Dr. Kathy Boomer, The Nature Conservancy
Dr. Rebecca Schneider, Cornell, NY

Re-plumbing the Chesapeake Watershed: Improving roadside ditch management to meet TMDL Goals

Workshop Findings and Recommendations
October 2014

Workshop Goals

1. **Increase awareness of the critical impacts** of roadside ditches and best management practices to reduce these impacts.

2. **Inventory** current status of **ditch management** across the Chesapeake Watershed.

3. **Develop recommendations** for how best to improve roadside ditch management to meet TMDL goals, reduce flooding and buffer impacts of climate change.

Re-plumbing the Chesapeake: Workshop Structure

- SESSION I: **Sizing Up the Problem**
  - Rebecca Schneider (NY)
  - Beverly Wemple (VT)
  - Zack Easton (VA)
  - Robin Van Meter (MD)
- SESSION II: **Mitigation Strategies**
  - Steve Bloser (PA)
  - David Wick (NY)
  - Ray Bryant (PA/MD)
  - Bernard Sweeny (PA/MD)
  - Laura Christianson (MS)
  - Jason Keppler (MD)
  - William Ryall (MD)
- SESSION III. **Barriers to Implementation**
  - Jeff Sweeney (CBP)
  - Kari Dolan (VT)
  - David Orr (NY)
  - Robert Shreeve (MD)

Re-plumbing the Chesapeake: Workshop Discussion

I. How do roadside ditch impacts & practices vary across the Bay watershed?

II. What is needed to improve roadside management across the Bay watershed?

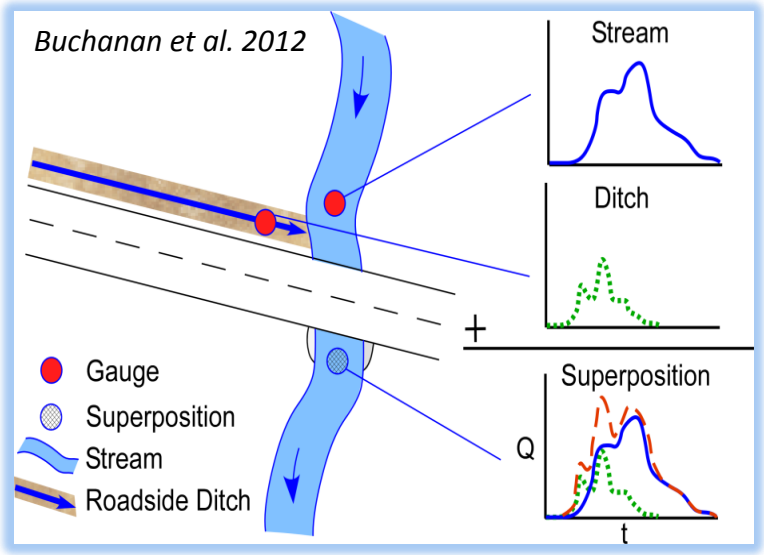
Take-home Message

"**Roadside ditches have had a significant but previously unrecognized impact** on the Chesapeake Bay for almost a century. The audience of 71 water resource professionals, highway practitioners, scientists, and policy-makers unanimously agreed that **roadside ditch management represents a critical but overlooked opportunity to help meet TMDL and habitat goals**. Additionally, improved ditch management provides a strategy for **buffering the impacts of high intensity rainfalls and other extremes expected with climate change**. "

Roadside Ditches: Big Impacts from Micro-scaled Features

Hydrologic Impacts:

- Extends stream network, doubling or more stream density (Sweeny 2014)
- Intercepts more than 20% of runoff/shallow groundwater flow (Schneider et al 2014; Diaz-Robles 2007)
- Increases peak flow by more than 50% (Buchanan 2012)



