

Use Case

A use case walks through an example of how EnviroAtlas data, sometimes in conjunction with other data or resources, may be used to address real-world questions. Use cases can be hypothetical or based on actual cases where EnviroAtlas has been used in decision making at the local, regional, or national scale.

Using EnviroAtlas Data to Identify Cost-Effective Locations for Manure Management Incentives



Use Case

Introduction

This use case explores one solution for minimizing the negative impacts of excess nutrients in waters throughout the Mid-Atlantic study area by providing options for managing manure application to the land. A similar analysis could be applied anywhere.

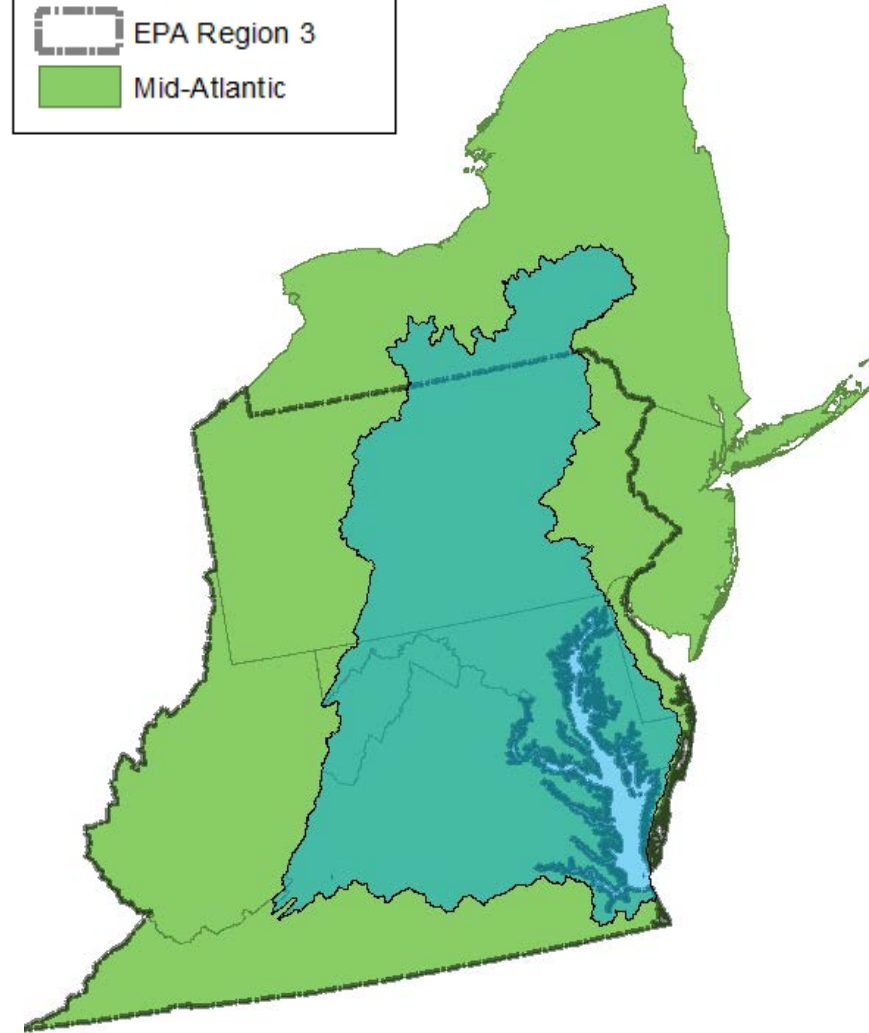
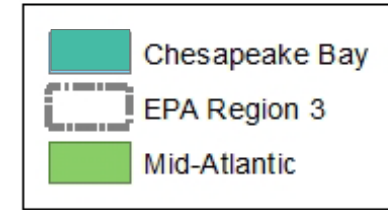
The Mid-Atlantic Region includes Delaware, Maryland, New York, New Jersey, Pennsylvania, Virginia, and West Virginia.

Mid-Atlantic Focus Area

- The study area for this use case includes about half of the Mid-Atlantic Region and about 90% of the Chesapeake Bay drainage area.
- The Chesapeake Bay Watershed covers 64,000 square miles and is home to over 17 million people. It is known for its famous blue crabs and the area is rich in biodiversity and history.
- The Chesapeake Bay faces a number of problems, chief among them, the presence of excess nutrients.



Multiple EnviroAtlas data sets are used in this use case. Because the focus is on the Mid-Atlantic, the maps shown have been created specifically for this area. When accessed in EnviroAtlas, these maps span the contiguous US.



[Learn more about EnviroAtlas data.](#)

❖ The Problem

Applying too much manure to crop and pasture lands can negatively impact water bodies

❖ One Solution

Provide financial incentives for manure transport

- Approach overview
- Identify areas that are vulnerable to over-application of manure
- Identify areas where excess nutrients are likely reaching waterbodies
- Identify areas where reduction of nutrients will benefit water quality management goals
- Combining benefits and risks

❖ Cost-effective targeting of program funds

Subsidize manure hauling
In areas with highest cost-effectiveness

The Problem

Applying too much manure to croplands and pastures can negatively impact water bodies

Recovered manure is a source of nutrients available for croplands and pastures. Animal producers regularly apply manure to their cropland as a cost-effective disposal method.

Often, more manure is applied to the land than can be taken up by plants. As a result, excess nutrients runoff into neighboring waterbodies.

Excess nutrients in waterbodies can impair them in a number of ways, affecting ecosystems, human health, and the economy.

- Excessive algal growth leads to reduced oxygen levels in water and smothered plant and animal life.
- Impaired waters can cause harm to the fishing industry and seafood supply.
- Impaired waters may reduce opportunities for tourism and recreation.

