EnviroAtlas Use Case

EnviroAtlas contains ecological, economic and demographic datasets for 2 spatial extents—the contiguous U.S. and featured communities. This use case explores one solution for minimizing the negative impacts of excess manure application in the Chesapeake Bay watershed using EnviroAtlas national data.

http://enviroatlas.epa.gov/

United States Environmental Protection Agency

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

July 2015

Use Case Introduction

The Chesapeake Bay Watershed encompasses parts of Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia.

Chesapeake Bay Watershed

The Chesapeake Bay Watershed covers 64,000 square miles and is home to over 17 million people. The Chesapeake 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.

This use case explores one solution for minimizing the negative impacts of excess nutrients in the Chesapeake Bay waters by managing manure application.


Photo by Doug Forsell, USFWS

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

Learn more at http://www.chesapeakebay.net/

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 own 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.

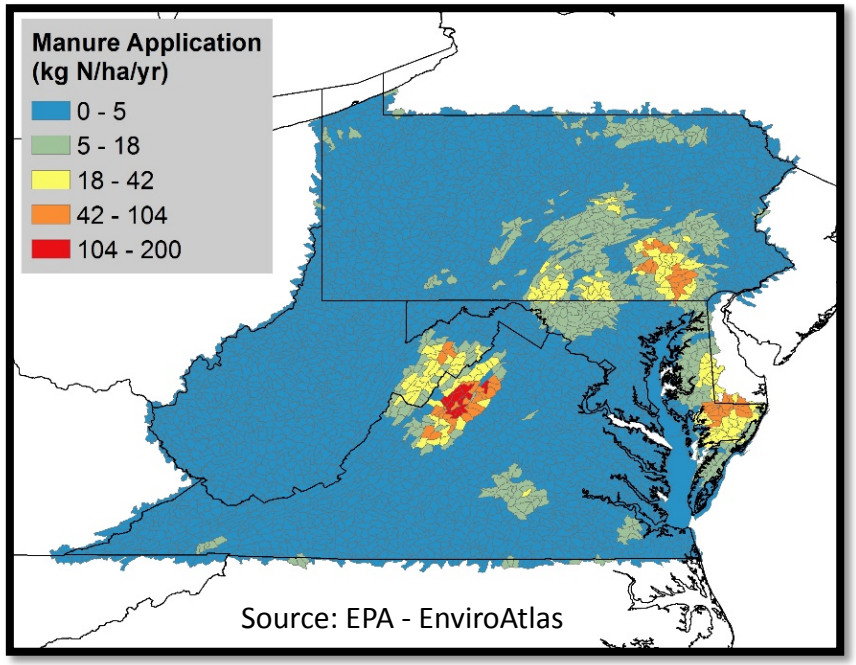
Nutrient loading is an issue in the Chesapeake Bay Watershed

One Solution

Provide financial incentives for manure transport

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 might encourage people to take advantage of this solution.



This use case follows these spatial analysis steps:

1. Identify the locations where distributing manure within the Chesapeake Bay watershed would be beneficial to meeting water quality goals and support safe recreation and habitat.
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.

❖ 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 where transportation subsidies are likely to have an effect
- 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