Roadside Ditches: Big Impacts from Micro-scaled Features

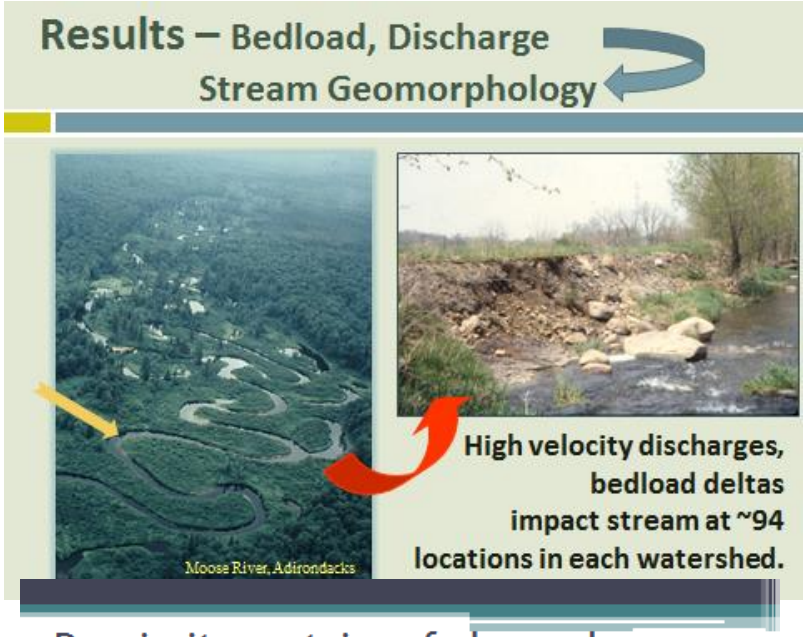
Water Quality Impacts:
Source and Conduit

- Exposed (scraped) ditches exponentially increase TSS concentrations (Diaz-Robes 2007)
- Accounts for more than 10% of observed sediment load in upper Susquehanna (SRBC)
- Provides important conduit of *E. coli* bacteria

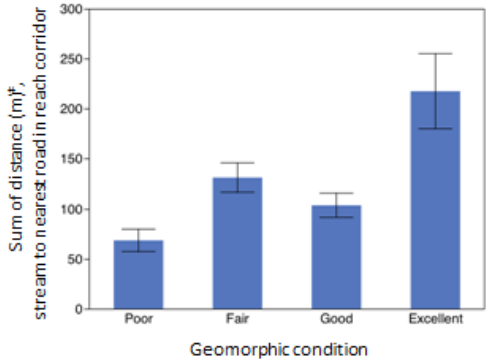
Roadside Ditches: Big Impacts from Micro-scaled Features

Habitat Impacts:

- Alters environmental flow regimes
- Increases bed loads causing down-stream disequilibrium (e.g., Pechenick et al 2014)
- Headwaters dry out
- Salinization of freshwater habitats (e.g., Kaushal et al 2005)



Proximity metrics of channel condition



Credit: R. Schneider; B. Wemple

PA Dirt and Gravel Road Maintenance Program

- Began in 1997 (Trout Unlimited initiative)
- 2,500 projects and counting
- PA priority: $35 million budget

Steve Bloser, Director
Penn State University

Program Overview

~~Traditional Stormwater~~

- ~~Collection~~
- ~~Armoring~~
- ~~Transport~~

Environmentally Sensitive Maintenance

- **Dispersal**
- **Sheet flow**
- **Infiltration**

“disconnect the rural storm water system”

“restore natural drainage”

Roadside Ditches: Mitigation Strategies

Low Cost ($):

- Scrape during late spring/early summer (facilitates vegetation re-establishment
- Scrape to trapezoidal shape (decrease flow rates, facilitate maintenance)
- Hydroseed
- Disconnect from streams

vs.

Roadside Ditches: Mitigation Strategies ($$$)

