Leveraging Artificial Intelligence and Machine Learning to Advance Chesapeake Bay Research and Management: A review of status, challenges, and opportunities

February 24-25, 2025
SERC @ Edgewater, MD

Workshop Report-Out,
September 16

Workshop Steering Committee

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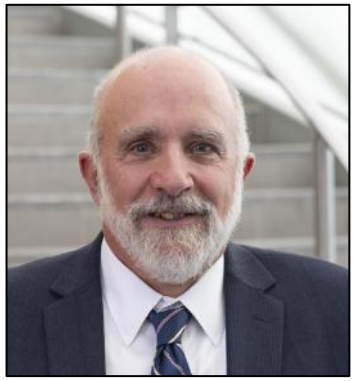

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50+ Workshop Participants (In-person and Virtual)

Workshop Objectives

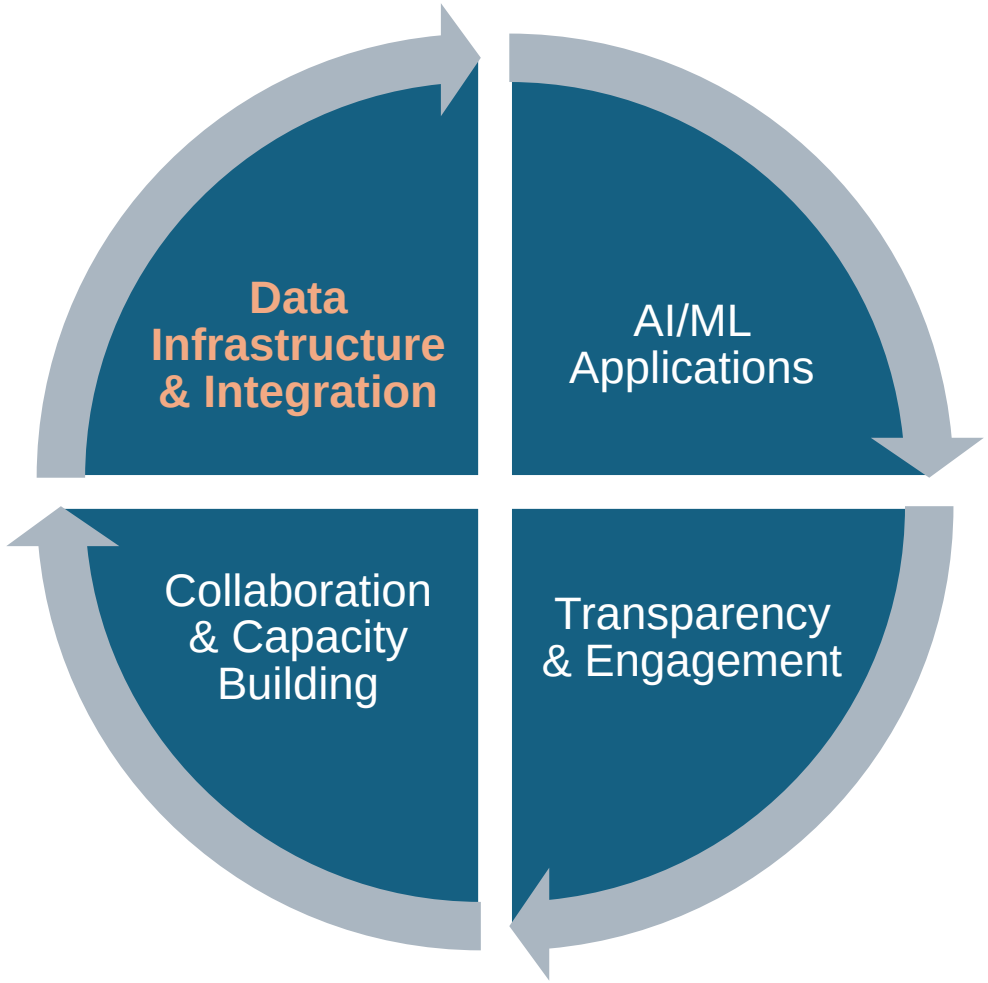
This workshop gathered federal, state, and academic partners to synthesize the **state of the science on AI/ML** approaches, identify research needs, and improve science coordination.

