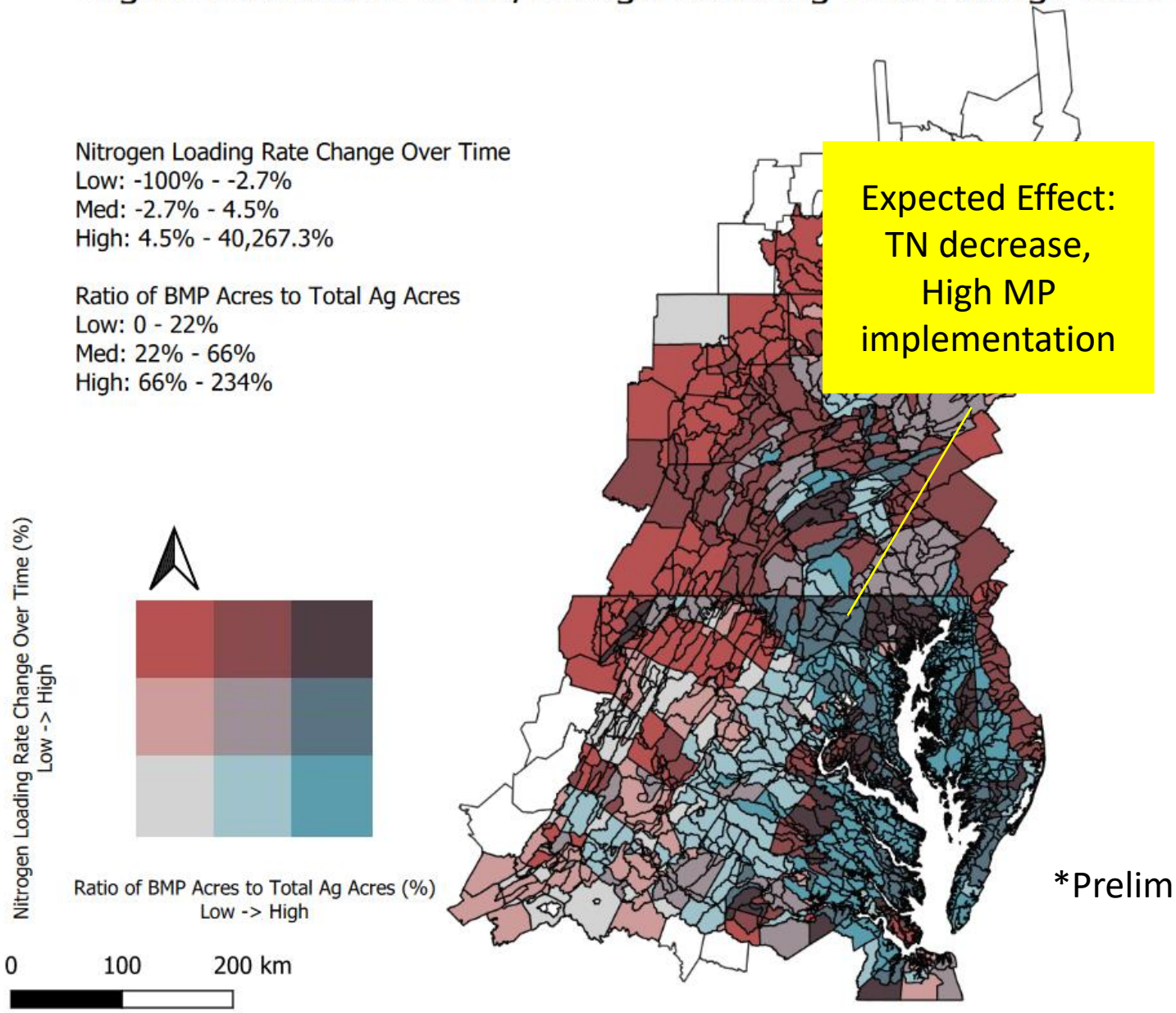

Expected Effect:
TN decrease,
High MP
implementation

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