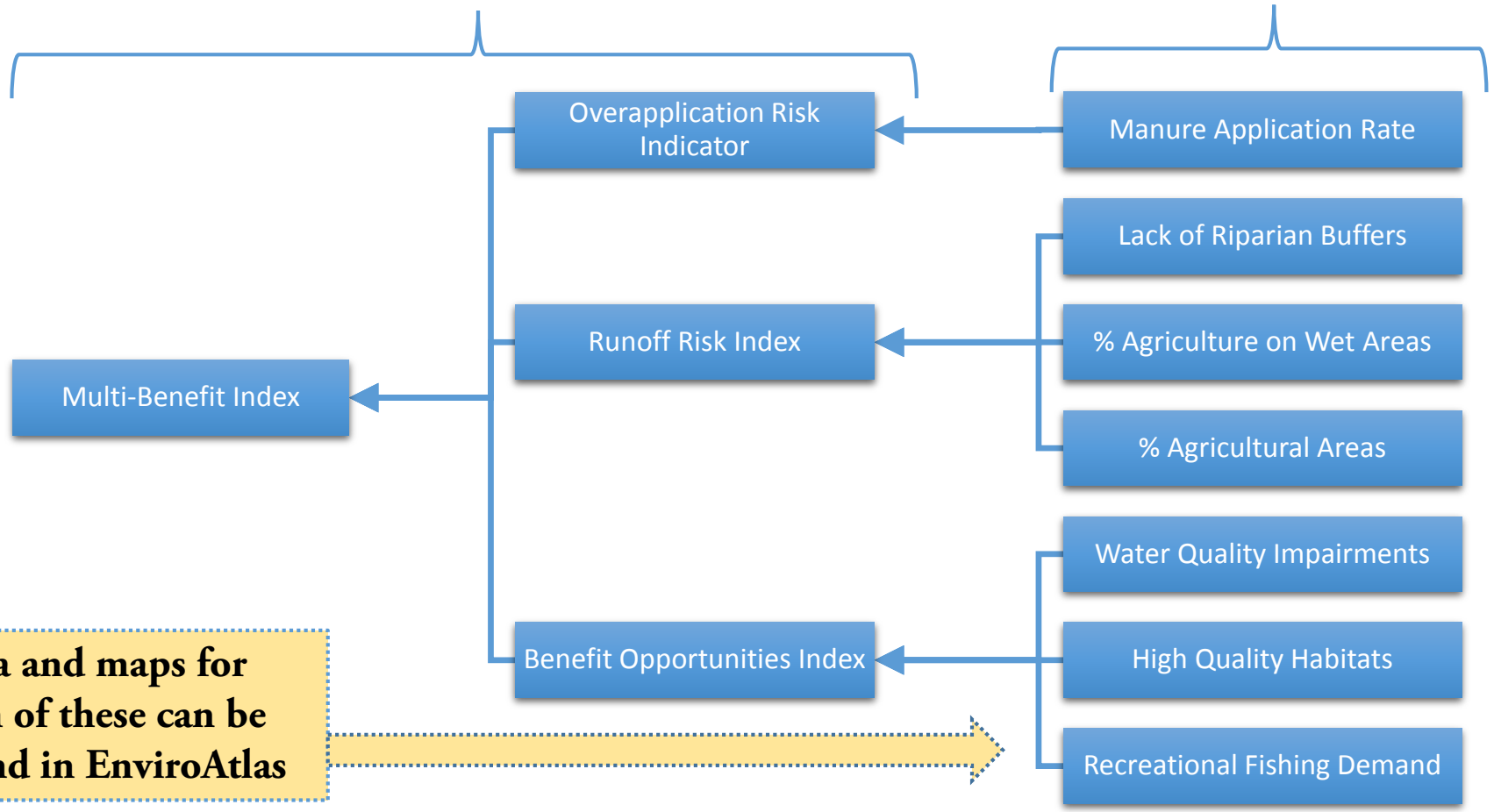
Subsidize manure hauling in areas with highest cost-effectiveness

Approach

Identify beneficial locations by combining indicators of ecosystem service benefits and nutrient runoff risk

