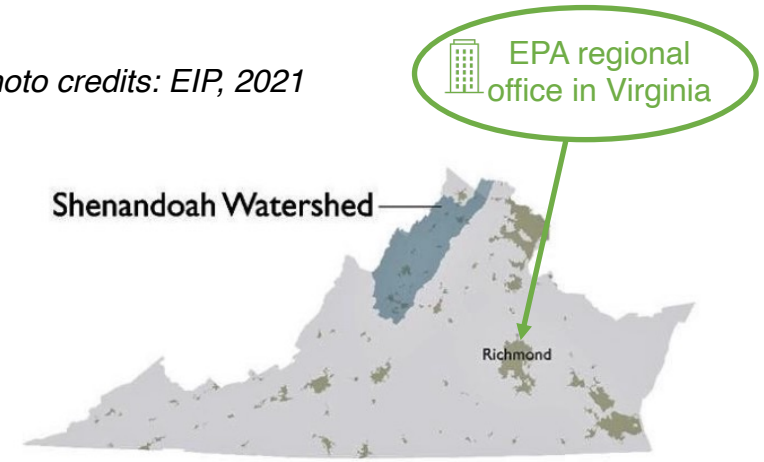

*Photo credit: EIP (2017)*

# Think outside the box: reducing non-point source N pollution to save Shenandoah River

*Yanyu Wang*

# Description of PES activity

*Photo credits: EIP, 2021*



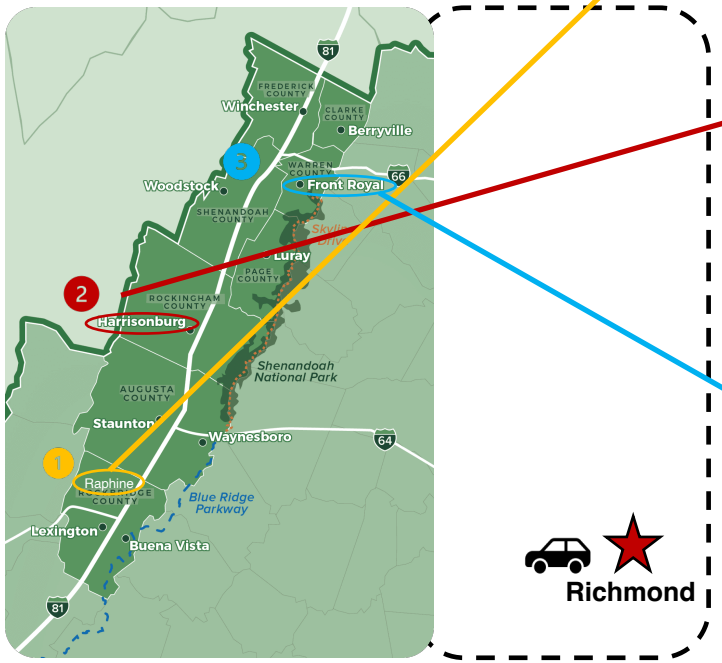




*Photo credits: https://shenandoahvalley.org/*

1 Shenandoah valley agricultural research and extension center (Virginia Tech)

2 Smith Creek Watershed

3 South Fork Shenandoah River

## Immersion visit at Shenandoah Valley *3 stops*

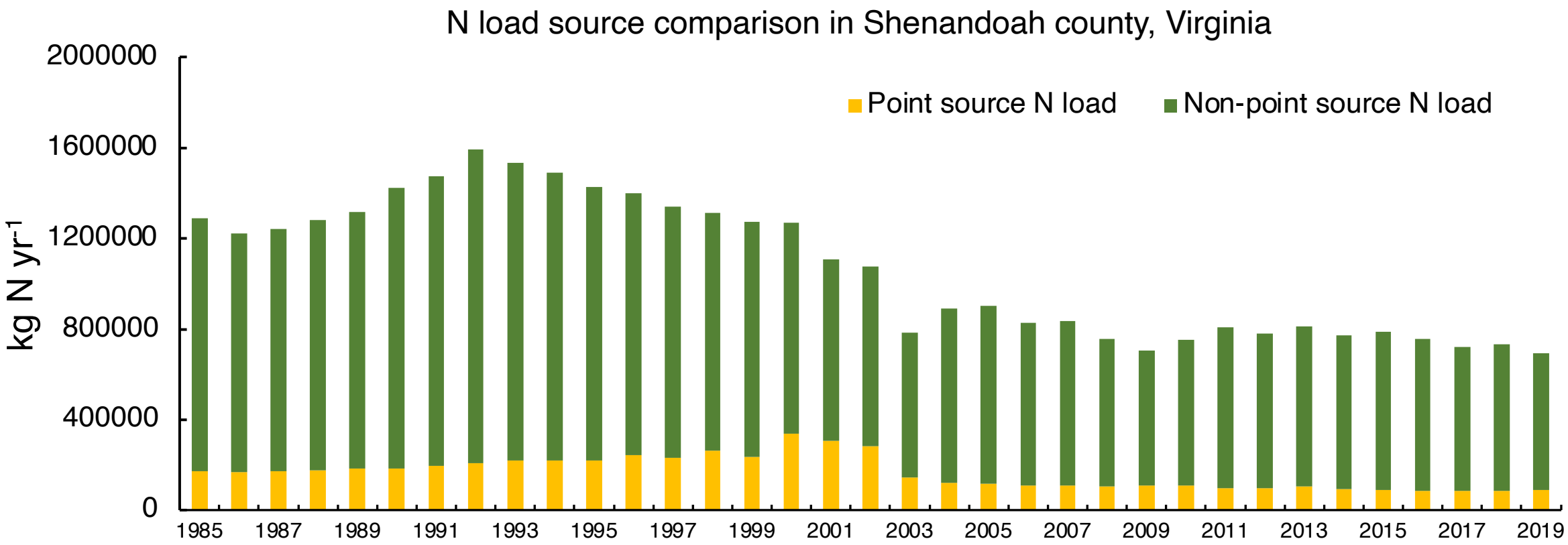
- Participants will be asked to join a Field Day visit held at Shenandoah valley agricultural research and extension center (*they will have the opportunity to communicate with producers regarding the opportunities and challenges of implementing BMPs and I will ask their thoughts from them*)
- Participants will come with me to have a tour at Smith Creek Watershed (*they will be asked why you think it took so long to delist Smith Creek Watershed from impaired water list)*
- Drive along Shenandoah River and come to Front Royal, participants will follow with me to visit a segment of South Fork Shenandoah river near Gooney Run (*they will be asked have you ever swimming, rafting, and tubing in the Shenandoah River and its tributaries? Have you seen any warnings for high level bacteria? If current inspections, monitoring, and regulatory requirements need to be tightened? If yes, how?*)

# Can we still tube and raft on the Shenandoah River?

Valley has ~ 182 million chickens and 271,000 castles on farms at the end of 2017→ 410,000 tons of poultry litter and one billion gallons of liquid manure annually