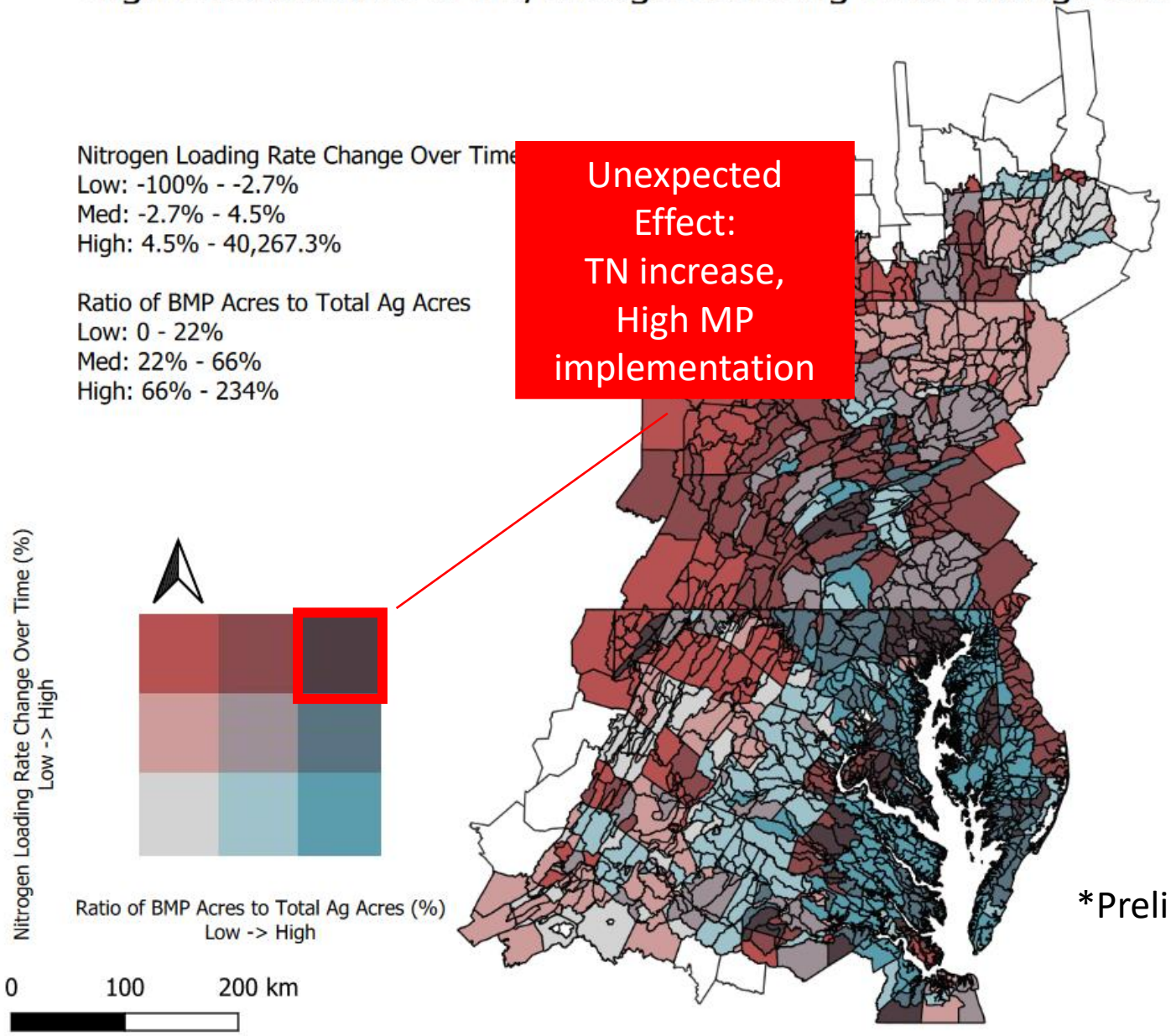

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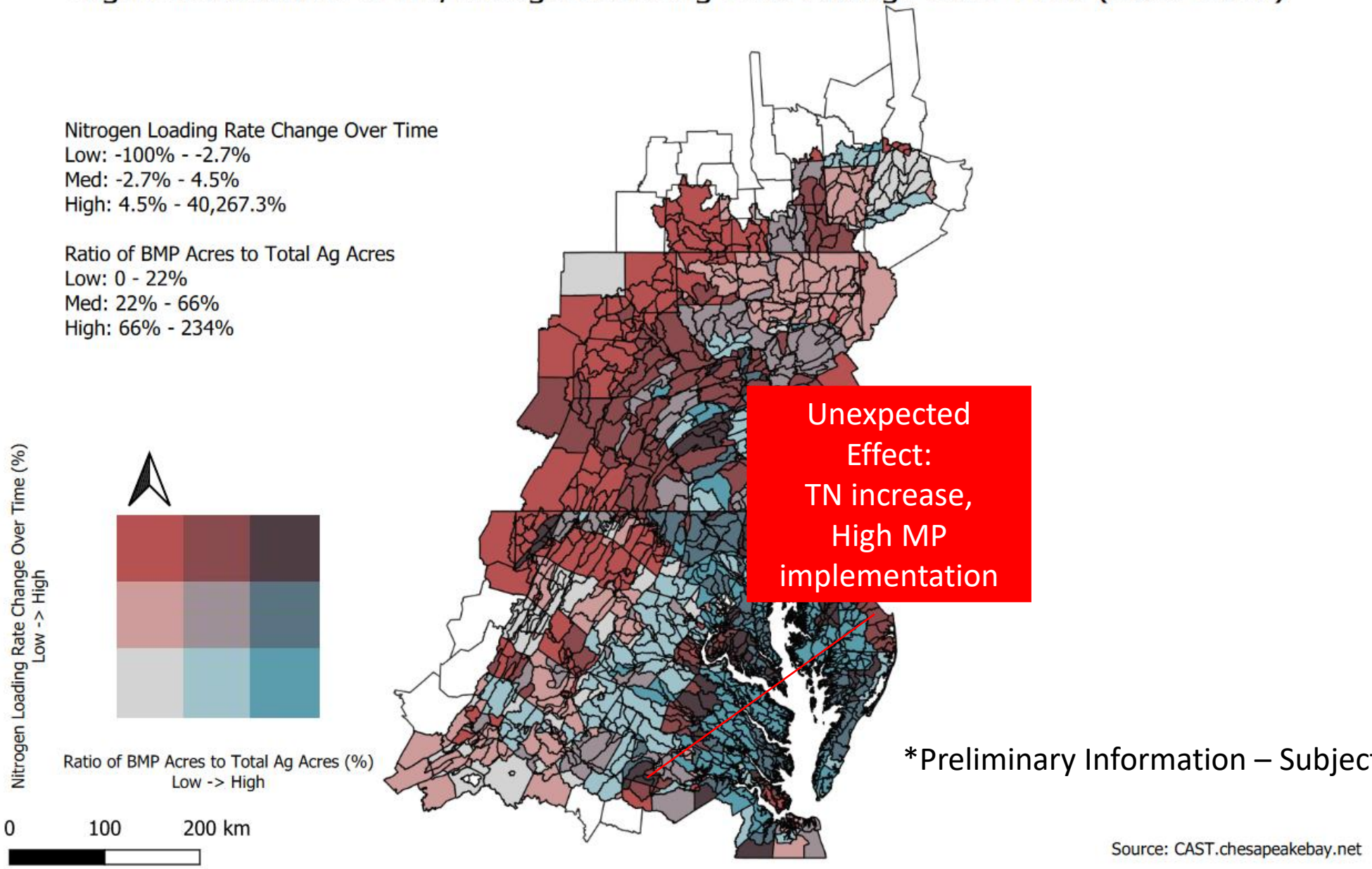