Engineered Road Design and Aggregate

Filters Mediums

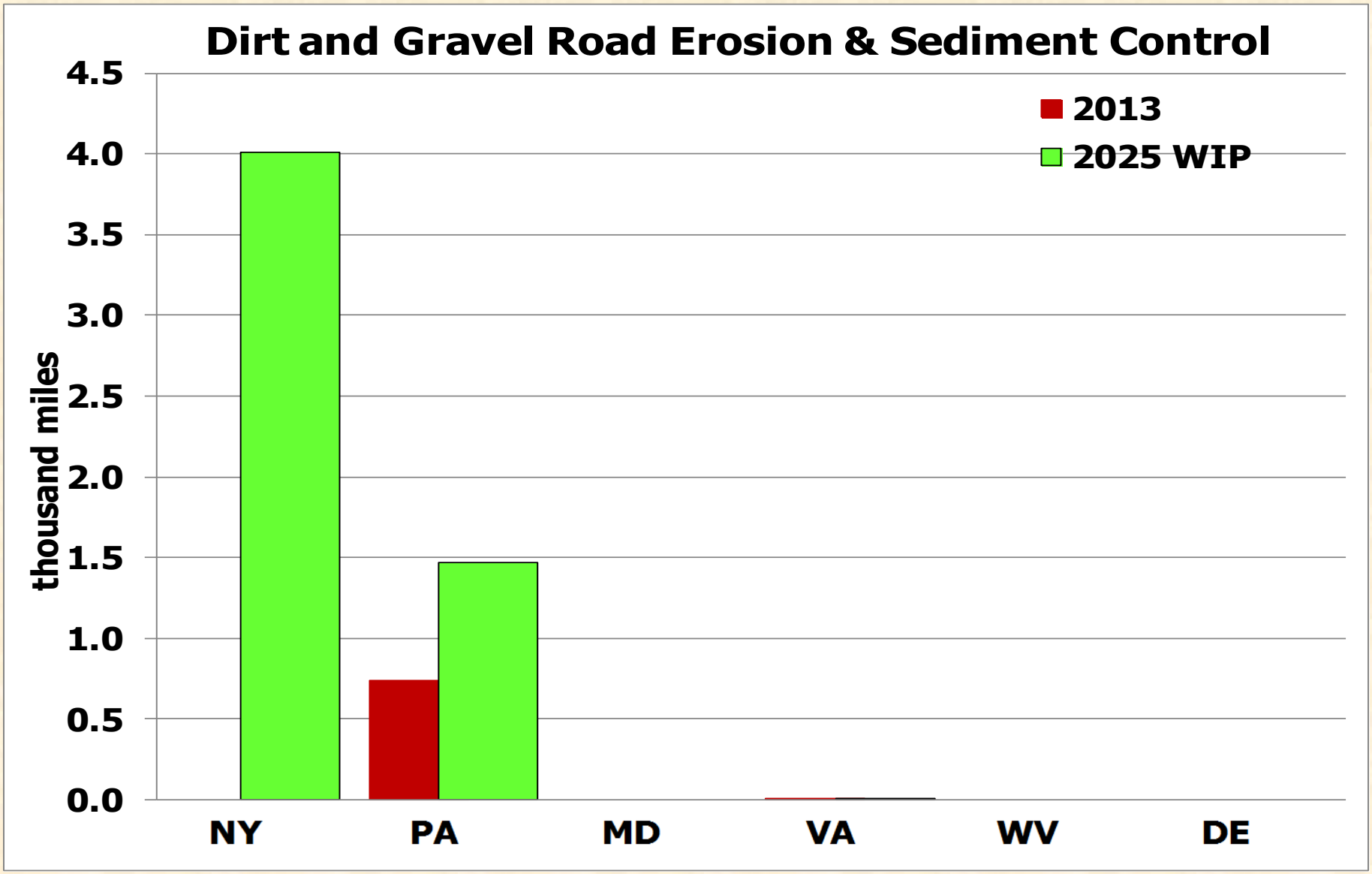
Flood pocket Wetlands, Level Lip Spreaders