1. **Summarize recent AI/ML applications to the Chesapeake Bay ecosystem and lessons learned**
2. **Identify the challenges and gaps in applying AI/ML approaches to Chesapeake Bay data**
3. **Develop recommendations and identify opportunities for harnessing the power of AI/ML approaches to address Chesapeake Bay issues**

Breakout Session Guiding Questions

- How may AI/ML approaches be leveraged (or have been used) to address issues in the context of the Chesapeake Bay restoration?
- What are some of the advantages and disadvantages of AI/ML compared to other established approaches?
- What challenges or gaps have you encountered when applying AI/ML in the context of Chesapeake Bay (or elsewhere)?
- What have you done (or may be done) to address the challenges and gaps?
- What are the biggest barriers preventing broader AI/ML adoption in Chesapeake research and management?
- What forums, workshops, or working groups may be established to foster collaborations and discussions among different groups of AI/ML researchers as well as between them and Bay scientists and managers?

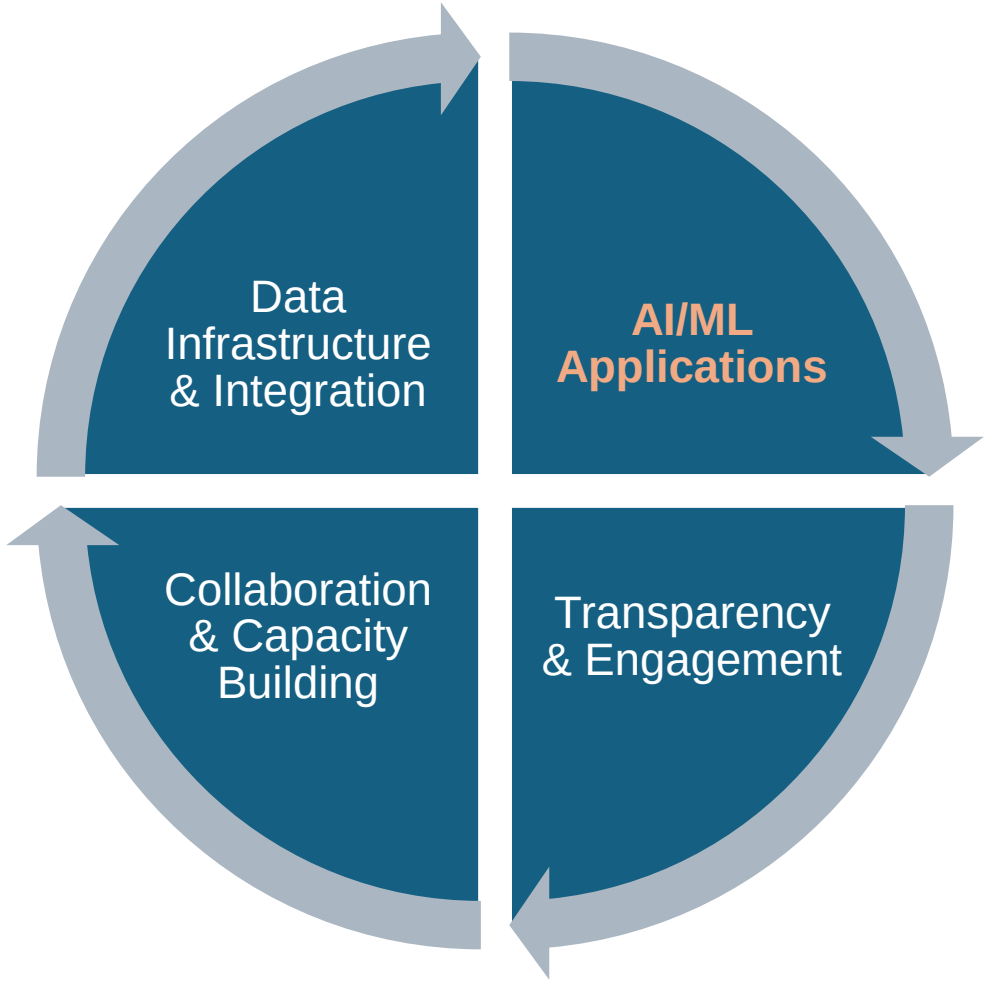
Workshop Recommendations



1. Strengthen data infrastructure and integration for AI/ML applications

- Harmonize spatial and temporal datasets across programs and ensure consistent metadata.
- Leverage diverse datasets, including satellite, in-situ, and high-frequency data, for modeling, monitoring, and filling water quality data gaps.
- Design monitoring and data processing efforts so that resulting products are problem-relevant and can be readily incorporated into AI/ML workflows.
- Build harmonized response and predictor datasets and develop exemplar use cases to guide widespread AI/ML applications.