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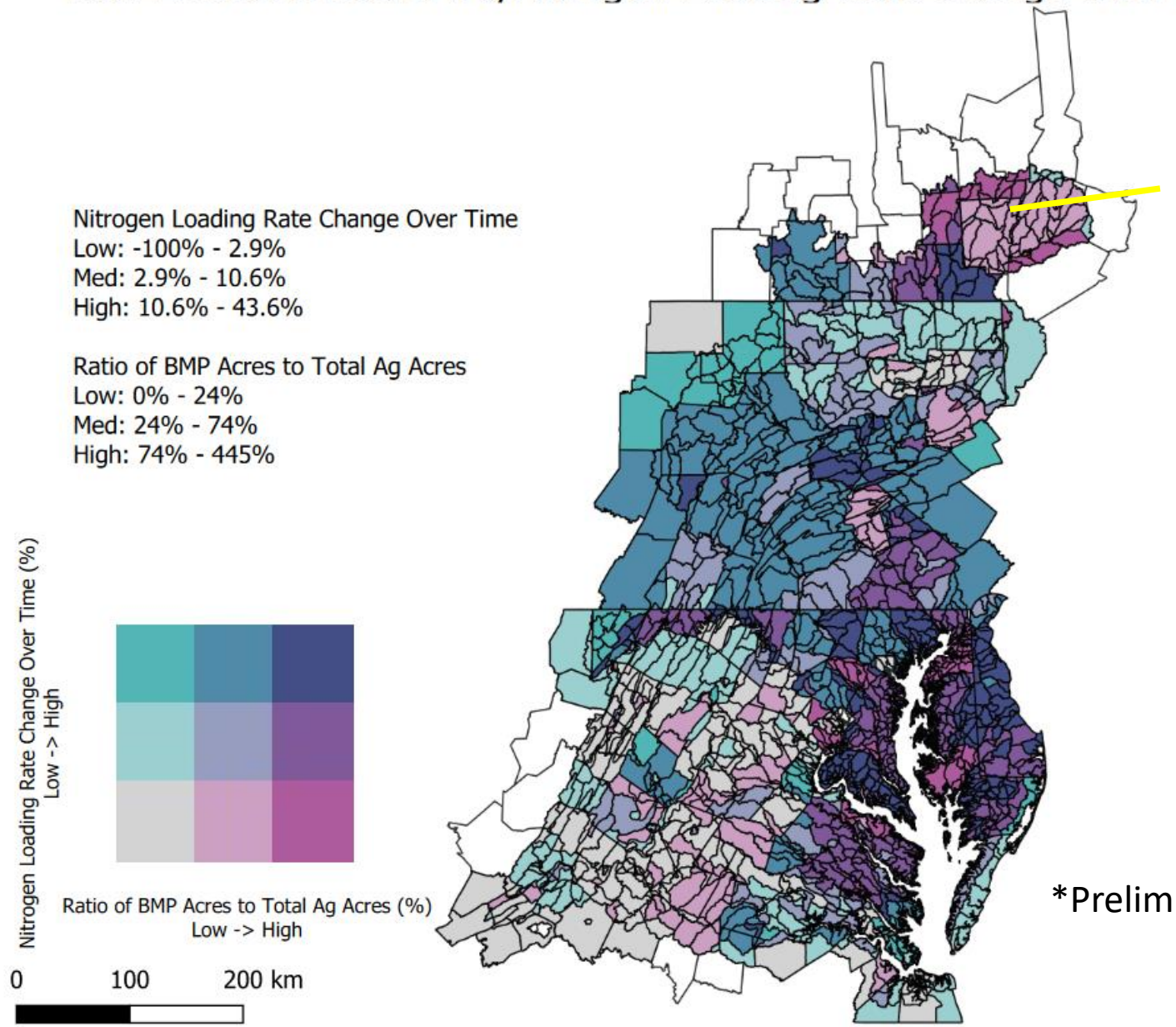
Chesapeake Bay Watershed Agricultural Best Management Practices Heat Map
Low Effectiveness BMPs/Nitrogen Loading Rate Change Over Time (2009-2022)