Nutrient loading is an issue in much of the Mid-Atlantic, including the Chesapeake Bay Watershed.



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Subsidize manure hauling in areas with highest cost-effectiveness

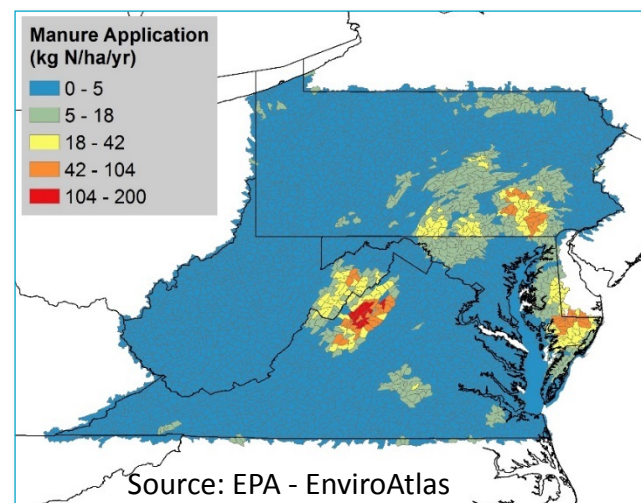
One Solution

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The U.S. Environmental Protection Agency (EPA) encourages point-nonpoint trading as a mechanism to meet water quality goals. Point sources, such as wastewater treatment plants, could purchase nutrient reduction credits reducing the overall costs of compliance (Wainger 2012).

As a way to prevent over-application of manure within a given area, excess recovered manure can be transported to nearby cropland and pastures that are in need of nutrients.

Because hauling manure can be costly, incentives or voluntary trading programs could encourage people to take advantage of this solution.



This use case follows these spatial analysis steps:

1. Identify the locations where distributing excess manure could be beneficial to meeting water quality goals.
2. Use estimates of manure hauling costs based on the abundance and proximity of crop and pasture land that could accept manure (Aillery et al. 2005).
3. Investigate the most cost-effective areas for targeting manure transport incentives based on benefits and costs.

[Read the manure application metric fact sheet to learn more.](#)

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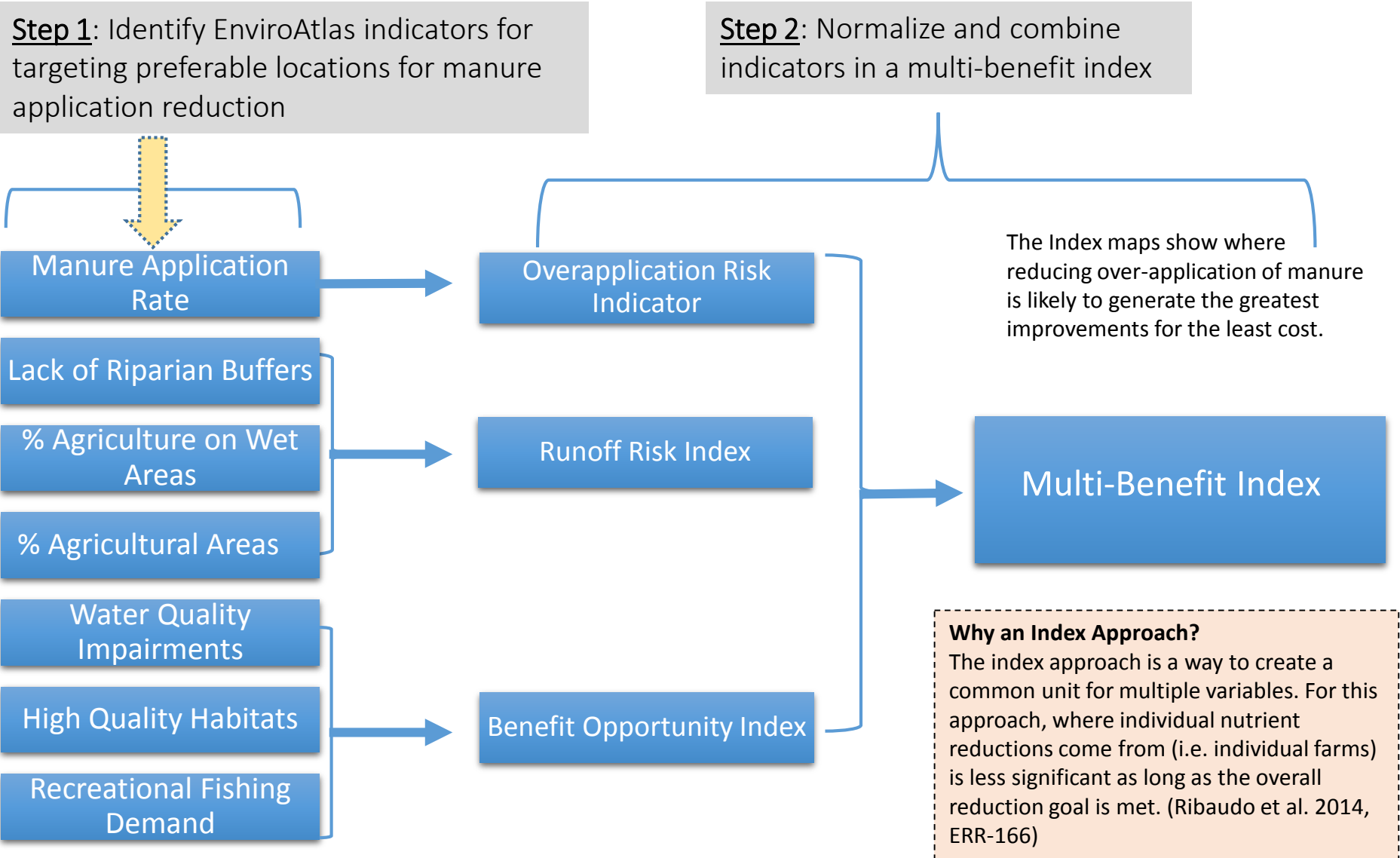
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Approach