<u>Step 2</u>: Normalize and combine indicators in a multi-benefit index

<u>Step 1</u>: Identify indicators that suggest level of benefits by location



Data and maps for each of these can be found in EnviroAtlas

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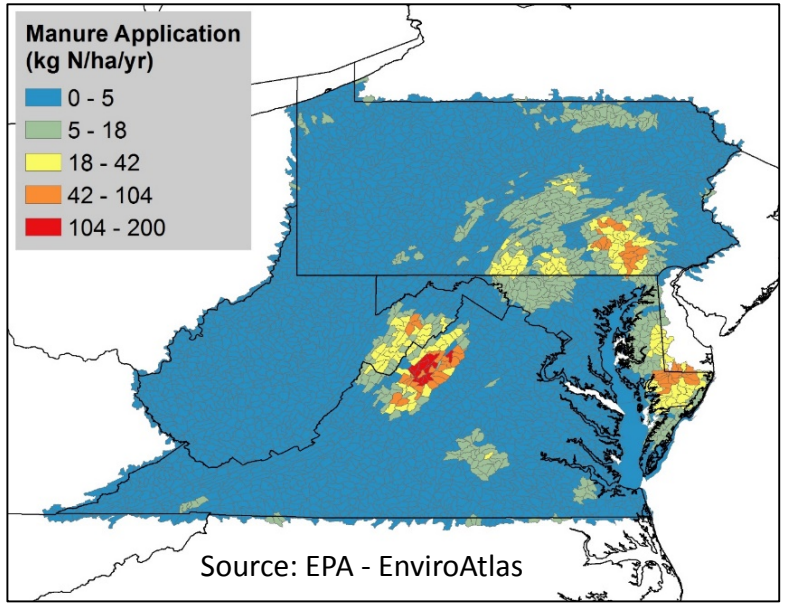
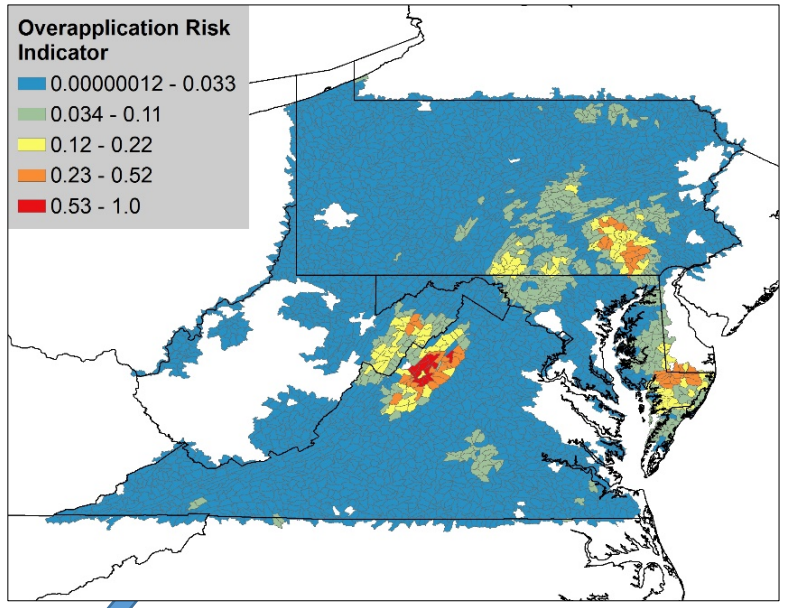
Identify areas where transportation subsidies are likely to have an effect





The Overapplication Risk Indicator was created using the EnviroAtlas Manure Application Map

Watersheds with "zero" manure application were removed. Remaining values were rescaled between 0 and 1, where 1 represents the highest manure application rates.

Higher application rates (closer to 1) indicate greater potential to reduce nutrients through improved manure management