Credits: S. Bloser; R. Bryant; B. Sweeny

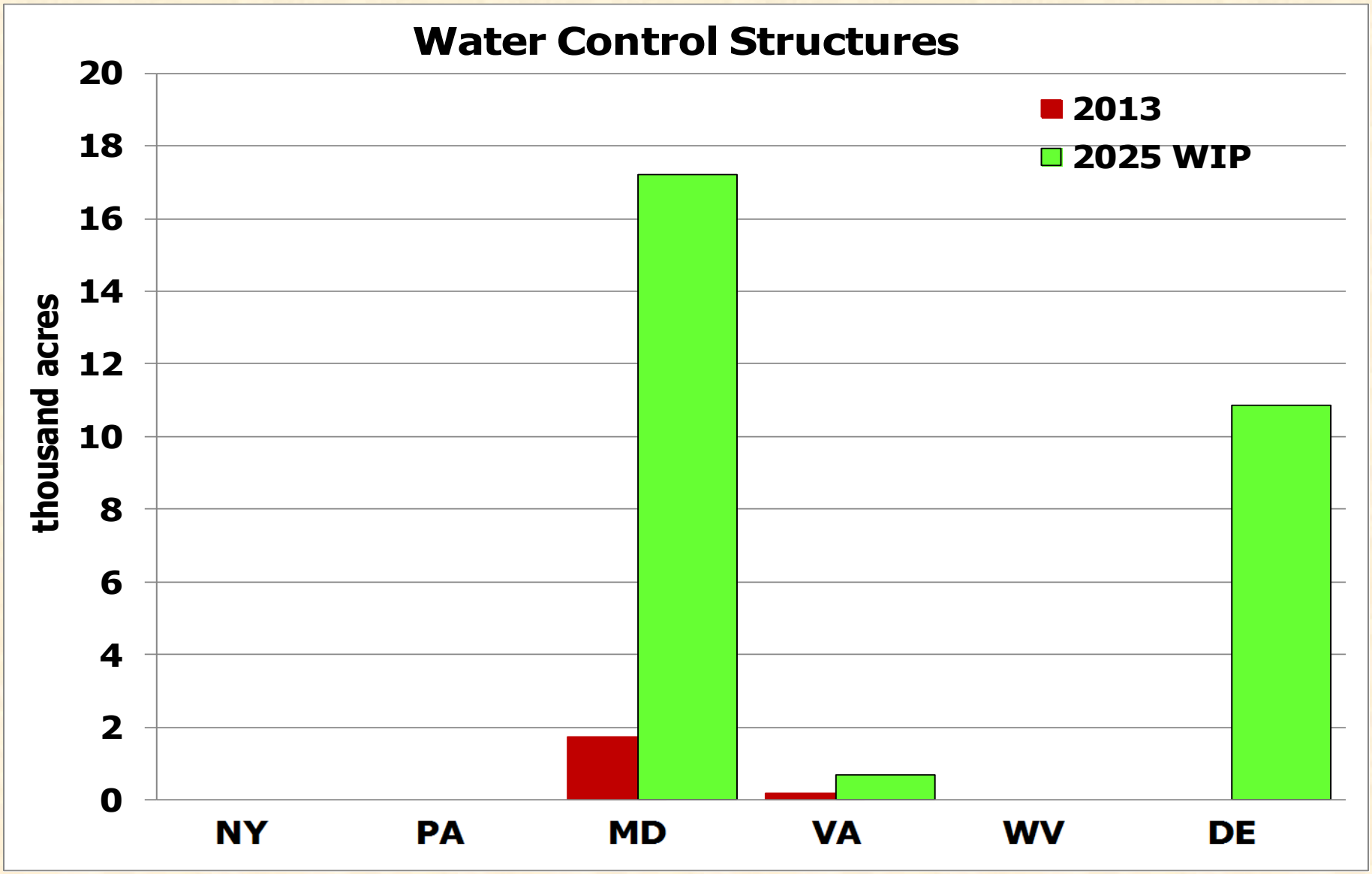
Ditch Management in the CBP Watershed Model

- Forest + Agricultural + Stormwater BMPs
  - Dirt and Gravel Road Erosion & Sediment Control
- Agricultural BMPs
  - Drainage Water Control Structures on Eastern Shore ditch network to keep water on the landscape = irrigation
  - Wetland Restoration = LIDAR to detect slight elevation differences to reveal best places for floodplain restoration
  - Ditch Filters = Cropland drainage phosphorus-sorbing materials
- Stormwater BMPs
  - Vegetated Open Channels
  - Bio-swales = dry swale with under-drain