Med/High percentage of MPs, TN decreasing over time

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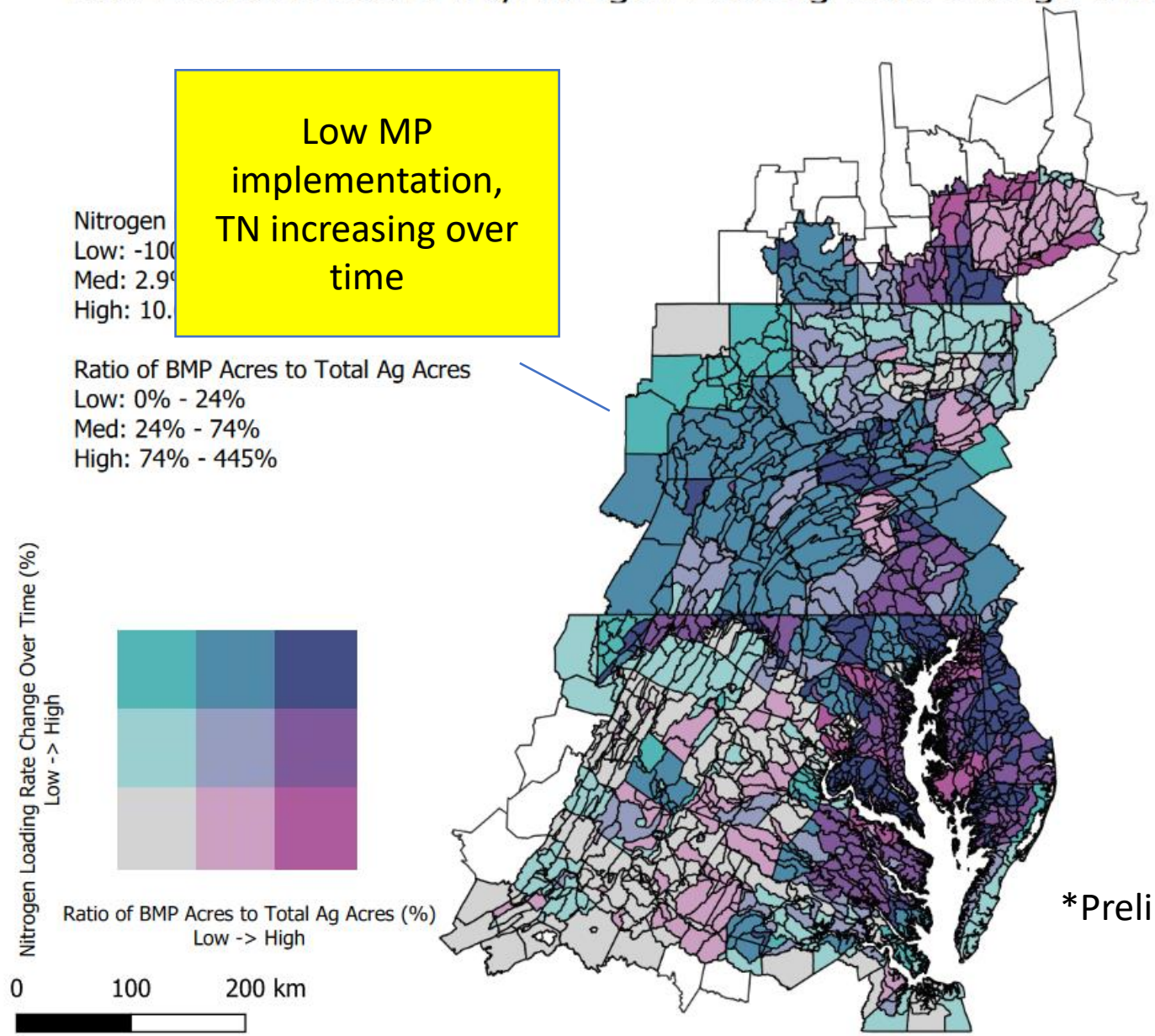