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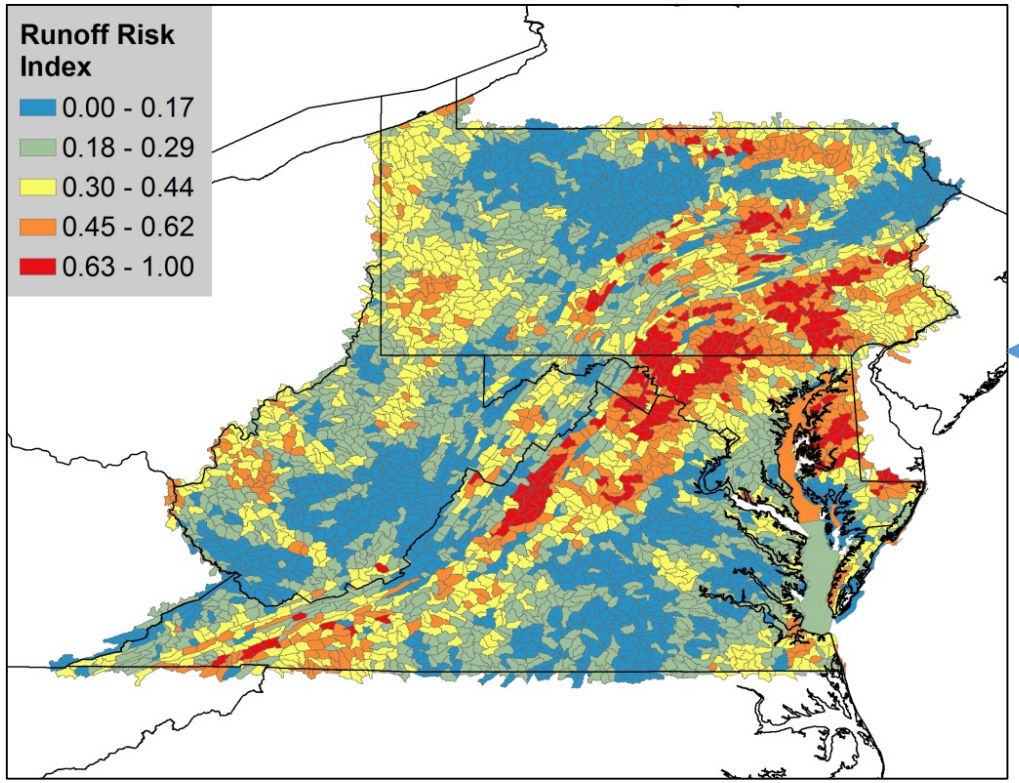
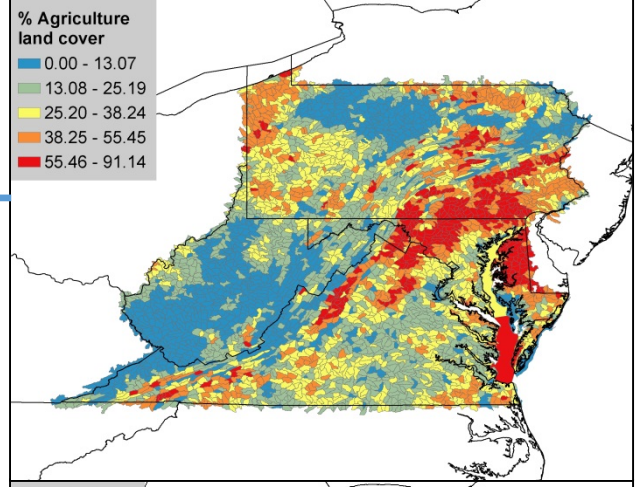
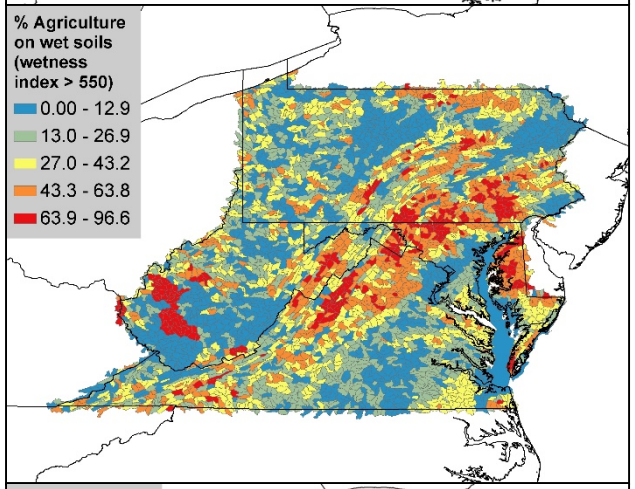
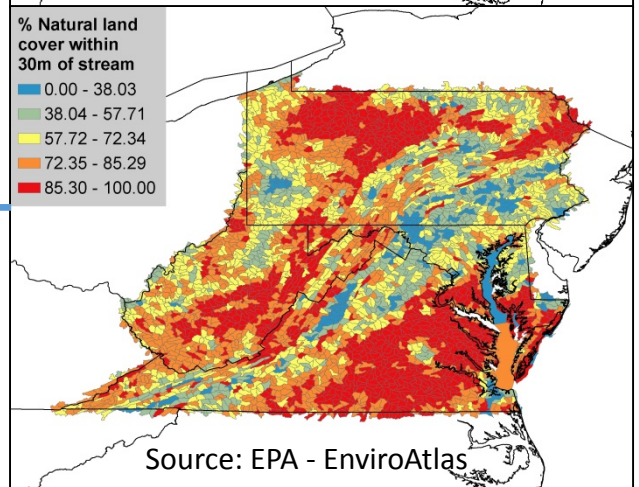
Identify areas where excess nutrients are likely reaching waterbodies