Combine indicators of ecosystem service benefits and nutrient runoff risk to create a multi-benefit index



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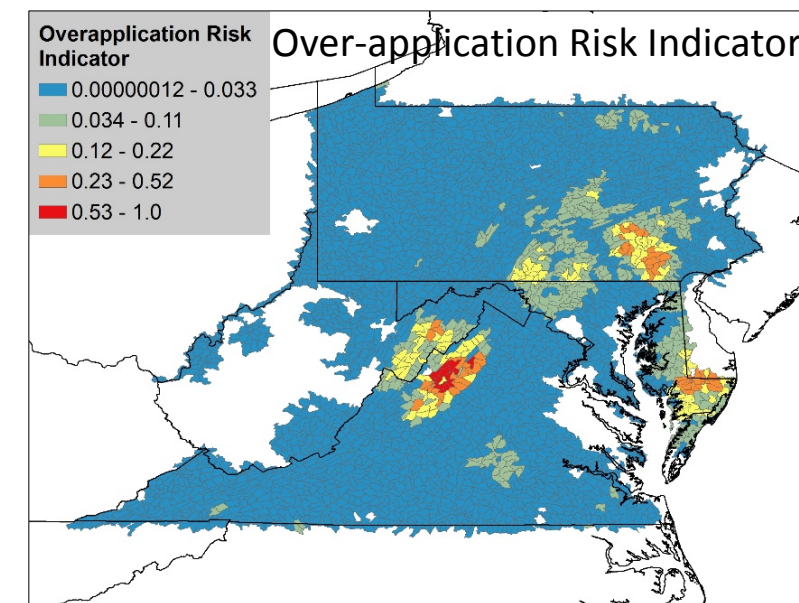
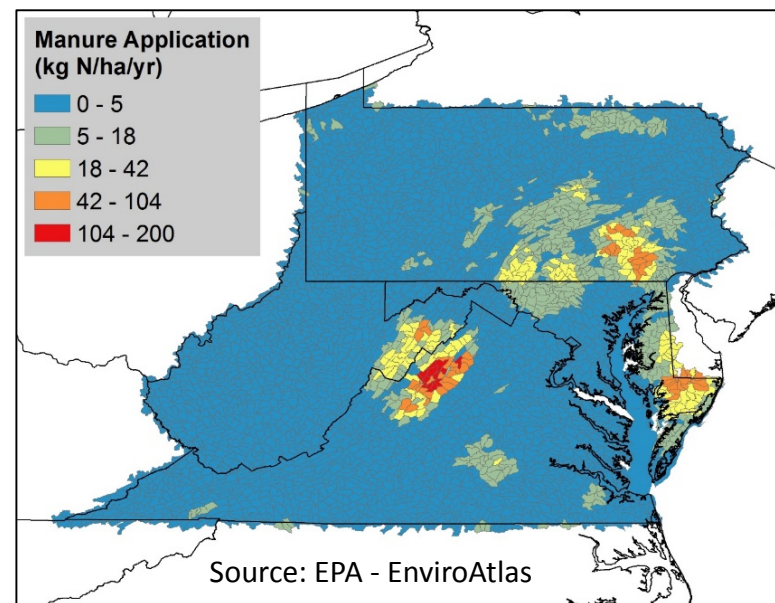
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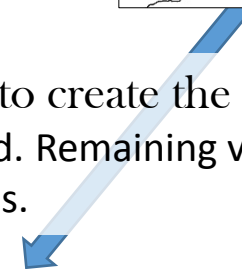
Subsidize manure hauling in areas with highest cost-effectiveness

Identify areas that are vulnerable to over-application of manure

Where might transportation subsidies be needed?



The EnviroAtlas Manure Application Map was used to create the Over-application Risk Indicator. Watersheds with “zero” manure application were removed. Remaining values were rescaled between 0 and 1, where 1 represents the highest manure application rates.



Areas that have higher application rates are at greater risk for over-application of manure (closer to 1). These areas (in red) indicate greater potential for improving manure management strategies.