Ditch Management
BMP Implementation and Targets



Ditch Management
BMP Implementation and Targets



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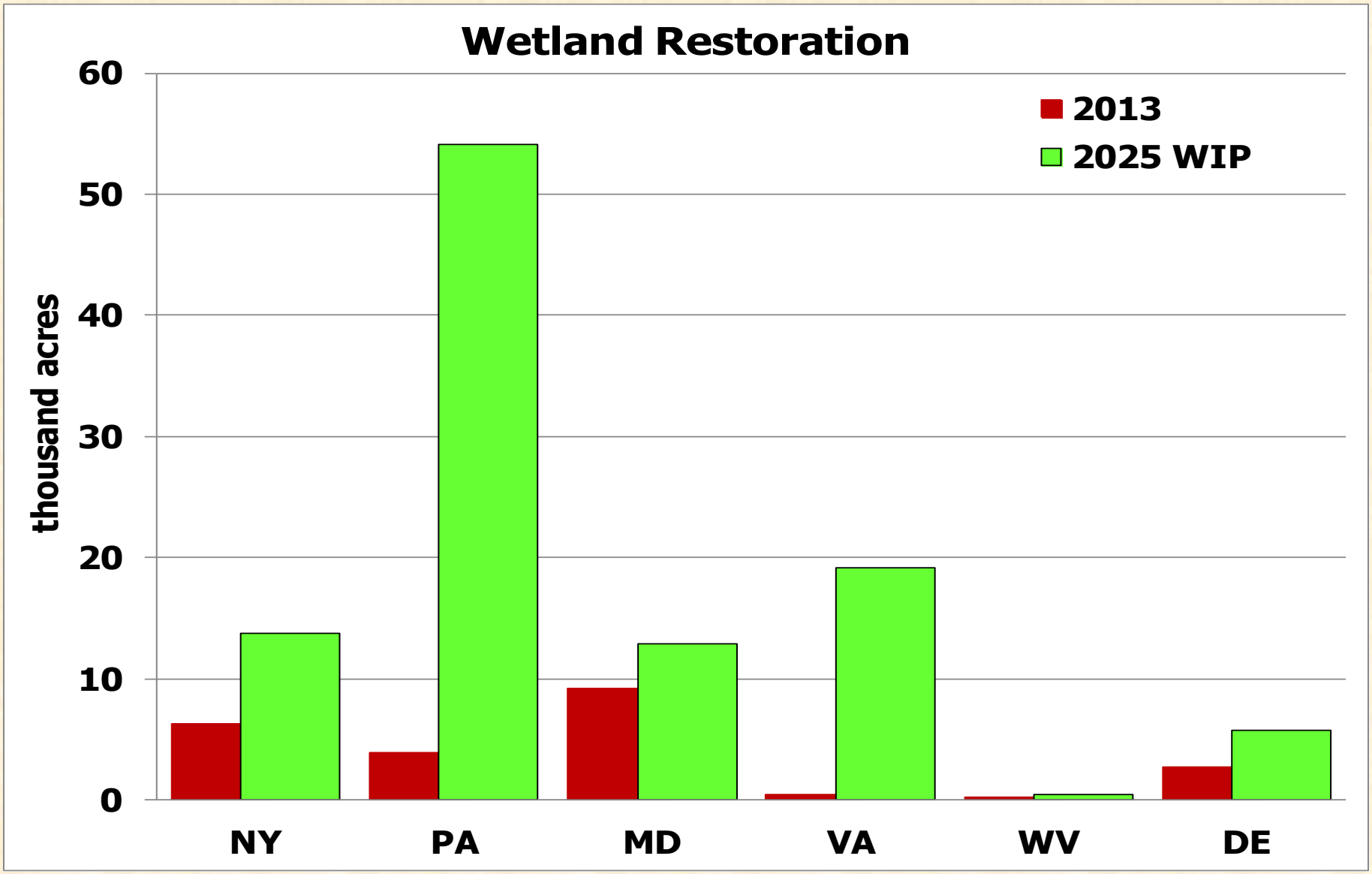

