Chesapeake Bay Program's (CBP)
Scientific and Technical Advisory Committee (STAC)
Workshop
**Leveraging Artificial Intelligence and Machine Learning to
Advance Chesapeake Bay Research and Management**
February 24-25, 2025
Smithsonian Environmental Research Center
Mathias 1013
Workshop webpage

Exact Times Are Subject to Change
This meeting will be recorded to assure the accuracy of meeting notes.

This STAC workshop is aimed at providing a unique opportunity for researchers and managers to gather and review the state of the science on AI/ML approaches and their potential to advance Chesapeake Bay research and management. The workshop will focus on three main objectives:

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

Monday, February 24, 2025

9:00 am   **Coffee & Light Breakfast (Provided)**

9:45 am   **Welcome and Introductions** – *Meg Cole (CRC)*
STAC Coordinator, Meg Cole, will outline the workshop logistics and facilitate brief introductions from all participants.

10:00 am   **Workshop Overview and Motivations** – *Qian Zhang (UMCES)*
Workshop Chair, Qian Zhang, will provide context for the workshop, including its purpose, objectives, and key motivations.

I: Summarize recent AI/ML applications to the Chesapeake Bay ecosystem and lessons learned
This session will synthesize recent applications of artificial intelligence and machine learning (AI/ML) within the Chesapeake Bay region, including both tidal and nontidal areas. The discussion will focus on the objectives of each study, the rationale for selecting specific AI/ML approaches, the new insights generated through these methods, and how these findings have (or could) inform restoration efforts in alignment with the Chesapeake Bay Watershed Agreement goals and outcomes.

10:15 am   **Introductory Overview of AI and ML** – *Alison Appling (USGS)*
Alison Appling will provide foundational insights into artificial intelligence (AI) and machine learning (ML), including key definitions, a taxonomy of AI approaches, and an introduction to several common methods.

10:45 am   **Overview of Chesapeake Bay Restoration: CBP Goals & Outcomes** – *Gary Shenk (USGS)*
Gary Shenk will discuss the 10 key goals identified by the Chesapeake Bay Program (CBP) for ecosystem restoration. While AI is already being used to generate information supporting these goals, significant opportunities remain for further application.

11:15 am   **15-minute Break**

11:30 am   **Literature Summary of Watershed and Living Resources Studies Involving AI/ML**
– *Kim Van Meter (PSU) and Kelly Maloney (USGS)*
Kim Van Meter and Kelly Maloney will present a summary of existing literature on AI/ML applications in watershed and living resources studies, highlighting key findings and trends.

12:00 pm   **Literature Summary of Estuarine and Living Resources Studies Involving AI/ML**
– *Jian Shen (VIMS) and Stephanie Schollaert Uz (NASA)*
Jian Shen will present a general overview of recent literature on estuarine and living resources studies involving AI/ML. Following this, Stephanie Schollaert Uz will discuss *AI/ML Integration of Satellite Remote Sensing: Data Harmonization Challenges and Gaps*, focusing on challenges and gaps in data harmonization.

12:30 pm   **Lunch (Provided)**

II: Identify the challenges and gaps in applying AI/ML approaches to Chesapeake Bay data

This session will explore key challenges and gaps in applying AI/ML to Chesapeake Bay data, including data limitations such as lack of data or issues with harmonization, insufficient expertise in AI/ML algorithms and methodologies, unavailability of software code for replication or adaptation, communication barriers in effectively using or explaining AI/ML-generated insights (e.g., explainable ML), and coordination gaps among research and management institutions within the Chesapeake Bay Program (CBP) Partnership.

1:30 pm   **Introduce Lightning Talk Speakers, Open Mentimeter, and 'Office Hours' Structure**
– *Meg Cole (CRC)*
Cole will introduce the lightning talk speakers, launch the Mentimeter interactive platform for audience engagement, and outline the structure for the upcoming 'Office Hours' poster/session, designed to facilitate focused discussions and collaboration.