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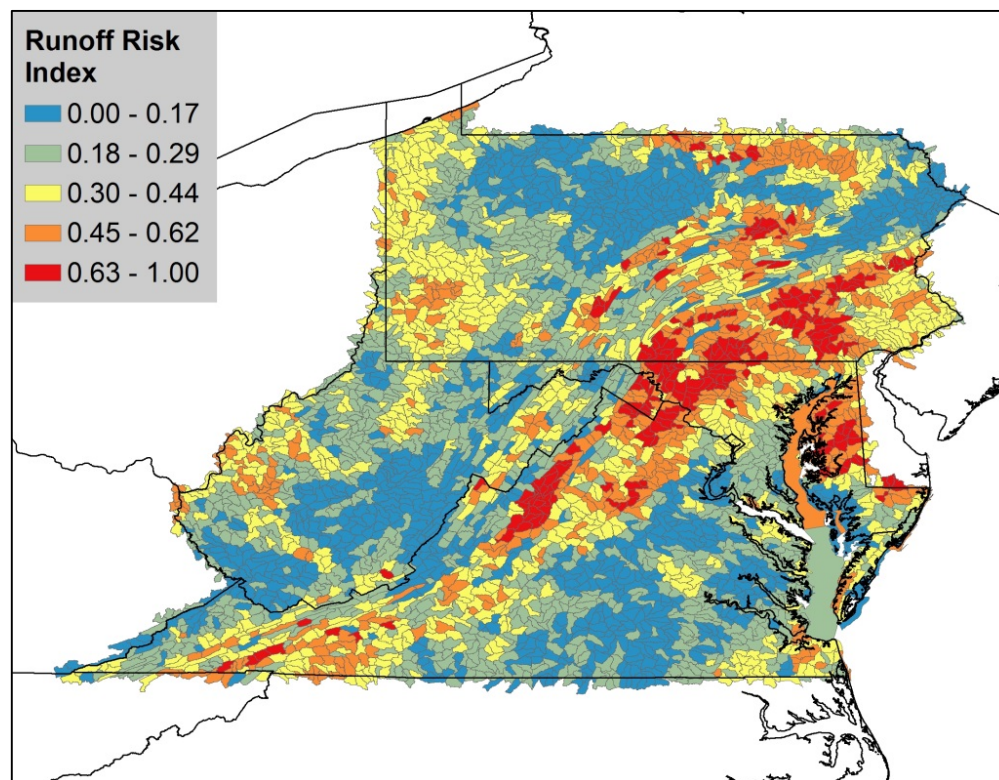
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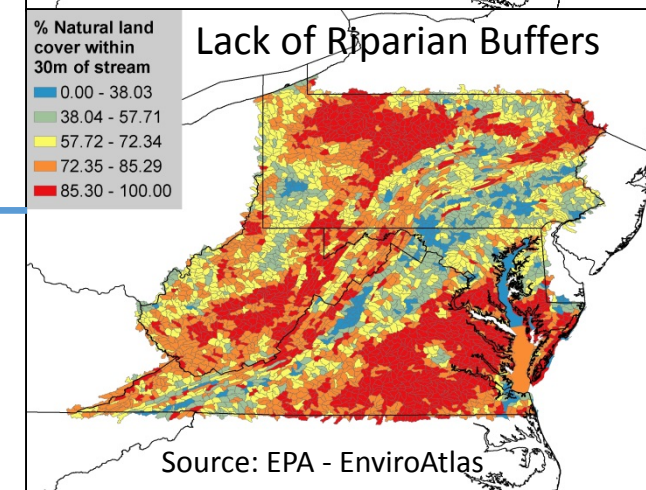
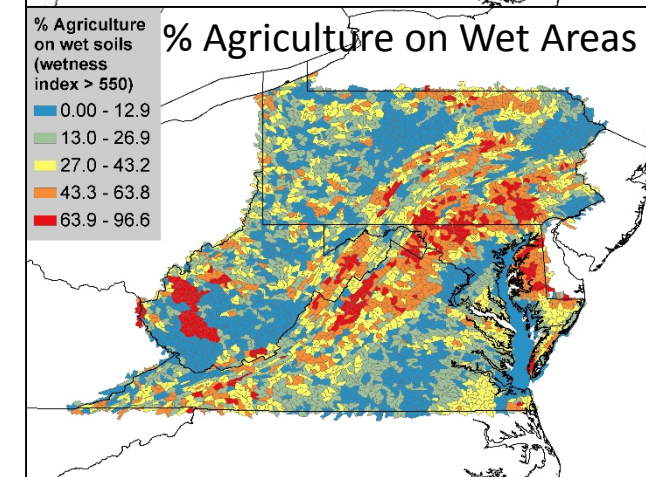
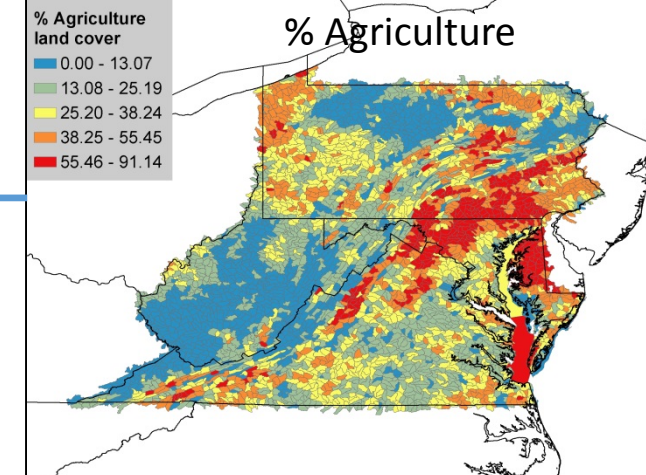
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Identify areas where excess nutrients from manure are likely reaching waterbodies



The Runoff Risk Index is a combination of 3 variables (found in EnviroAtlas) that reflect the likelihood that nutrients applied on land will reach streams. High values indicate high likelihood of runoff and, therefore, greater potential effectiveness of transport subsidies.