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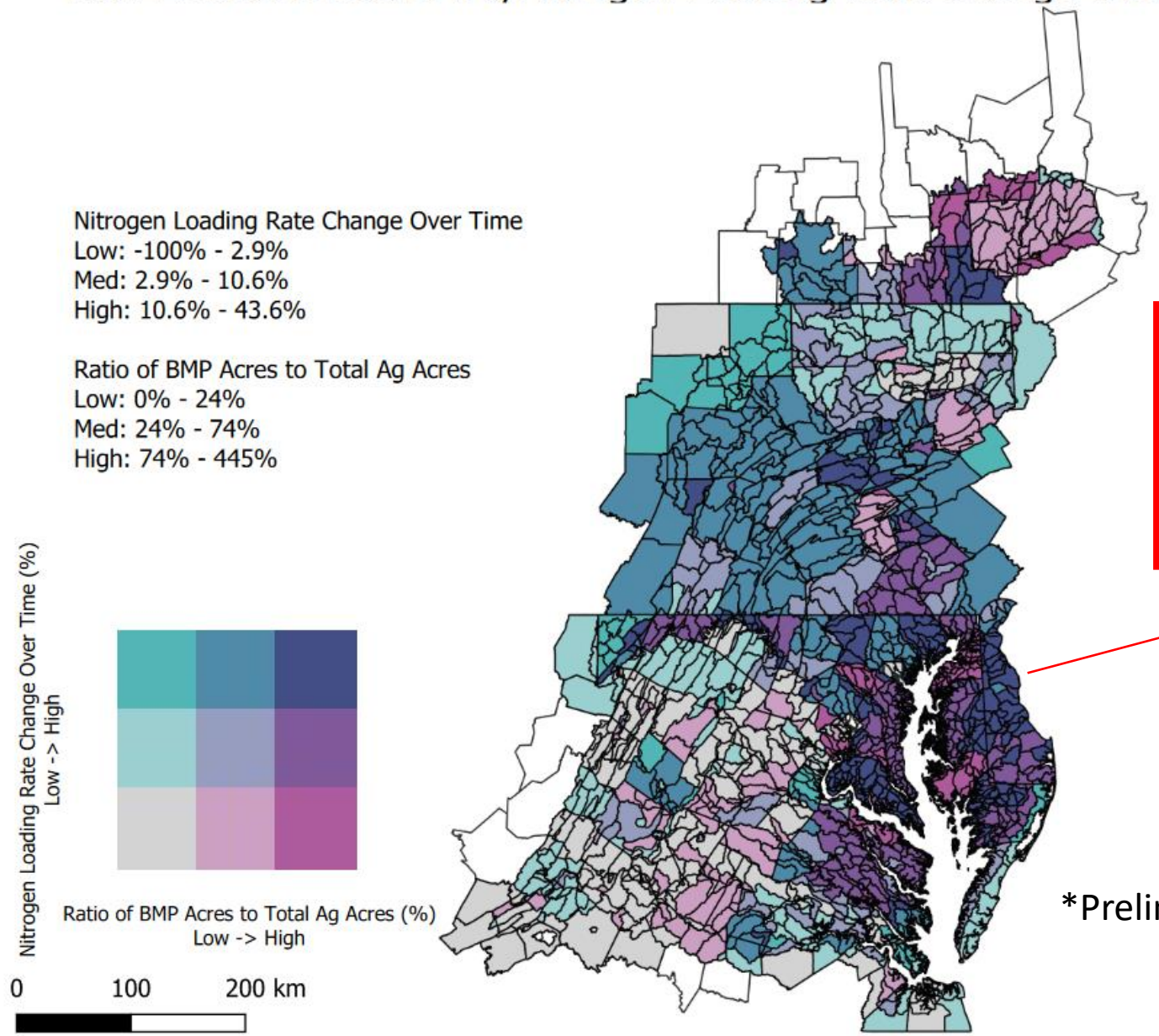

High MP implementation, TN increasing over time

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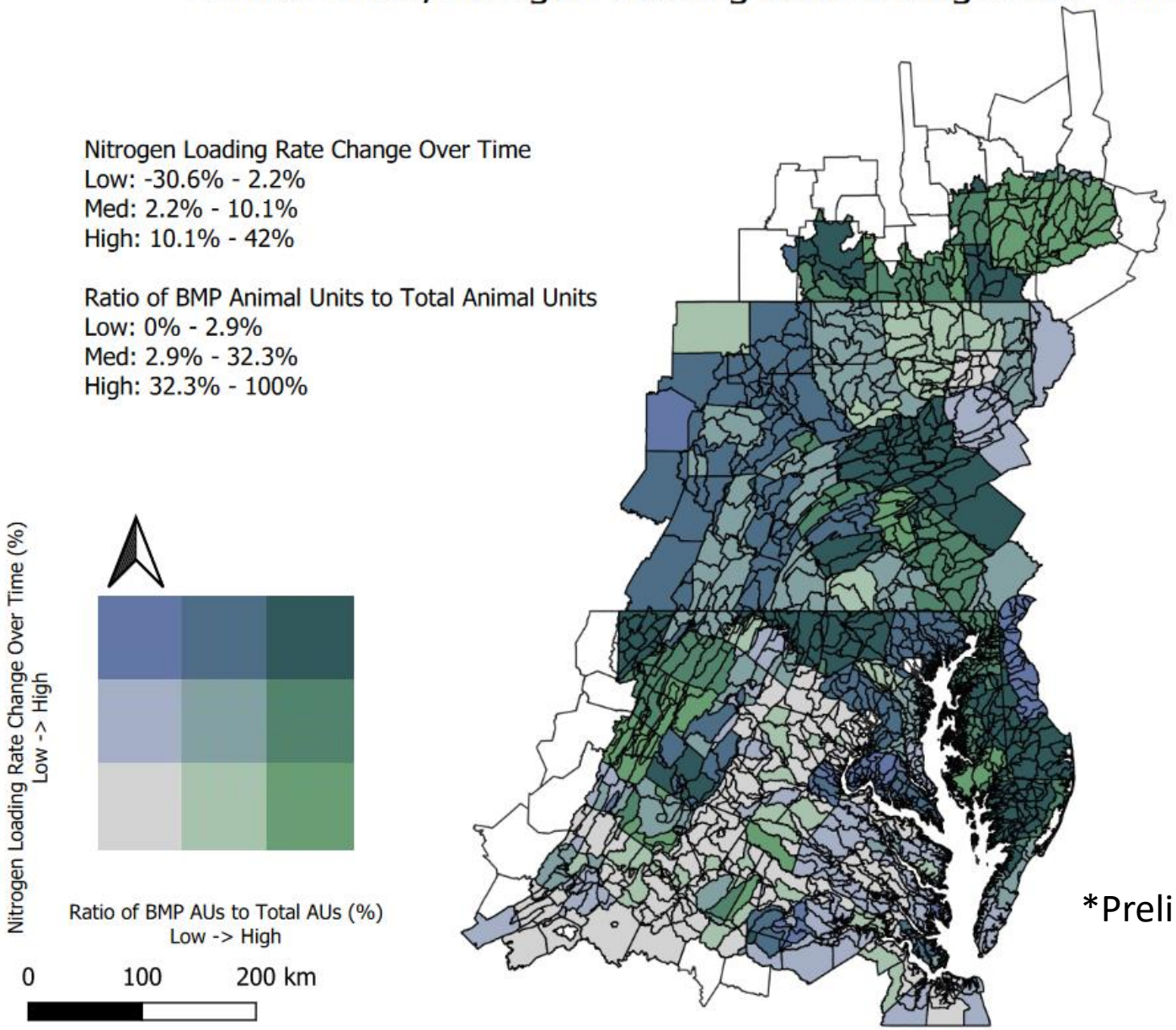
Source: CAST.chesapeakebay.net