*Photo credits: iStockphoto*

# Significant contribution of non-point N load

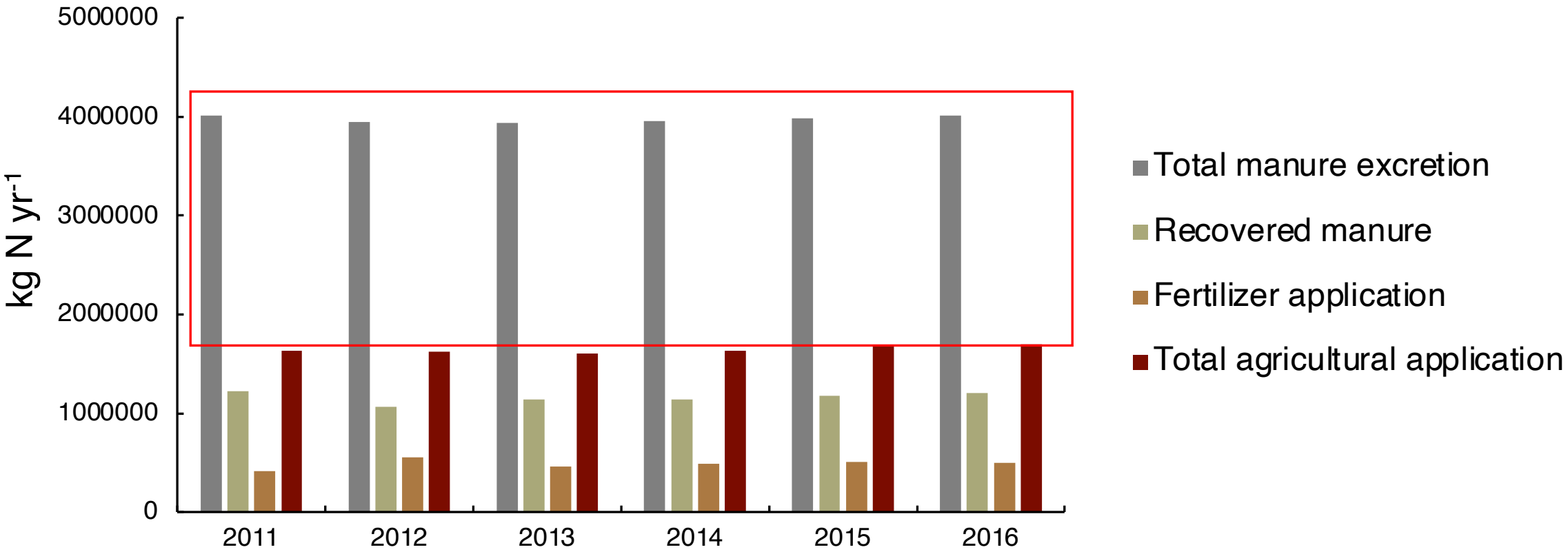



*Data credit: Sabo et al. (2022)*

Point source N load: *municipal and industrial wastewater treatment loads, combined sewage overflows, and septic*

Non-point source N load: *legume N fixation + poultry and livestock manure N applied + atmospheric deposition on agricultural land + agricultural N fertilizer- crop N removal*

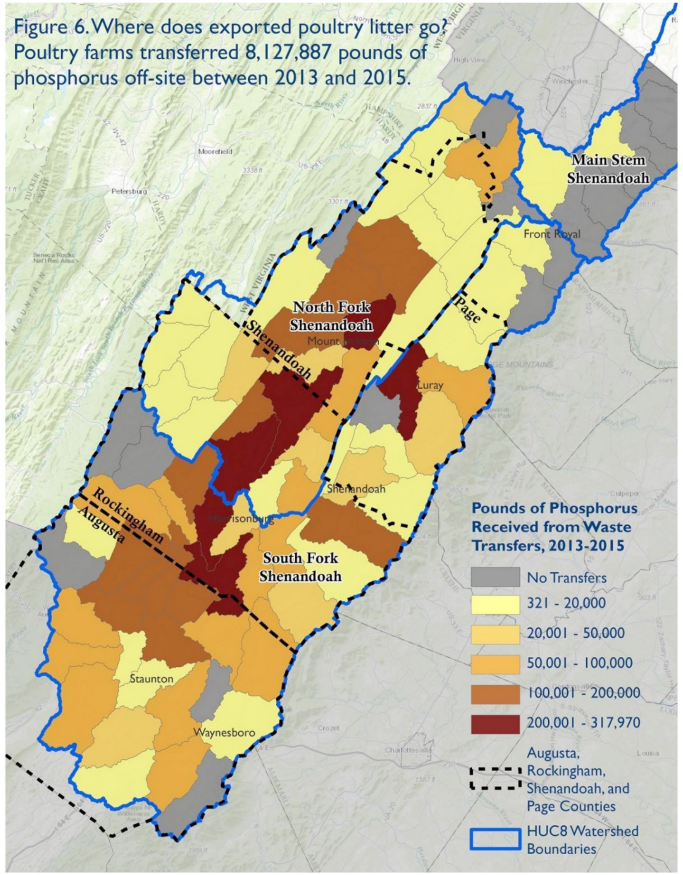
# Too Many Animals, Not Enough Cropland




Large manure surplus indicates the need to export out those amount of manure

# Goal of PES activity

- Require end-users to obtain NMPs to spread manure according to the soil test assessment or the environmental threshold