Source: EPA - EnviroAtlas

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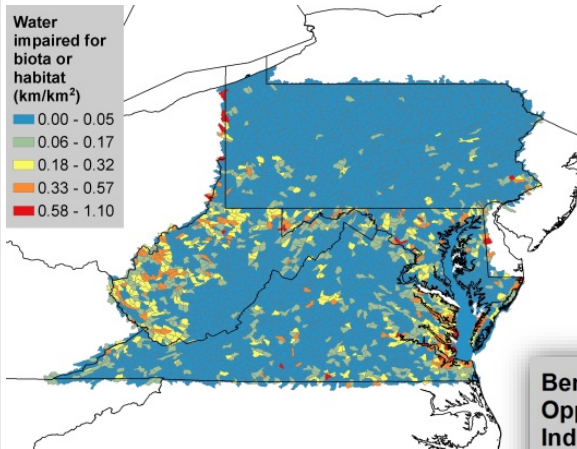
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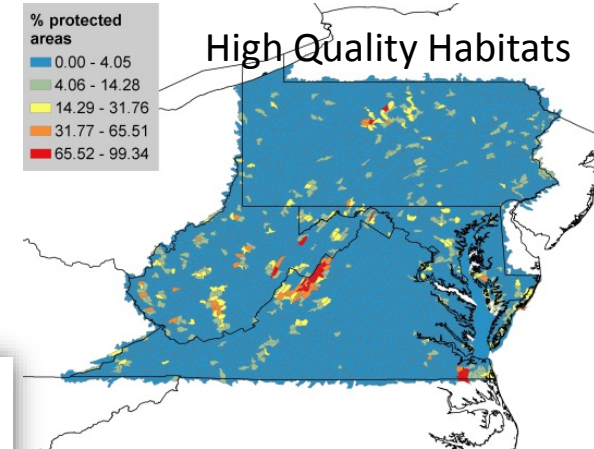
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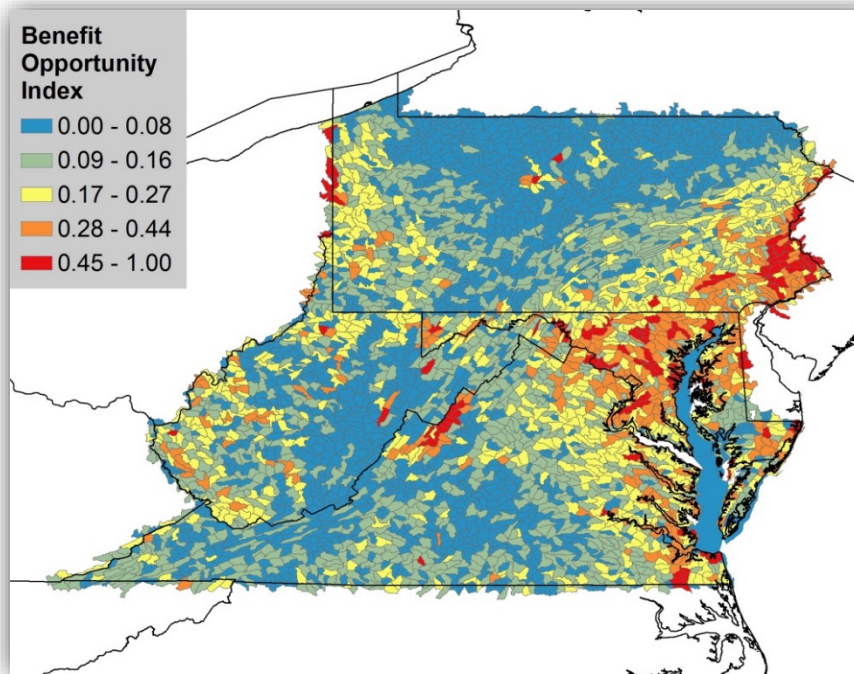


Identify areas where reducing nutrient runoff will benefit water quality, habitat, and recreational fishing

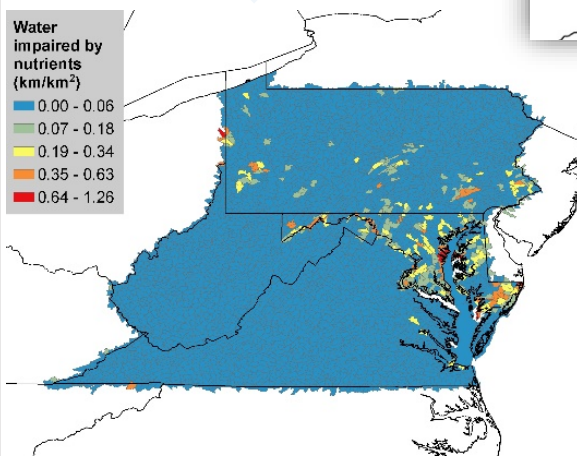


Water Quality Impairments

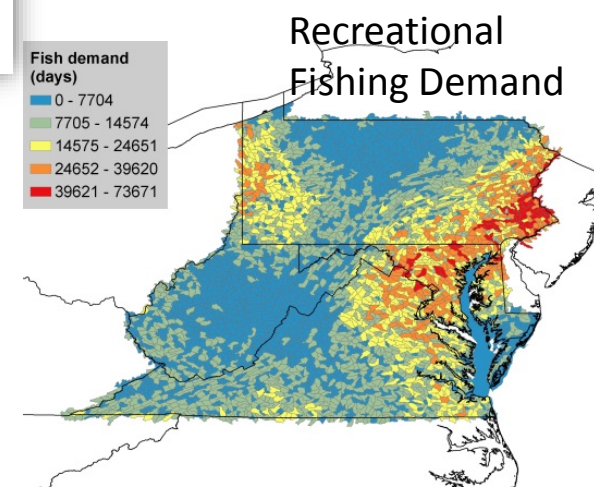
Note: Water bodies impaired by nutrients or for biota are listed on the 303(d) list provided by each state under the Clean Water Act.



Note: Protected areas are intended to protect specific species, habitat, or areas with ecological, cultural and scenic value



The Benefit Opportunity Index is a combination of 4 variables that reflects the relative potential benefits from reducing nutrient runoff.