The Runoff Risk Index is a combination of 3 variables (each 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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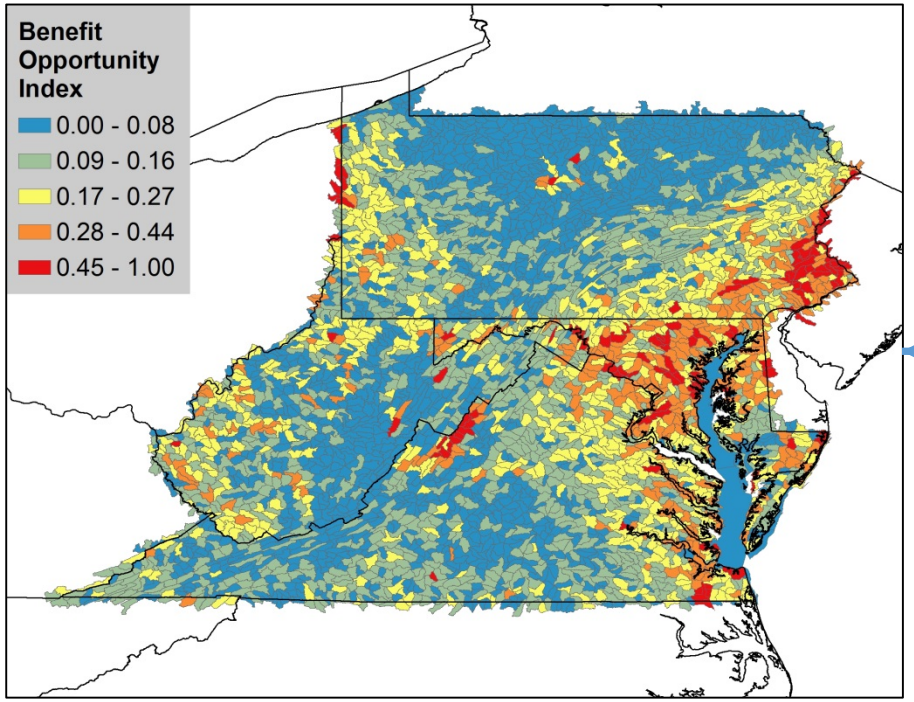
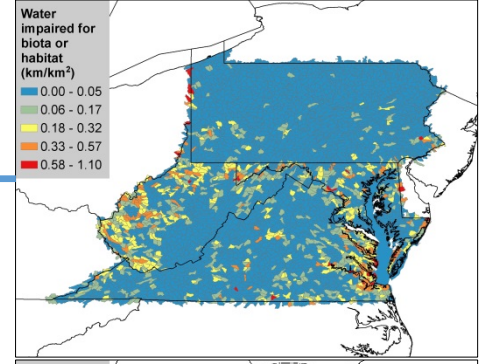
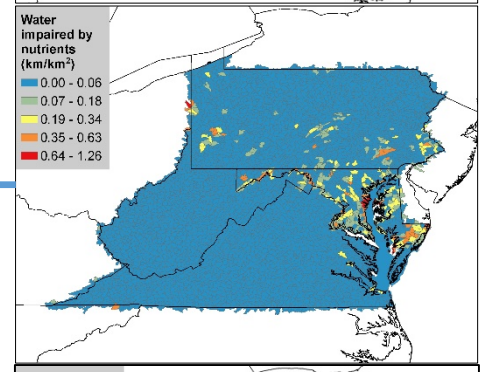
❖ Cost-effective Targeting of Program Funds

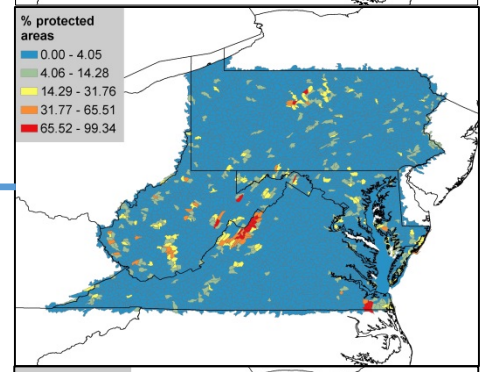
Subsidize manure hauling in areas with highest cost-effectiveness

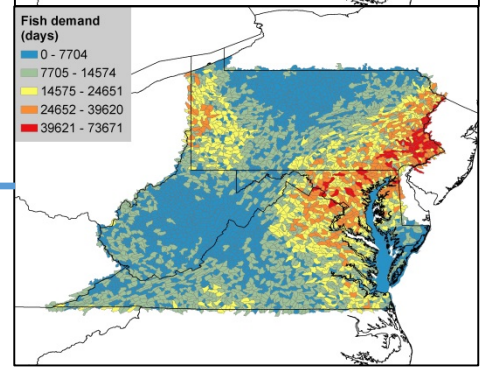
Identify areas where reducing nutrient runoff will benefit water quality, habitat, and recreational fishing