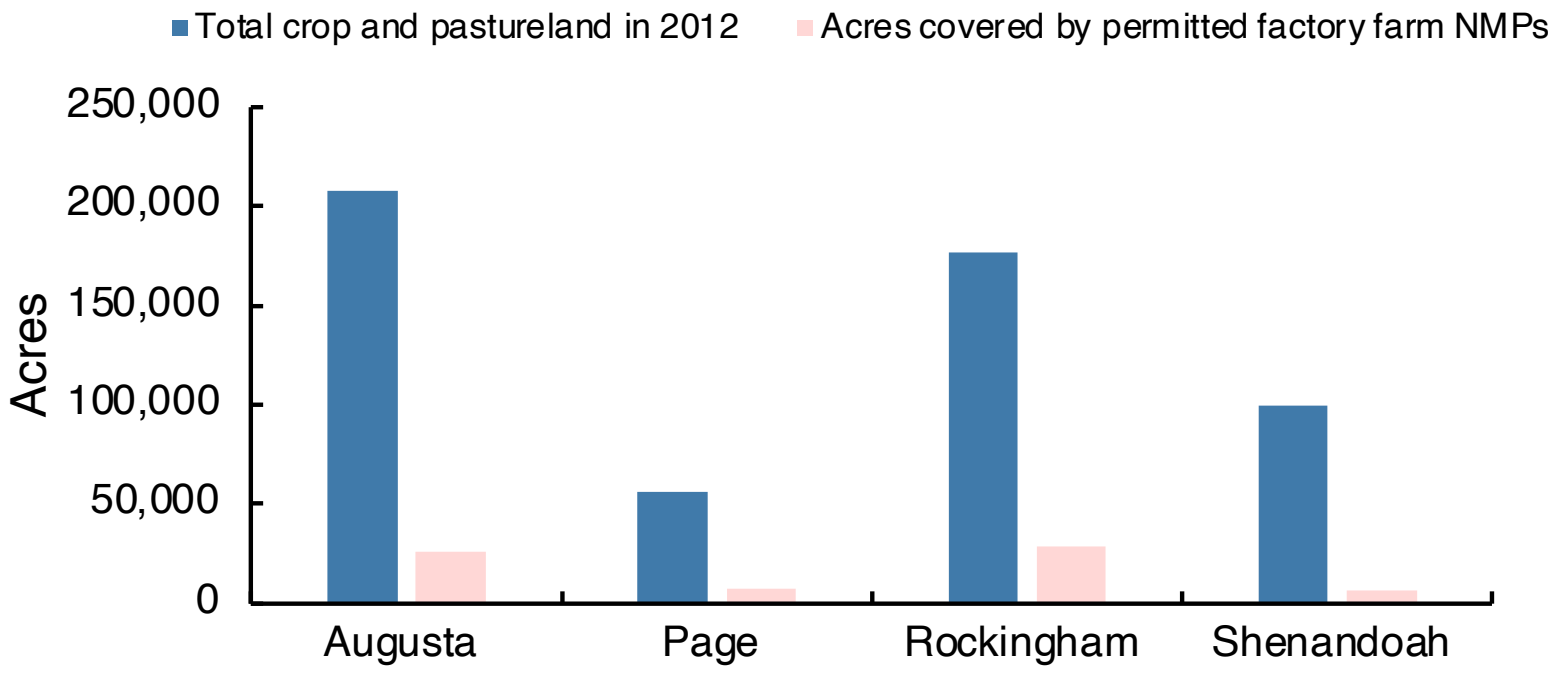



*Map credit: EIP (2017)*


*NMPs: Nutrient Management Plans*

# Goal of PES activity

- Require nutrient management plans for all farms, not only for large CAFOs




*Data credit: EIP(2017)*

Factory Farm Nutrient Management Plans Cover Only **12.5%** of Augusta, Page, Rockingham, and Shenandoah County Farmland

# Audience of PES activity

**Audience**: EPA regional officers (Virginia) who reach the DDL to update discharge permit for Concentrated Animal Feeding Operations (CAFOs)