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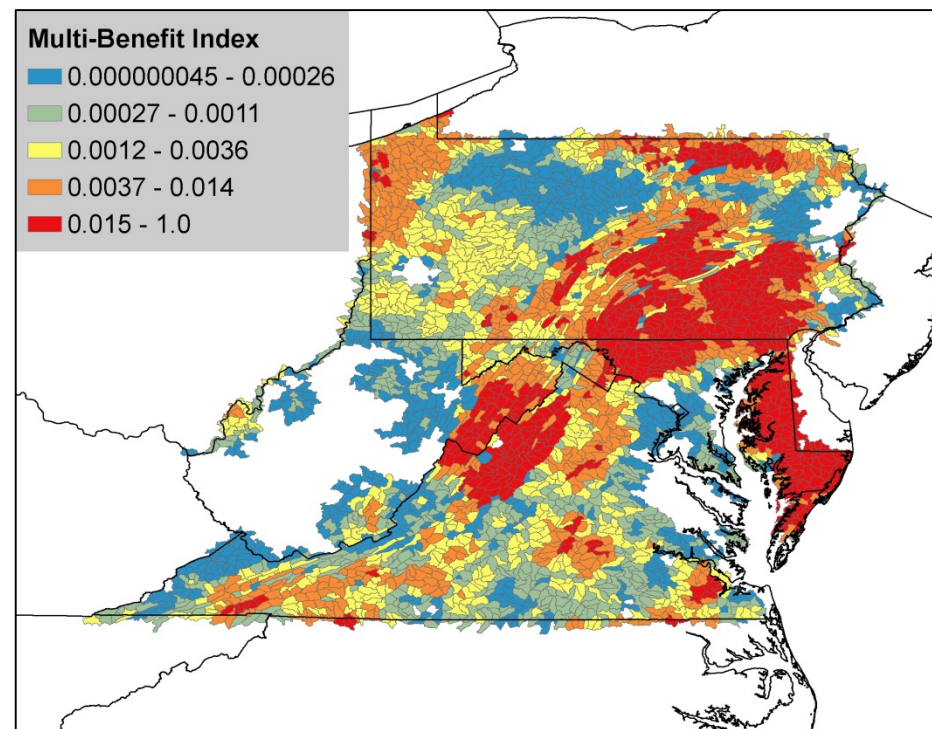
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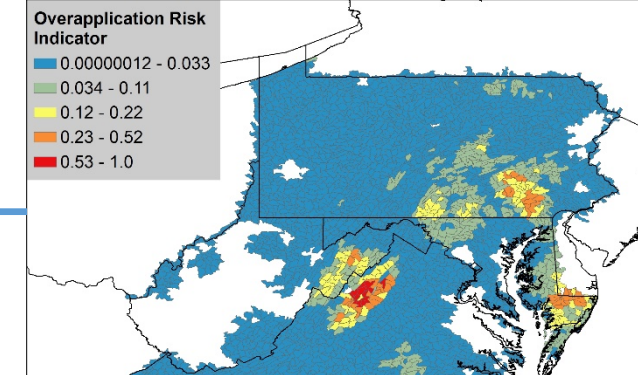
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Combine indexes on benefits and runoff risks

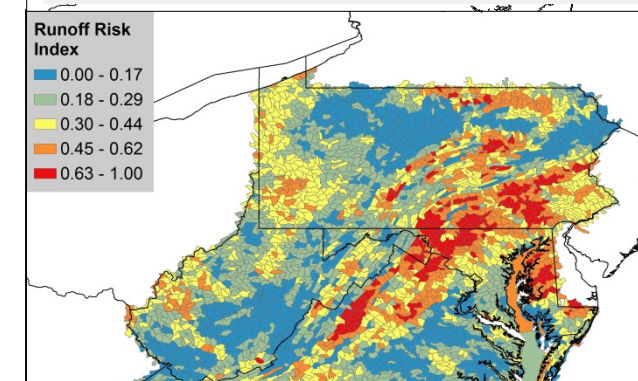


The Multi-Benefit Index reflects the relative level of expected benefits in an area, based on:

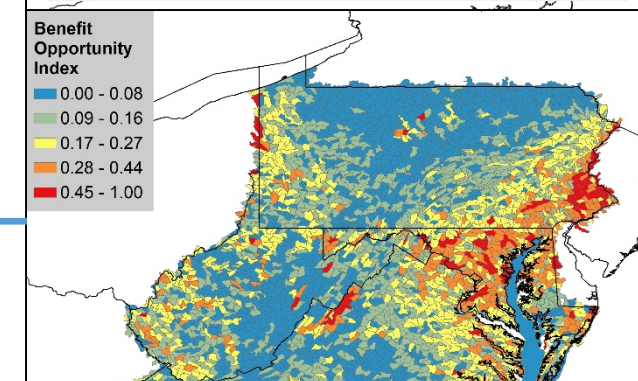
- 1) The opportunity to reduce nutrient runoff from manure
- 2) Likelihood of nutrients reaching a stream
- 3) Potential to improve impaired water quality or to protect areas with high habitat quality or high demand for fishing



Where is there a greater risk for over-application of manure?



Where are excess nutrients from manure likely reaching waterbodies?



Where will reducing runoff benefit water quality, habitat, and recreational fishing?