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

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

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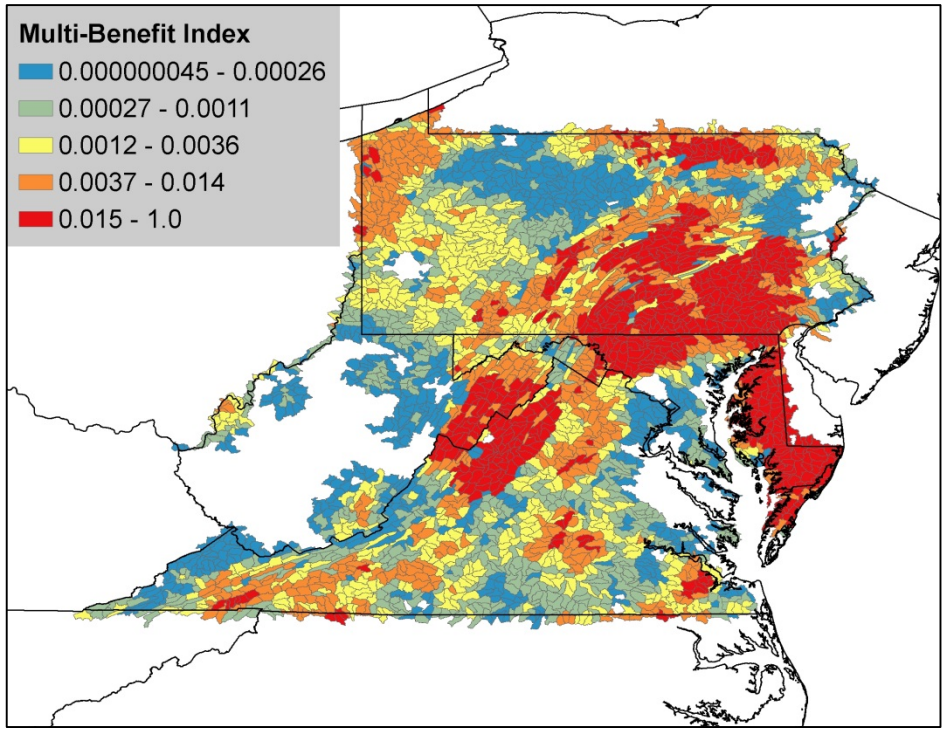
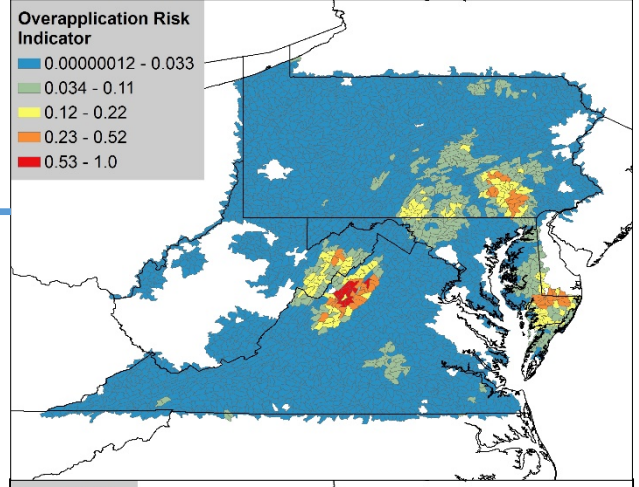
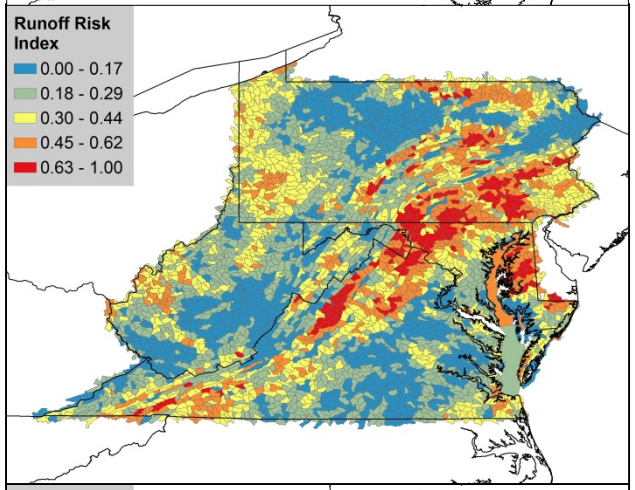
❖ Cost-effective Targeting of Program Funds