1:45 pm   **Lightning Talks with Q&A (Round 1)**
Eight speakers have been invited to share their recent work through concise, 7-minute presentations. This session will be divided by a 15-minute break following the fourth speaker. Participants are requested to save questions for the Poster Session at 2:40pm.
- Patrick Bitterman (Kent) – GeoAI and Social Systems Modeling
- Mike Evans (Conservancy) – Integrated AI models to forecast land use change
- Shuyu Chang (PSU) – Advances in water quality predictions: datasets and learning frameworks
- David Parish (VIMS) – Modeling Light Conditions in the York River Estuary by Anchoring Satellite Imagery with High-Frequency In-Situ Observations

2:05 pm	**15-minute Break**

2:20 pm	**Lightning Talks with Q&A (Round 2)**

- Matthew Cashman (USGS) – Physical habitat is more than a sediment issue: A multi-dimensional habitat assessment indicates new approaches for river management
- Taylor Woods (USGS) – Observed and projected functional reorganization of riverine fish assemblages from global change
- Jenn Fair (USGS) – Images to Info: the USGS Flow Photo Explorer
- Sean Emmons (USGS) – Leveraging machine learning and expert knowledge to unravel the complexities of multiple freshwater ecosystem stressors

2:40 pm	**Lightning Talk 'Office Hours' and Workshop Poster Session** Lightning talk speakers and participants are invited to showcase their work during a poster session in the Atrium of the Mathias Lab.
4:00 pm	**Wrap-Up and Objectives of Day 2** – *Qian Zhang (UMCES)* Qian Zhang will provide a summary of the day's discussions and outline the objectives and key focus areas for Day 2 of the workshop.
4:30 pm	**Happy Hour (Optional)** Join us for refreshments and snacks in the Atrium, following the Office Hours and Poster Session, to unwind and network with fellow participants.
4:30 pm	**Day 1 Recess**
6:00 pm	**Dinner Off Campus (Optional)** Participants interested in attending a group dinner are invited to meet in the Mathias Lab Atrium at 6:00pm to depart together.

Tuesday, February 25, 2025

8:30 am	**Coffee & Light Breakfast (Provided)**
9:00 am	**Review of Day 1; Objectives for Day 2** – *Steering Committee Members*

III: Develop recommendations and identify opportunities for harnessing the power of AI/ML approaches to address Chesapeake Bay issues

This session will focus on developing actionable recommendations and identifying opportunities to leverage AI/ML approaches for Chesapeake Bay restoration. Key areas of discussion include identifying where the Chesapeake Bay Program (CBP) Partnership can benefit most from AI/ML, brainstorming how AI/ML can generate new insights to support restoration efforts, and formulating strategies to deliver AI/ML-generated information to watershed managers in an efficient, understandable, and actionable manner. Additionally, the session will explore guidelines for standardizing and streamlining the selection and use of AI/ML approaches for analyzing monitoring data, as well as proposing ways to enhance collaboration and synergies among stakeholders within the CBP Partnership.

9:30 am	**State-of-the-Art AI & Physics-Informed ML in Hydrology and Water Quality: Insights and synergies** – *Chaopeng Shen (PSU)* Chaopeng Shen will present on the evolution of the AI/ML field in the context of

watershed and estuarine sciences, including emerging directions and opportunities, and the communication and explanation of results (e.g. xAI).

10:00 am **15-minute Break**

10:15 am **Panel: AI/ML Community Development**
– Dong Liang (UMCES), Chaopeng Shen (PSU), Vandana Janeja (UMBC), Kelly Maloney (USGS), Robert Sabo (EPA), Alison Appling (USGS)
Moderated by steering committee member *Matt Baker (UMBC)*, this panel will explore strategies for fostering synergies, breaking down barriers, and establishing pathways for ongoing dialogue and collaboration within the AI/ML community.

11:15 am **Breakout Sessions**
Participants will move into small groups for further discussion. Group assignments are random, but each breakout will include a facilitating steering committee member(s), a notetaker, and individuals involved in the CBP partnership.

12:30 pm **Lunch (Provided)**

1:30 pm **Breakout Groups Report-out**
Assigned steering committee members will present key insights and outcomes from their respective breakout group discussions.

2:15 pm **Plenary: Prioritization of High-Level Recommendations**
The steering committee will lead a discussion where workshop participants will refine and identify the highest-priority recommendations emerging from their small group discussions.

3:15 pm **Workshop Adjourns**
Steering Committee Meets