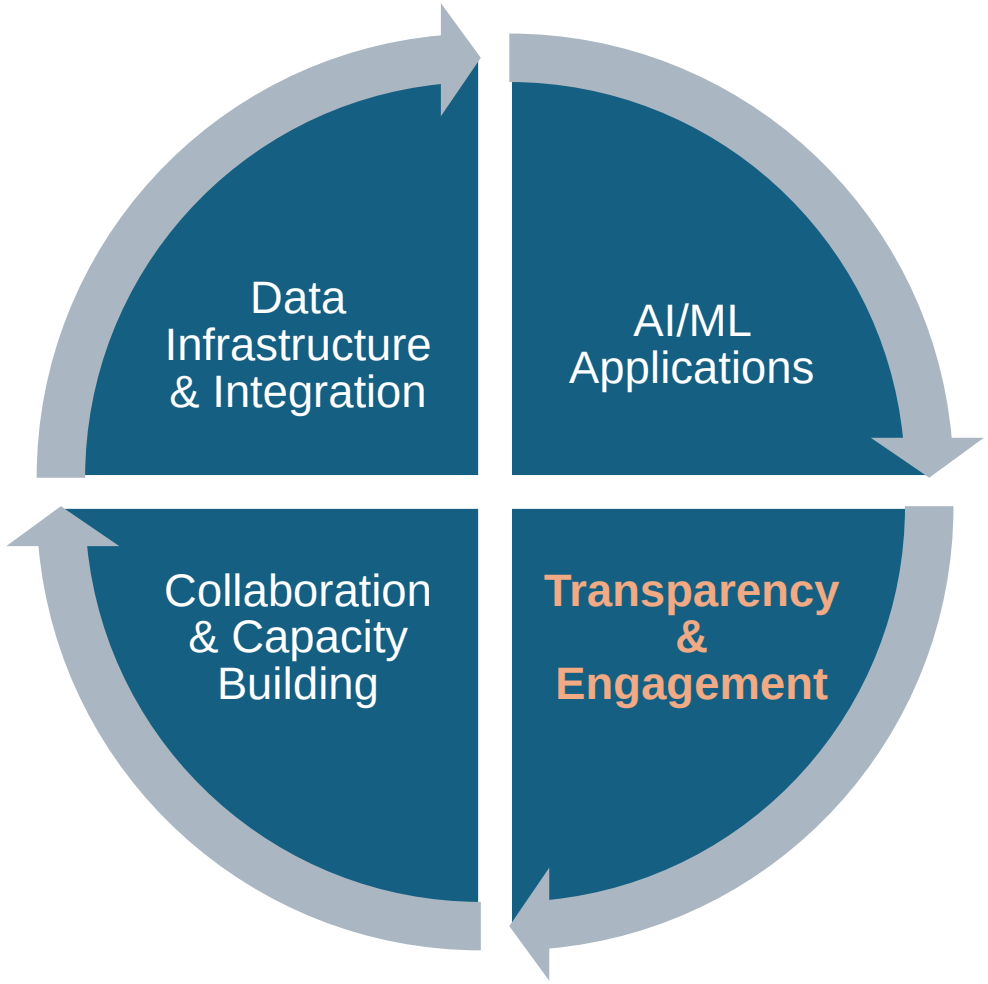
Workshop Recommendations



2. Leverage AI/ML for restoration of Chesapeake Bay tidal and non-tidal regions restoration and decision support

- Use AI/ML to assess restoration practices, evaluate progress, and identify drivers.
- Enhance Watershed and Estuarine Models by integrating AI/ML model outputs and insights.
- Develop accessible AI-driven tools (e.g., Chesapeake-specific LLMs) for scenario planning to help identify management priorities.