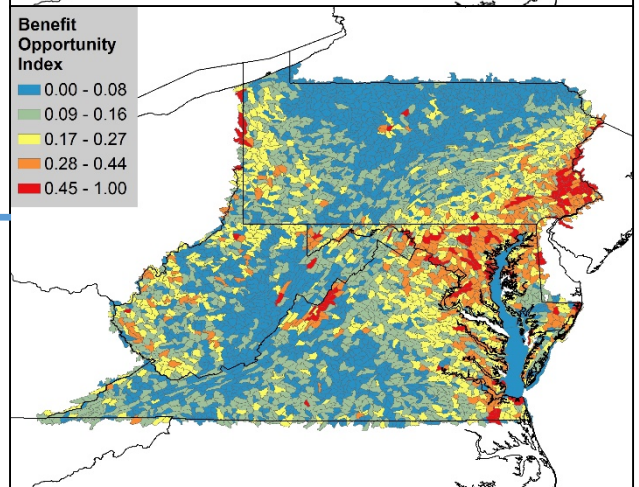
Subsidize manure hauling in areas with highest cost-effectiveness

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

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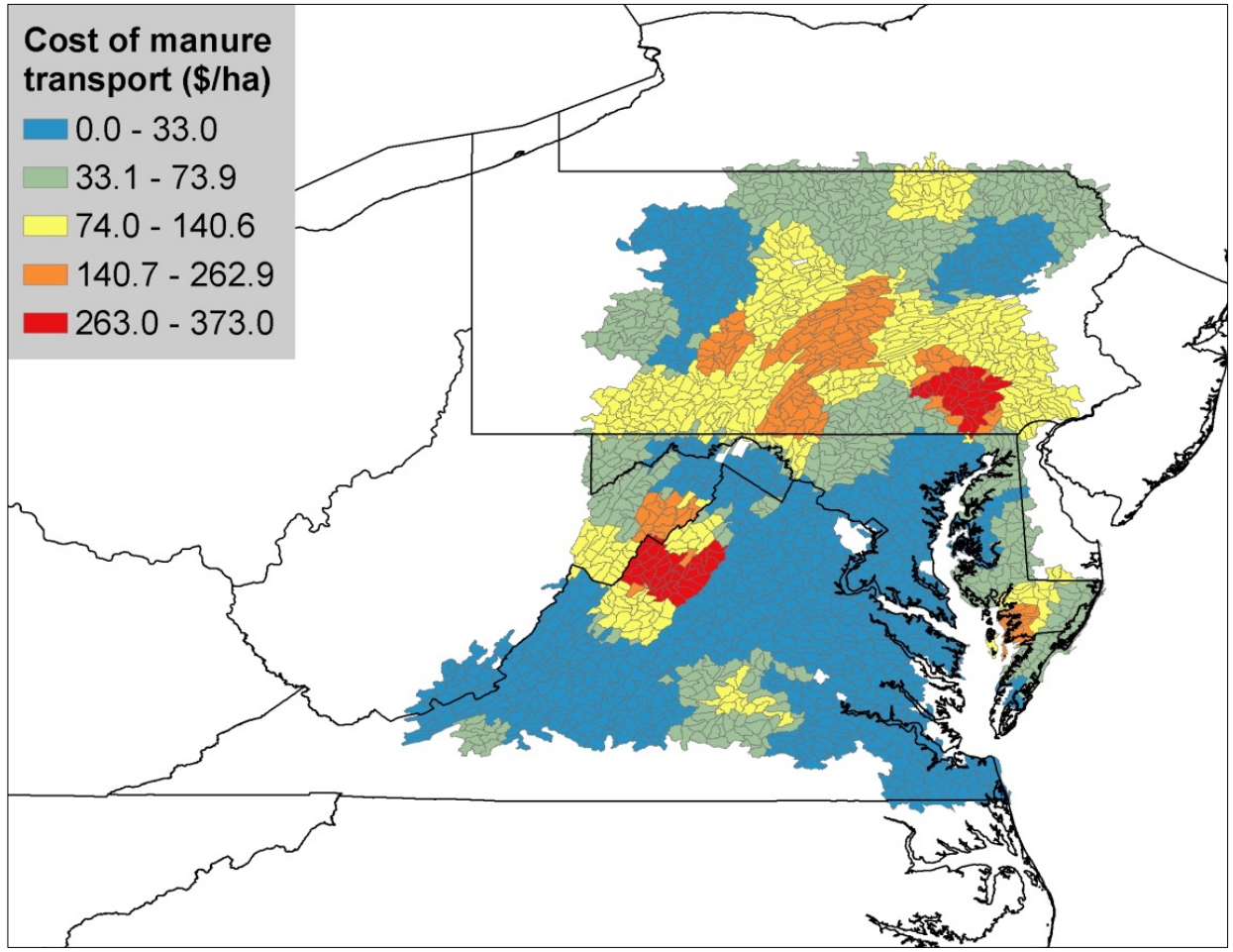
Cost of manure transport