Chesapeake Bay Watershed Best Management Practices Heat Map
Animal BMPs/Nitrogen Loading Rate Change Over Time (2009-2022)



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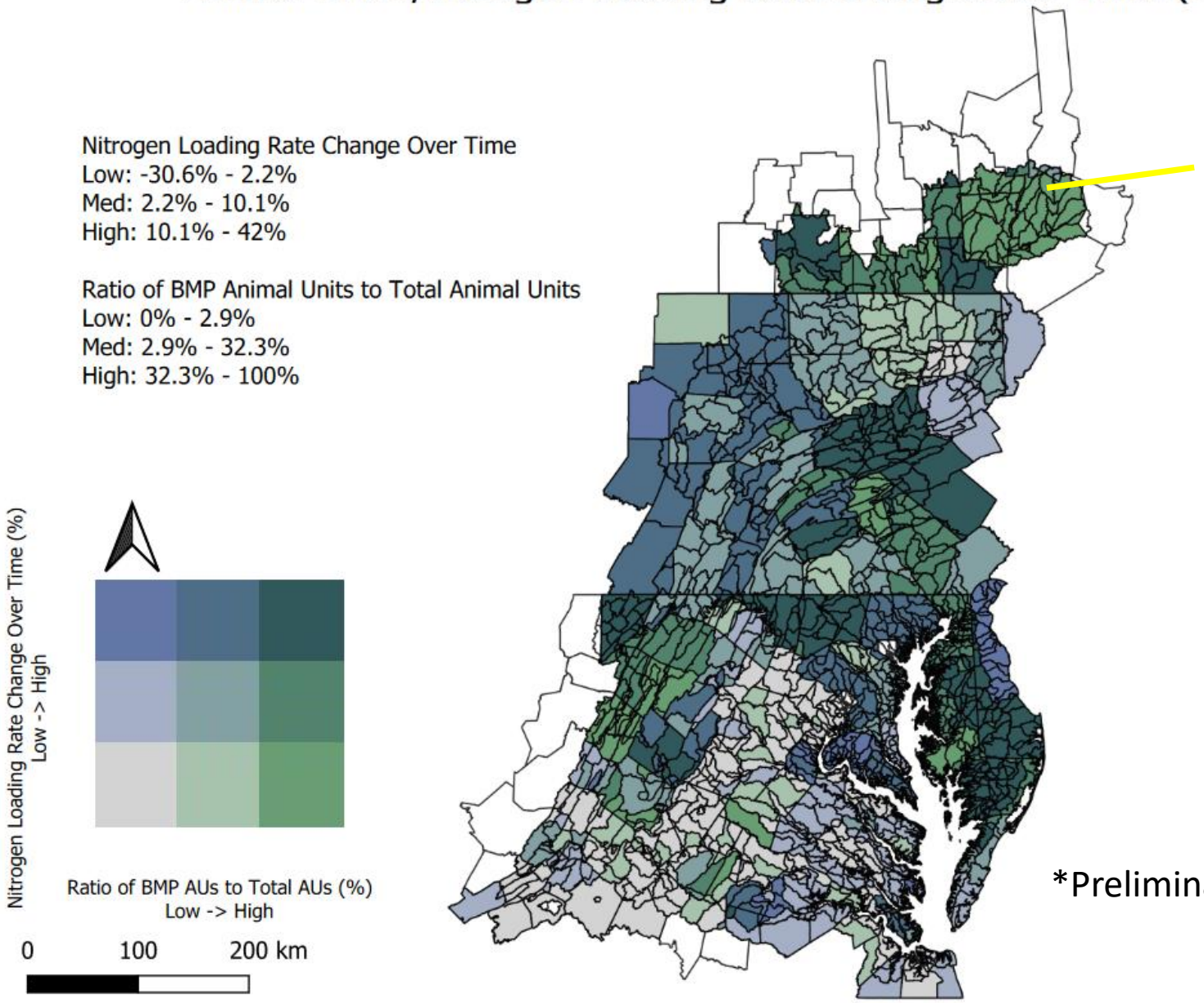