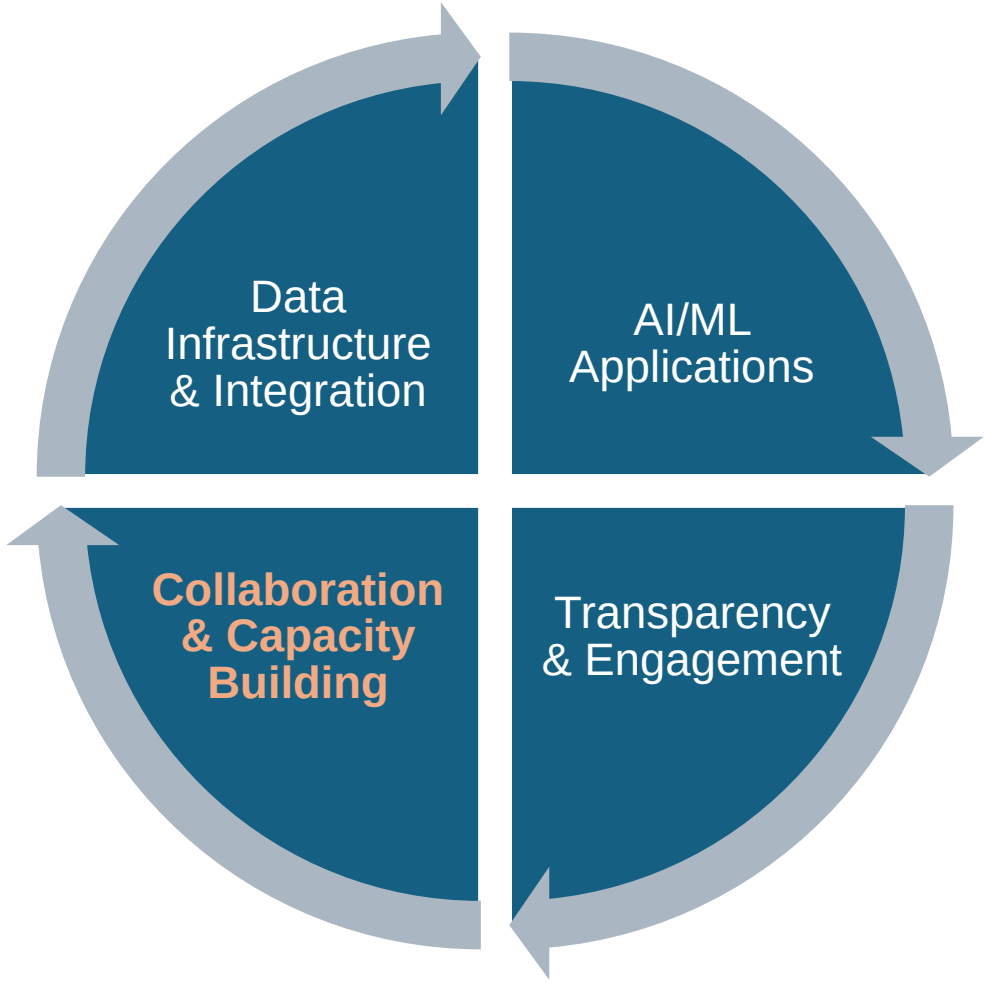
Workshop Recommendations



3. Promote transparency and engage managers and stakeholders

- Advance explainable AI and uncertainty protocols so that results are interpretable and trusted.
- Couple AI/ML with tailored data visualizations to improve interpretability and use.
- Foster close engagement of managers and decision-makers at all stages of AI/ML projects to ensure products align with management priorities and can be effectively applied.
- Use tailored communication strategies to translate AI/ML insights into actionable guidance for restoration planning.

Workshop Recommendations



4. Build collaboration and capacity

- Establish a Chesapeake Bay AI/ML network (e.g., **Ches-BRAIN**) to foster collaboration and conversations and to provide a clear place where managers and others can easily find and connect with AI/ML experts.
- Encourage participatory events such as Hackathons to spark innovation and strengthen cross-sector collaboration.
- Invest in training and literacy programs so that scientists, managers, and decision-makers can effectively use AI/ML tools and outputs.

** Ches-BRAIN: Chesapeake Bay Research with Artificial Intelligence and Networking*

Acknowledgements

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- Workshop Steering Committee
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