Characteristics of this audience that will help me connect with them and encourage them to change their behavior

- They want to protect people and environment from N pollution risks
- They would like to see de-listing of impaired waters
- They value the beauty of Shenandoah valley and want to provide guidance to restore it
- They possess latest scientific knowledge on the kind and extent of potential effects on health and well-being caused by pollutants

Characteristics of this audience that will make it challenging to encourage them to change their behavior

- They have resource constraints, including funding and personnel
- They have difficulty in specifying who pay for the implementation costs, leaving many plans unexecuted
- They might lack of understanding of the challenges confronted by local farmers when adopting BMPs
- Rare site inspections due to biosecurity concerns

# 1st Outcome of PES activity

- **Audiences know or are aware of specific science information.**

Why this outcome is appropriate for my audience:

- Strengthen the understanding of addressing nonpoint source pollution is the key to save Shenandoah river
- Reflect on the necessity of expanding nonpoint source pollution control to individual landowners
- Consider what inherent nature of current NMPs hinder the implementation to reduce nonpoint source pollution

# 1st Outcome of PES activity

- **Audiences know or are aware of specific science information.**

What tactics I will use to support this outcome:

- Show scientific evidence (bar graphs/map) depicting the contribution of nonpoint source and large amount of manure surplus in Shenandoah valley
- Tell a cleanup story about Smith Creek Watershed while we on the tour and provide time and space for us to think and discuss the underlying barriers for its de-listing
- Bring my audience for a Field day visit at Shenandoah valley agricultural research and extension center to communicate with frontline farmers and view current research projects

# 1st Outcome of PES activity

- **Audiences know or are aware of specific science information.**

Why these tactics are appropriate for this outcome:

- Bar graphs and maps themselves tell a story of the nonpoint source pollution and manure surplus (visually attractive and clear) so that my audience **better understand the contribution of it and motivate them to think about tightening its regulation**
- During the immersion visit at Smith Creek Watershed, I will tell a story of long-lasting restoring efforts without major improvement in the watershed, and we might be able to find feathers, smell the odor, and see the cattle, which might **motivate them to adjust NMPs requirement of containing mandates**
- Field visit provides an opportunity to **communicate with frontline farmers and learn up-to-date practices from researchers** which are suitable for adoption in Shenandoah valley

# 2nd Outcome of PES activity

- **Audiences believe in certain risk or benefits.**

Why this outcome is appropriate for my audience:

- Shenandoah valley is experiencing serious bacterial impairments while almost half of the waterways do not have cleanup and implementation plans (EIP, 2021)

- Lack of understanding about the potential economic benefits brought by mitigation of those nonpoint source N pollution

- Insufficient swimming warning posts for Shenandoah river

- Absence of frequent samplings for freshwater areas

# 2nd Outcome of PES activity

- **Audiences believe in certain risk or benefits.**

What tactics I will use to support this outcome:

- Visit a segment of South Fork Shenandoah river near Gooney Run (close to a campground site), have a conversation with potential tourists there (ask them do you know it is not safe to swim/raft/tube here)

- Ask my audience if they have any work/life experience with non-point source pollution

- Ask my audience if they know the potential magnitude of economic benefits of tourism and recreation in Shenandoah Valley (compare it to the cleanup costs)

- Tell a success story of controlling nonpoint source here at Shenandoah valley and ask what do you think should be prioritized in controlling nonpoint source N pollution

# 2nd Outcome of PES activity

- **Audiences believe in certain risk or benefits.**

Why these tactics are appropriate for this outcome:

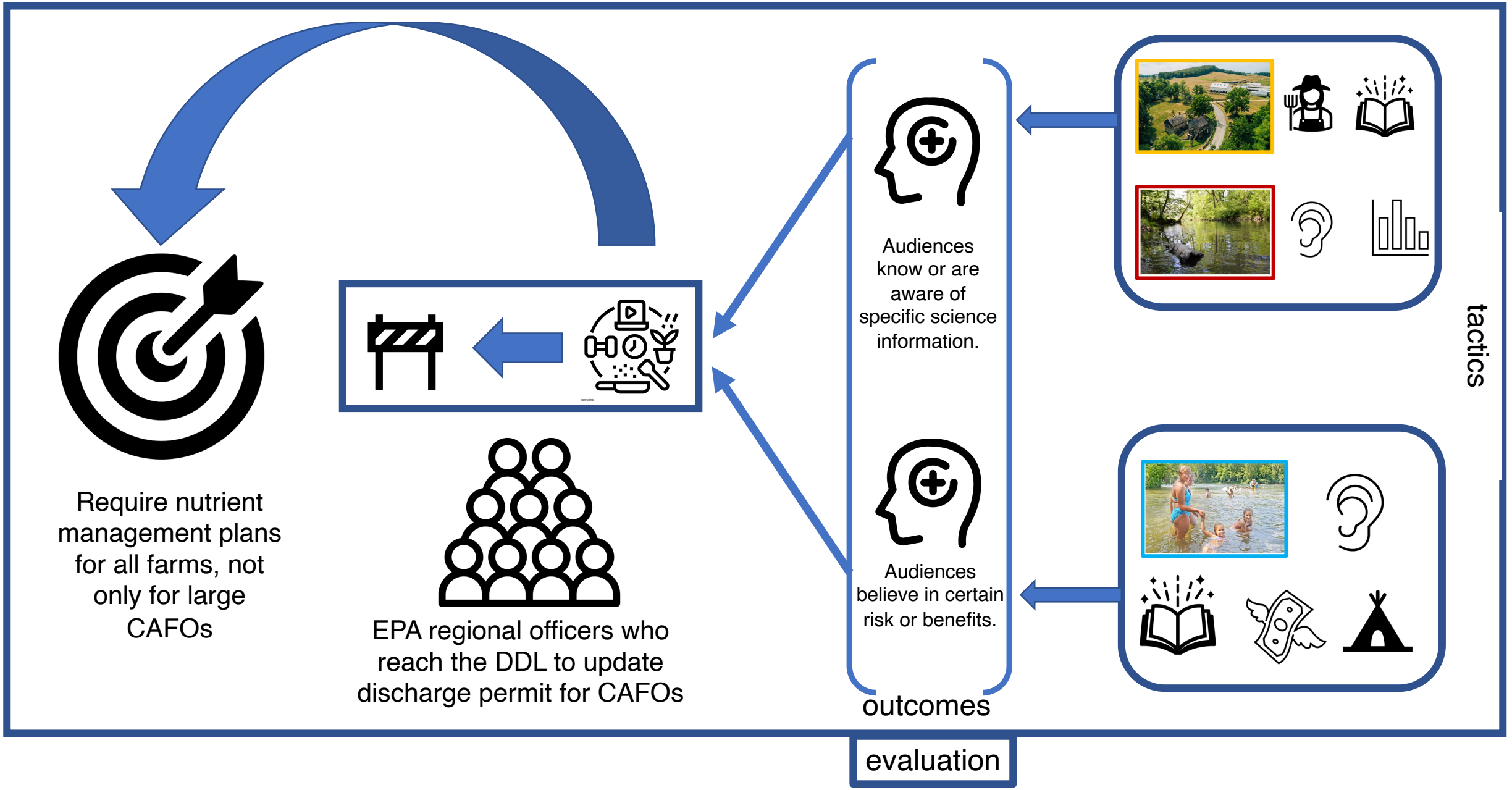
- EPA regional officers rarely do on-site (CAFO) inspection due to biosecurity concerns, bring them to a segment of South Fork River avoid the potential biosecurity concerns and **provide them with an opportunity to talk with tourists and see the real water quality situation near campgrounds**

- From asking them to share a personal story, this assists forming a consensus of this real issue of nonpoint source pollution and **motivate them to think about what they can do to control it in terms of inspections, monitoring, and regulatory requirements**

- Highlighting the value of tourism and recreation **help put the implementation costs under the context of much greater value of healthy waterways and natural areas**

- Tell a success story of controlling nonpoint source here at Shenandoah valley serves as an example **helps enlighten them think about the bearers for cleanup costs and encourage the wide adoption**

# Summary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outcomes
tactics
evaluation


Thank you!