High percentage of MPs,
TN decreasing over time

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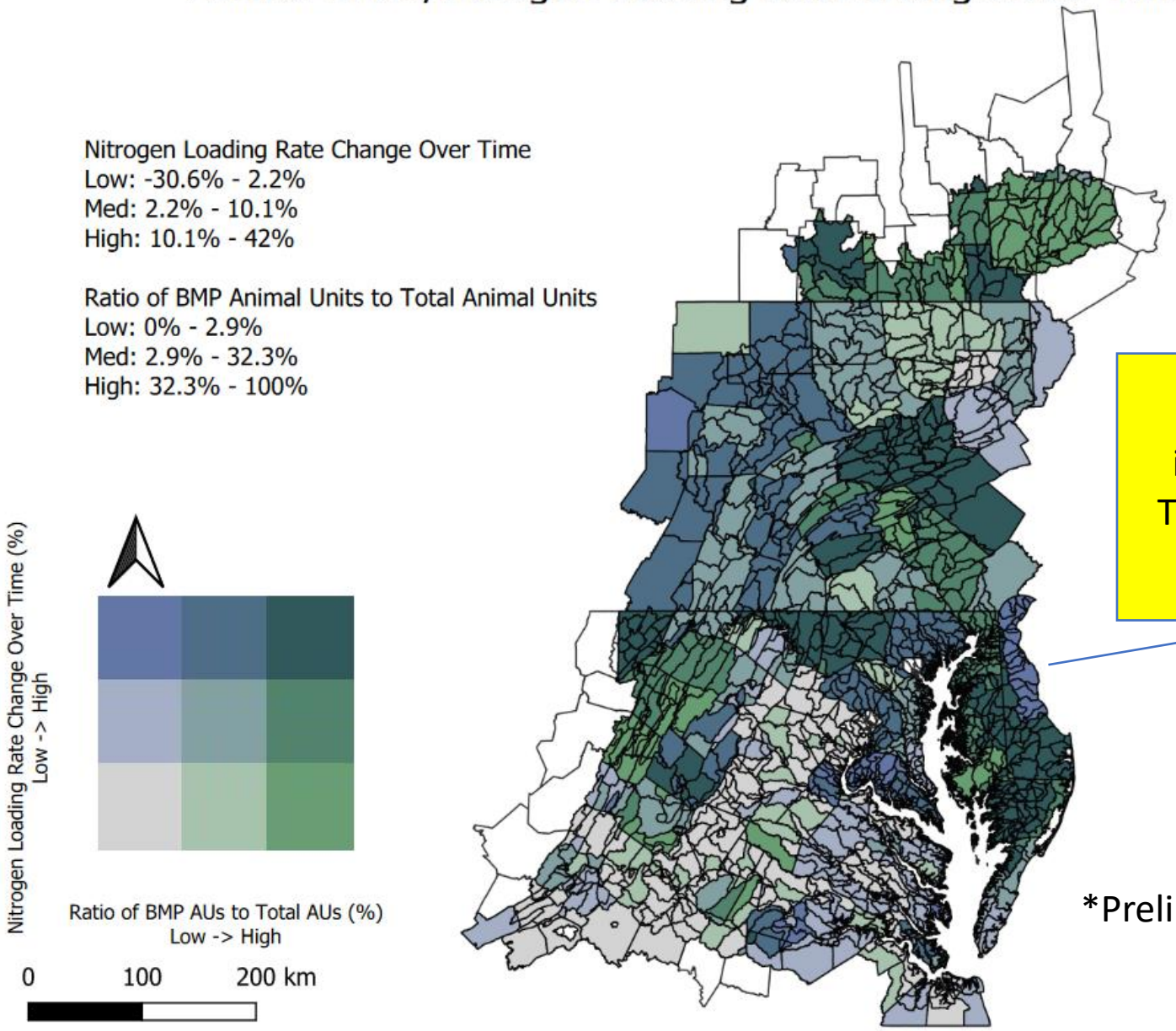