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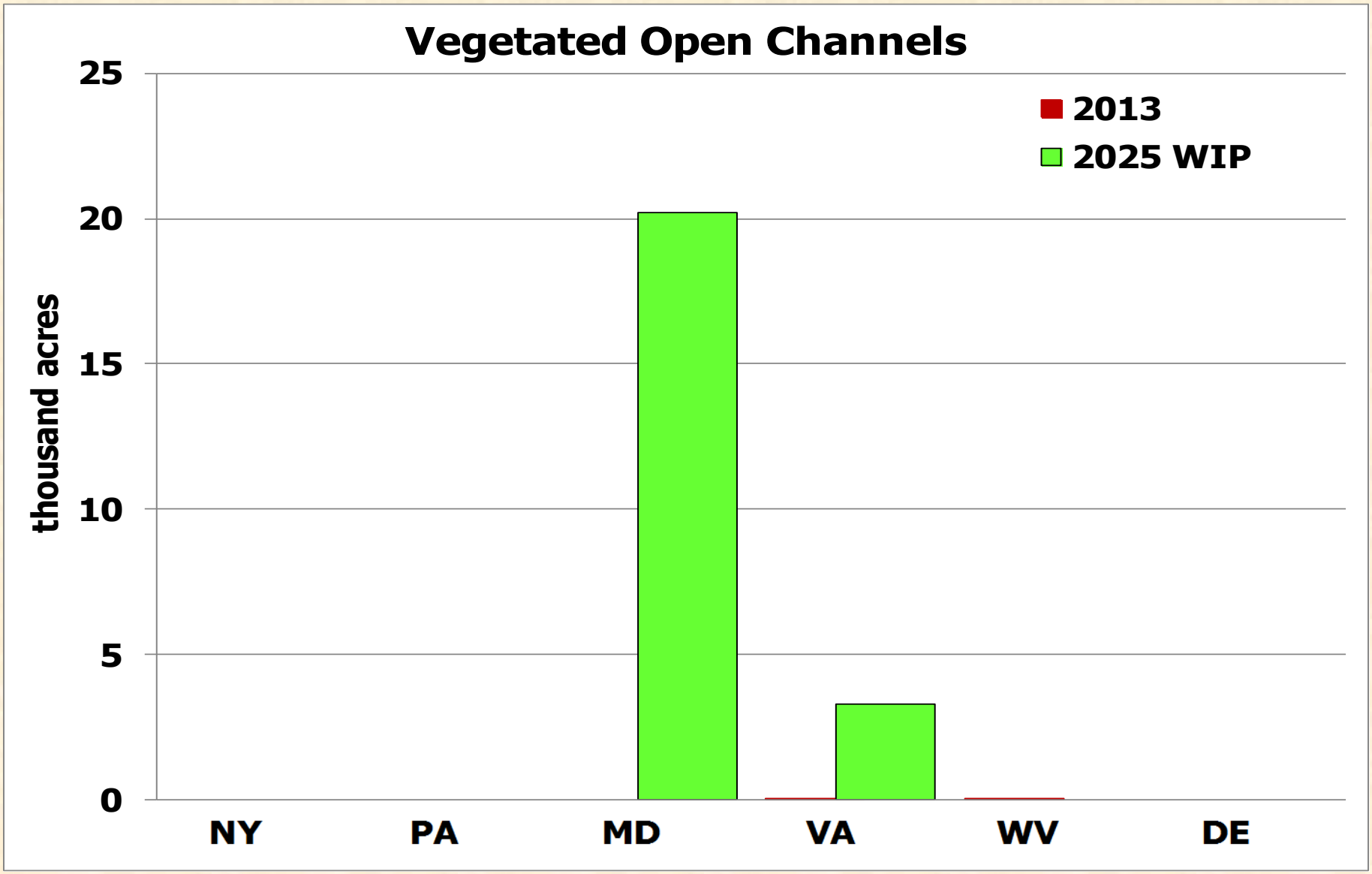