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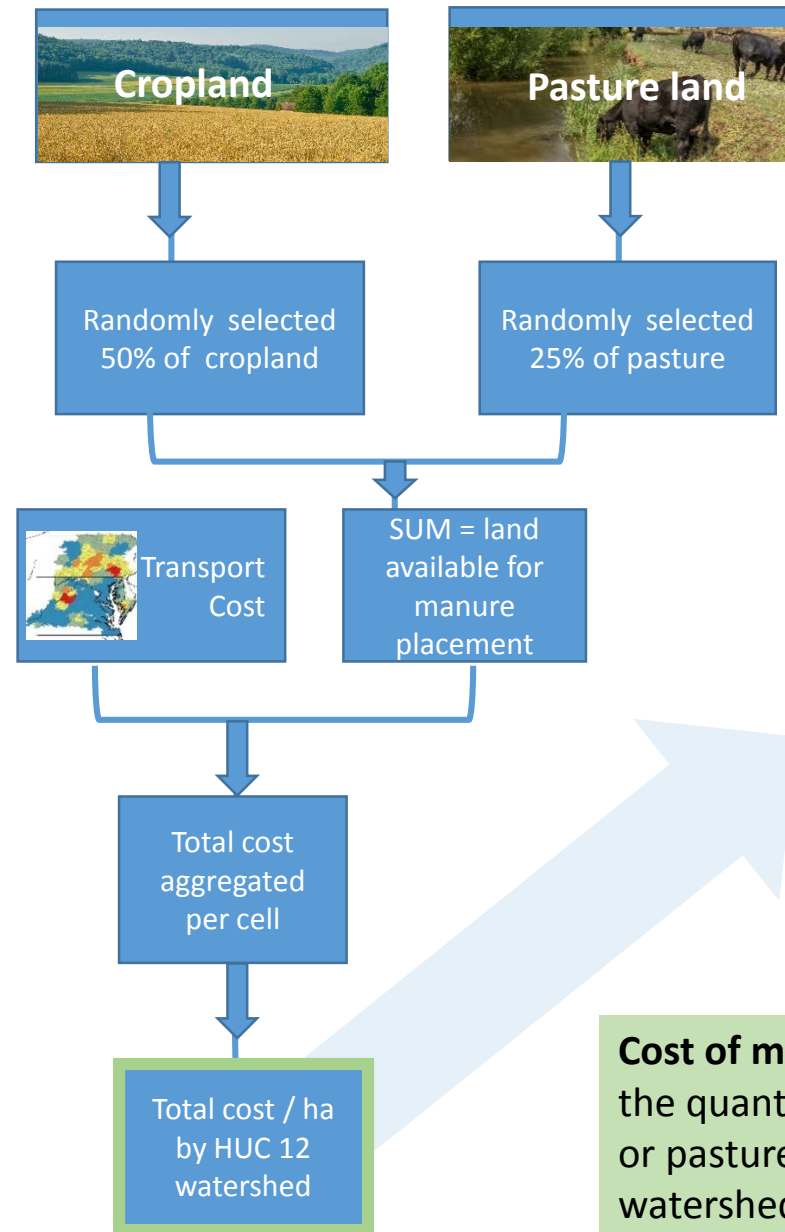
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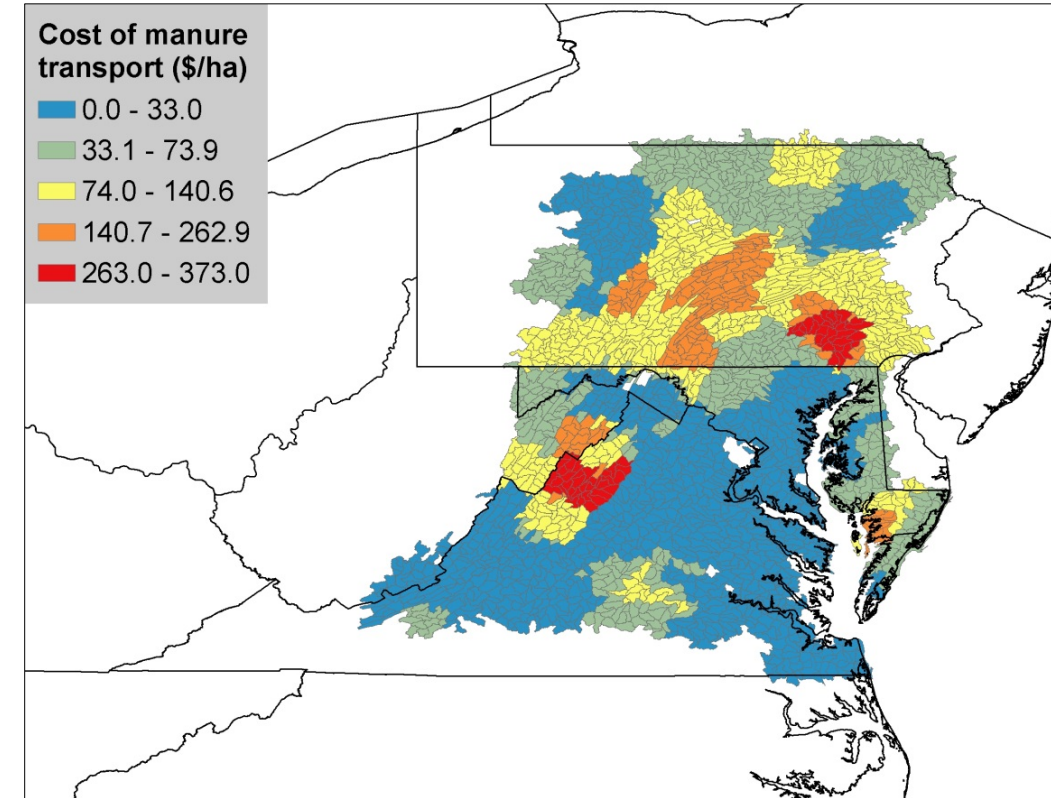
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Identify the cost of transporting manure



Cost of manure transport varies spatially because of the variability of the quantity of manure produced relative to the supply of nearby crop or pasture land available to receive that manure within a given watershed. Transportation cost source data were not available for entire study area.