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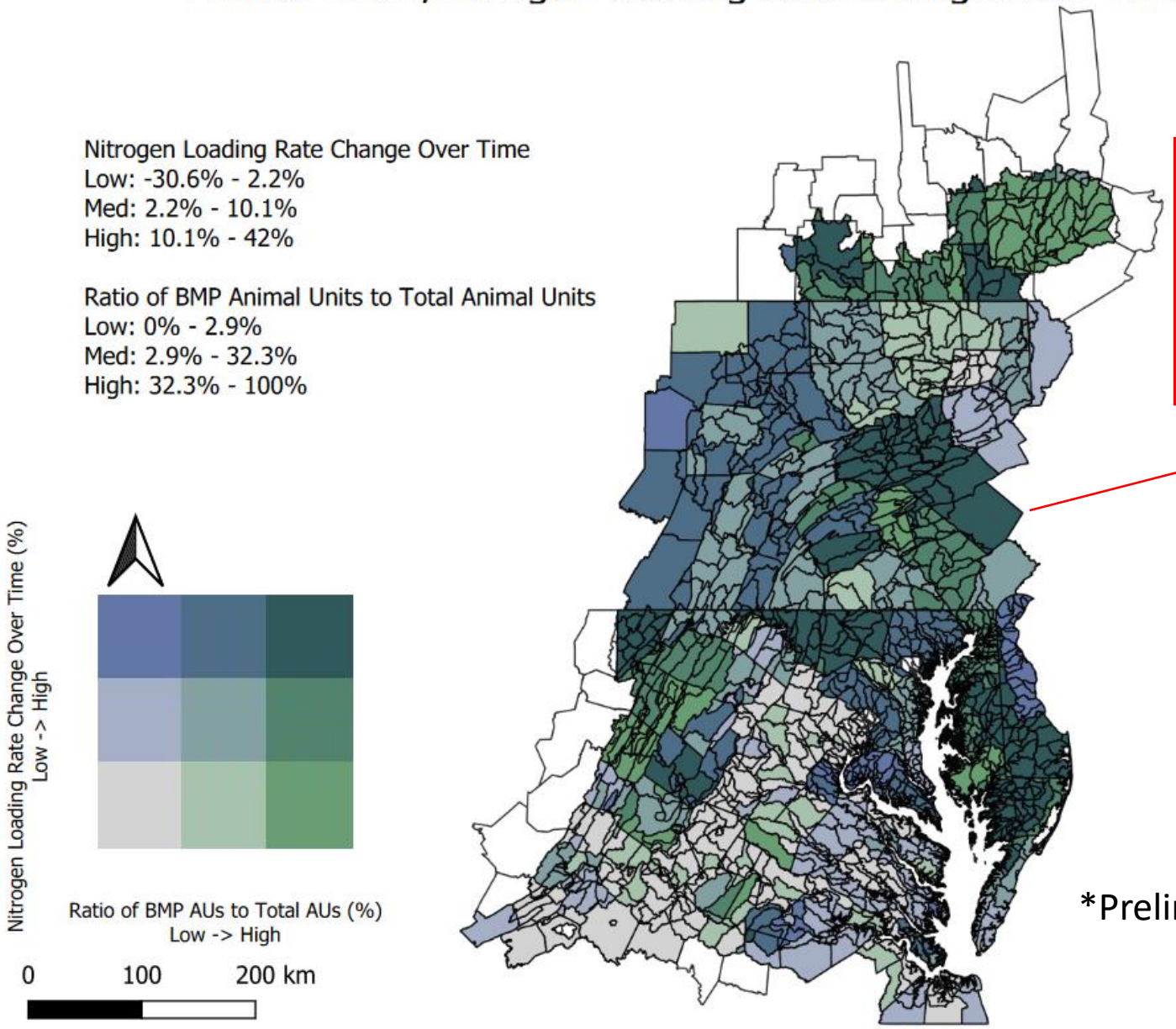

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Agricultural Cost Share Targeting Maps

Future efforts to identify areas that could benefit from agricultural cost share programs

Goal and Resources

Goal: DCR would like to increase participation: (1) from producers with few or no BMPs and (2) in the Continuing Conservation Initiative (CCI) to maintain a record of BMPs that are no longer under a NRCS contract. USGS will overlay the harmonized BMP dataset of VACS and USDA practices and share the areas with no known BMPs. Local extension agents will attempt to contact the property owners of those lands and encourage them to increase participation through the local SWCD.

Resources:

- Virginia Department of Conservation and Recreation (DCR) Agricultural BMP Cost-Share (VACS) data
- National Resources Conservation Service (NRCS) Agricultural Easement Data
- Common Land Unit GIS layer
- Tax Parcel IDs

Methods

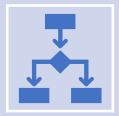
Add DCR VACS and NRCS practice data to a CLU GIS layer → Join Tax Parcel IDs → Identify Tax Parcel IDs where there are no VACS or NRCS practices

Summary

- Reviewed current data
- Completed: Targeting Maps that are dynamically displayed on CAST
- In development: Relationship between management practices and expected nutrient loads, change over time
- In development: Identifying target areas in support of VA outreach efforts

Objectives

Target audience: land use managers and conservation program technical staff



Expected outcome: increased understanding of the role of management practices and geographic focus areas for management practice implementation

Future directions: incorporate work of stream team, watershed assessments, SIMPLE, and other Theme 1 teams on explaining monitored loads

Preliminary results:

Management practices do not fully explain the expected change in loads. We have identified those areas using CAST-modeled loads and agricultural management practice data

Determined that animal agriculture and land-based practices are best evaluated separately