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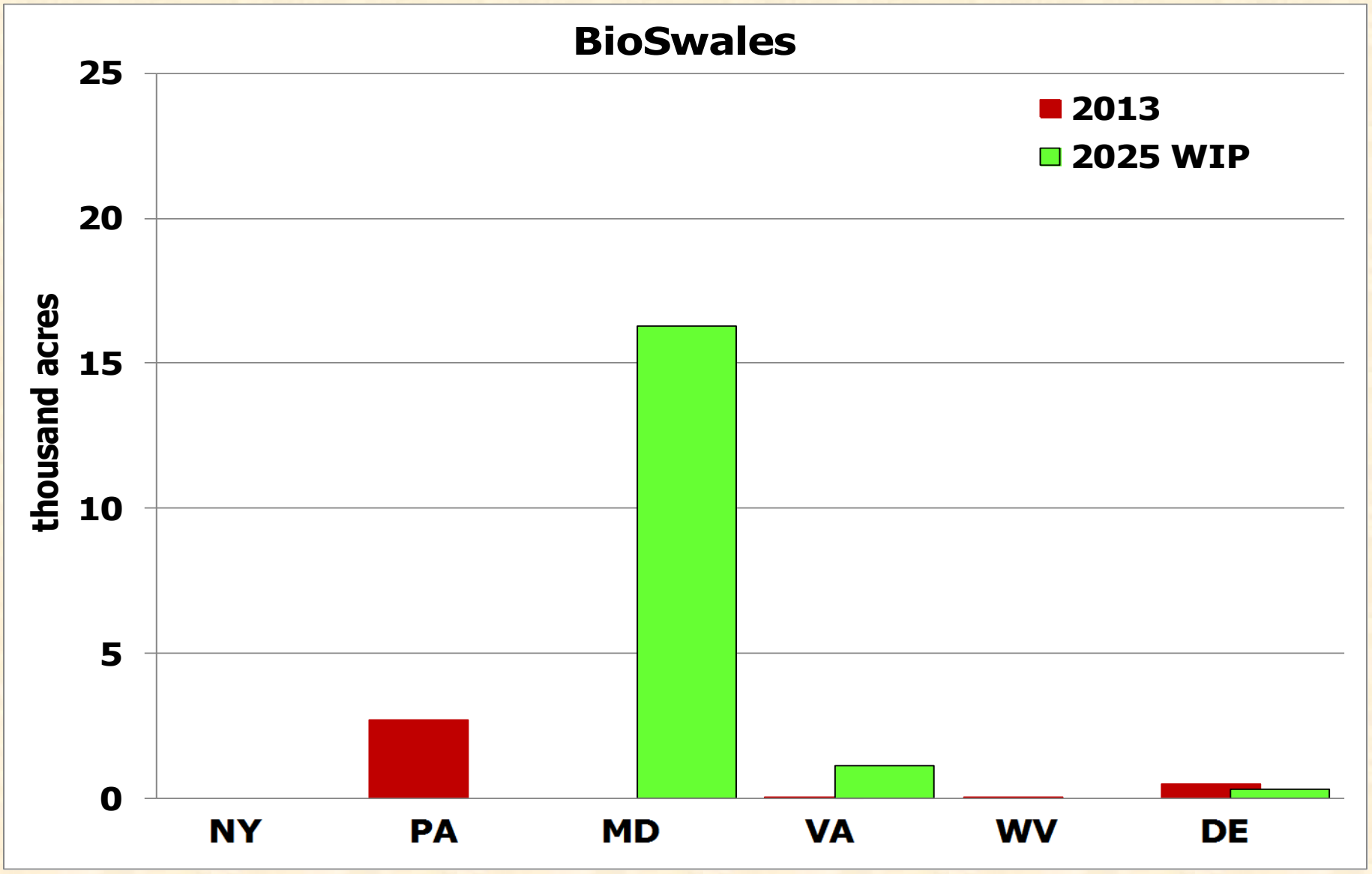


Key Findings - Management

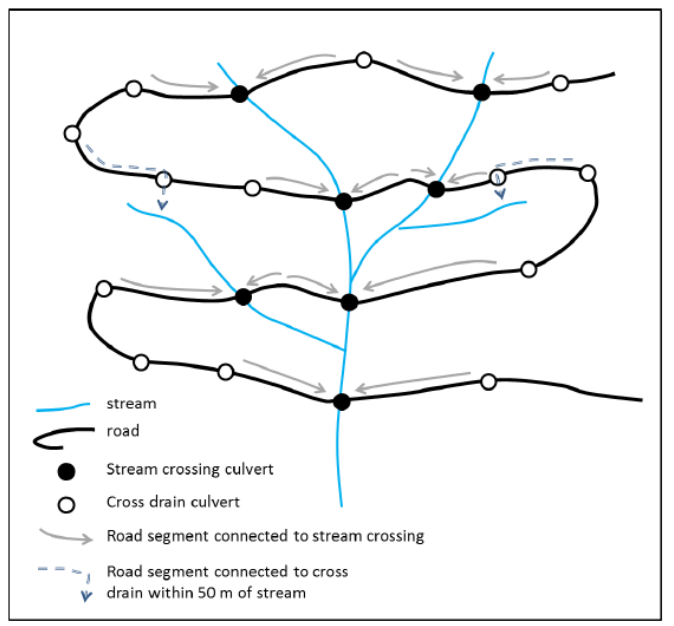
Critical elements of successful programs
(PA Center for Dirt and Gravel Roads, Cornell Local Roads, NYS Soil and Water Conservation District, Lake Champlain Basin TMDL Program)

1. Mapping of roadside ditch networks and their condition;
2. Cooperation and cross-agency partnerships;
3. Education of all stakeholders;
4. Good leadership.

Recommendations

1. **Recognize significance of impacts from “micro-scale” hydrologic features.**

- Lengthens stream networks and increases relative importance of surface water (vs groundwater) flow
- Short-circuits infiltration, natural filters, and storage.



Recommendations

2. Develop a watershed-wide program to promote "re-plumbing" of roadside ditch networks throughout the Chesapeake Bay watershed.