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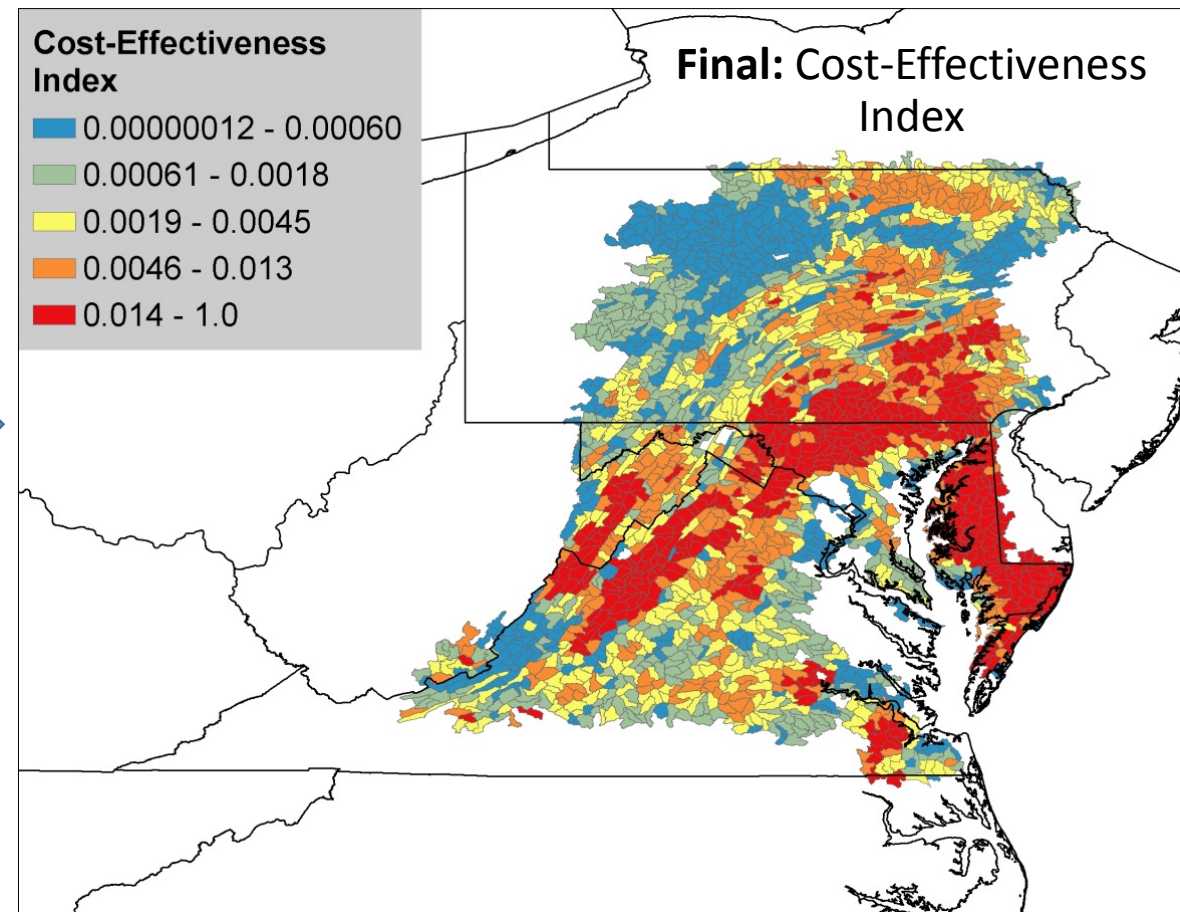
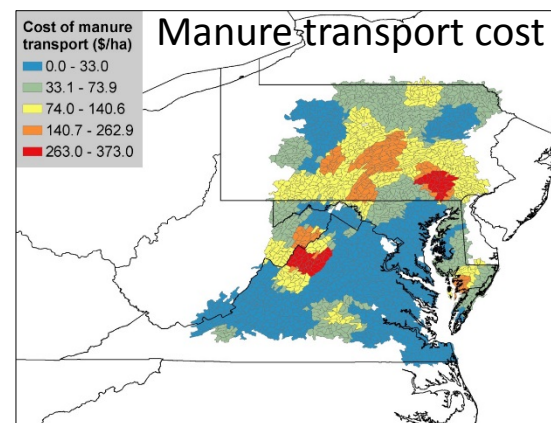
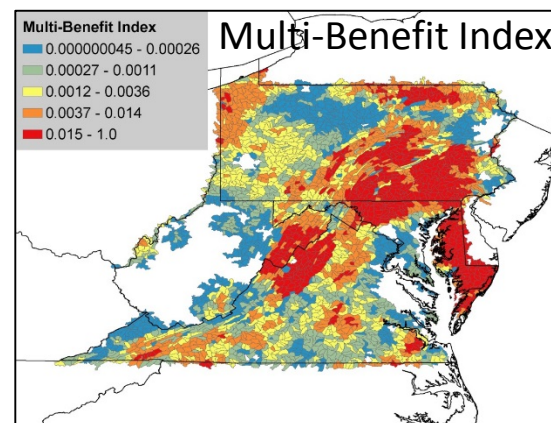
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Conclusion

Subsidize manure hauling areas with the highest cost-effectiveness



Cost-effectiveness of manure transportation subsidies: In the red areas, the combined benefits for subsidizing manure transport are likely to be the highest per dollar spent.

EnviroAtlas

Use Case

This use case was developed by Lisa A. Wainger & Cédric Magen as part of an EPA work assignment with Oneida Total Integrated Enterprises. It was edited by Jessica Daniel, EPA.



RECAP

- Nutrient loading is an issue in much of the Mid-Atlantic Region, which includes 90% of the Chesapeake Bay Watershed.
- Excess nutrients that get into waterbodies can impair them in a number of ways, affecting water oxygen content, aquatic species, recreation, and the economy.
- Applying too much manure to an area is one source of excess nutrients that can runoff into water bodies and harm them.
- To help address this issue, EnviroAtlas datasets were used to develop a management strategy for transporting excess manure to other areas in need of nutrients.
- EnviroAtlas indicators were combined together or with other indicators to create:

- A risk for manure over-application indicator
- + A runoff risk index, and
- + A benefits-opportunity index

Combined to make the Multi-Benefit Index



These indicators and indexes, in conjunction with the cost of manure transport, allowed for the creation of a Cost Effectiveness Index, which identified areas where the combined benefits for subsidizing manure transport would likely be the highest per dollar spent.