Cost of manure transport varies spatially because of the variability of the quantity of manure produced relative to the supply of nearby land that is available to receive that manure.

Source data courtesy of Marcel Aillery, USDA – Economic Research Service
(Methods described in Ribaudo et al. 2014, ERR-166)

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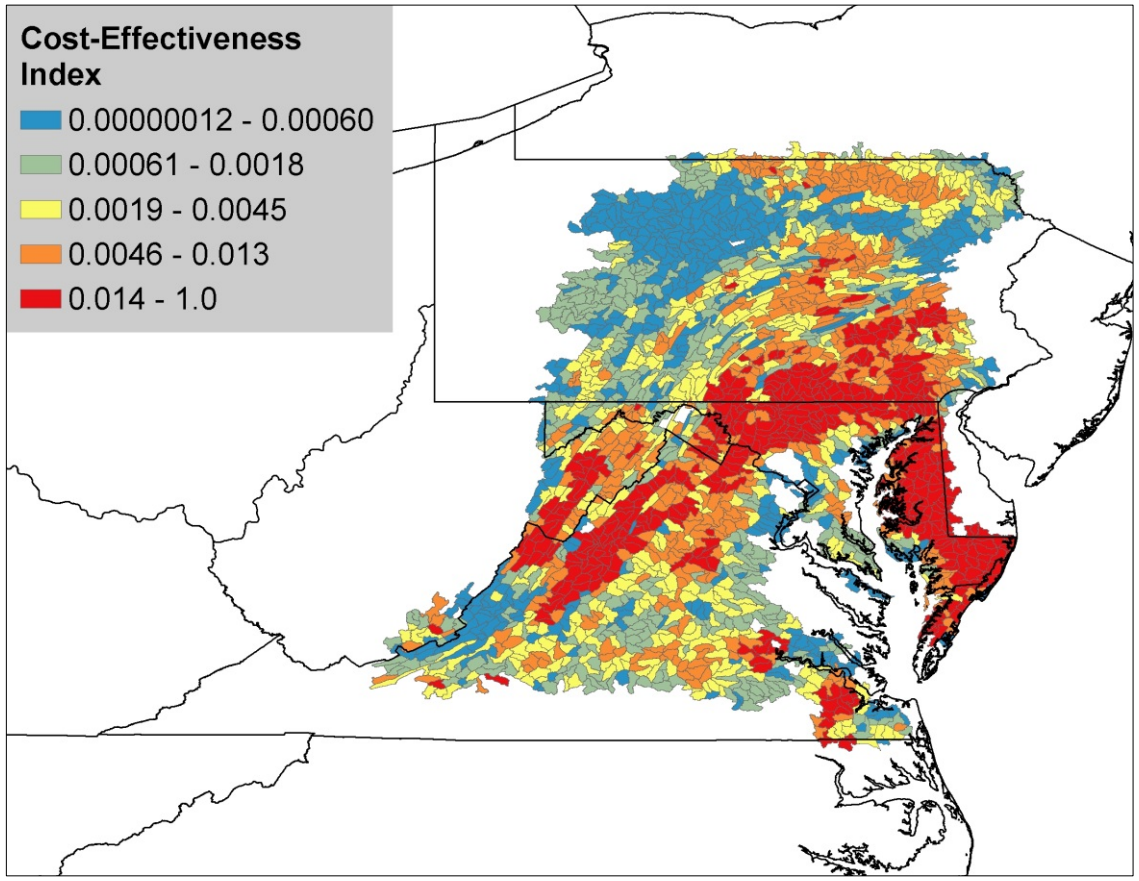
Conclusion

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 Student Services Contractor.

Access EnviroAtlas at http://enviroatlas.epa.gov/

Recap

- Nutrient loading is an issue in much 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
  - 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**.