- Needs to be geographically comprehensive because roadside ditch networks, like streams, ignore political boundaries

  - Poor practices in upstream municipalities contribute to flooding and pollution in downstream areas.

- Address the diversity of government structures, highway maintenance needs, and landscape settings throughout the Bay watershed.

Recommendations

3. Develop a portfolio of incentives to improve roadside ditch management, including:

- Education and awareness campaigns specifically tailored to different stakeholder groups;
- Regulatory incentives and deterrents;
- Increased access to equipment and other resources;
- Funding for implementation and for targeted research.

Recommendations

4. Develop a broad-based education and outreach program to increase awareness and provide guidance to key stakeholder groups:

- Build on successes of existing programs and Local Technical Assistance Program training centers;
- Include diverse stakeholders: highway staff, policy-makers; agency staff; NGOs, and private landowners.

Recommendations

5. Develop comprehensive BMP implementation guidelines, that include a full, organized inventory of BMPs:

- Describe when and where a given BMP is appropriate;
- Estimate BMP performance and cost-effectiveness;
- Explicitly link BMP guidance to TMDL regulatory framework;
- Develop a central website to distribute information.

Recommendations

6. Create a Roadside Ditch Management Executive Team, with representatives from relevant agencies from federal to town levels, along with other stakeholders including scientists and NPOs.

- Avoid redundancy or conflicting requirements among agencies and develop recommendations that work across political boundaries.
- Within CBP, develop ditch management recommendations collaboratively with CBP Urban Stormwater, Watershed Technical, and Agriculture Workgroups.

Recommendations

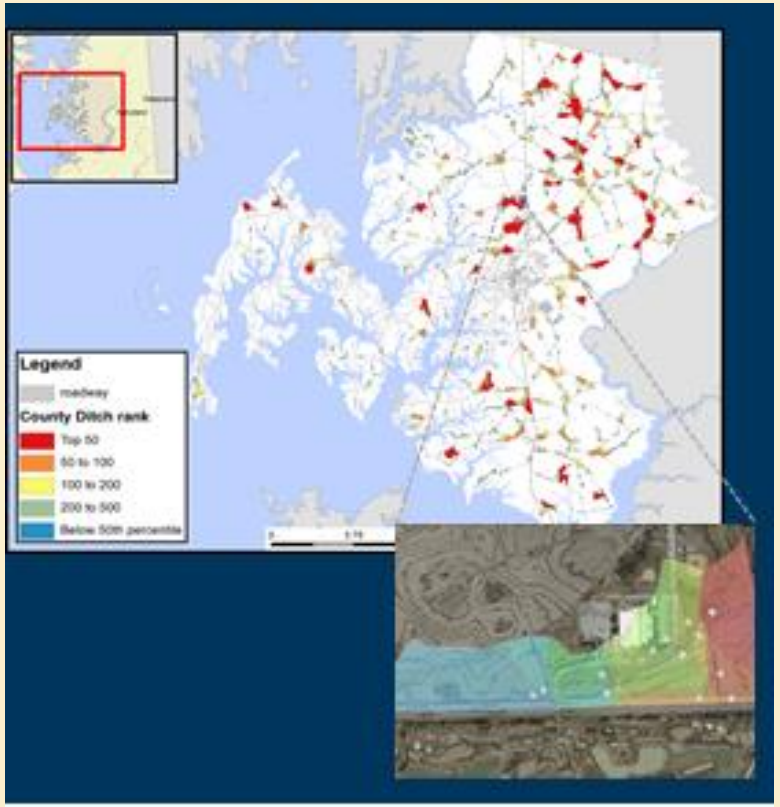
7. Support funding for roadside ditch improvement and maintenance practices.

- Highway staff unanimously report limited manpower, time, and equipment.
- Funding available for green infrastructure, storm water management, and conservation but very limited capacity for grant writing and applications.

Recommendations

8. Prioritize applied research that addresses key knowledge gaps limiting the reliability of decision tools and guidelines:

- Effectiveness of BMPs in different hydro-physiographic settings and climate conditions;
- Chemical contaminant transformations in ditches;
- Impacts of altered hydrology on downstream aquatic ecosystems;
- Other Contaminants of Concern?



Recommendations

9. Link science and management efforts, specifically research models to the development of targeting tools or guidelines and promote monitoring to evaluate success..

- For example: Consider whether current land use inventories and the CBP hydrologic modeling framework adequately capture impacts from roadside ditch networks.

Questions?