UNIVERSITY OF MARYLAND CENTER FOR ENVIRONMENTAL SCIENCE

CHESAPEAKE GLOBAL COLLABORATORY
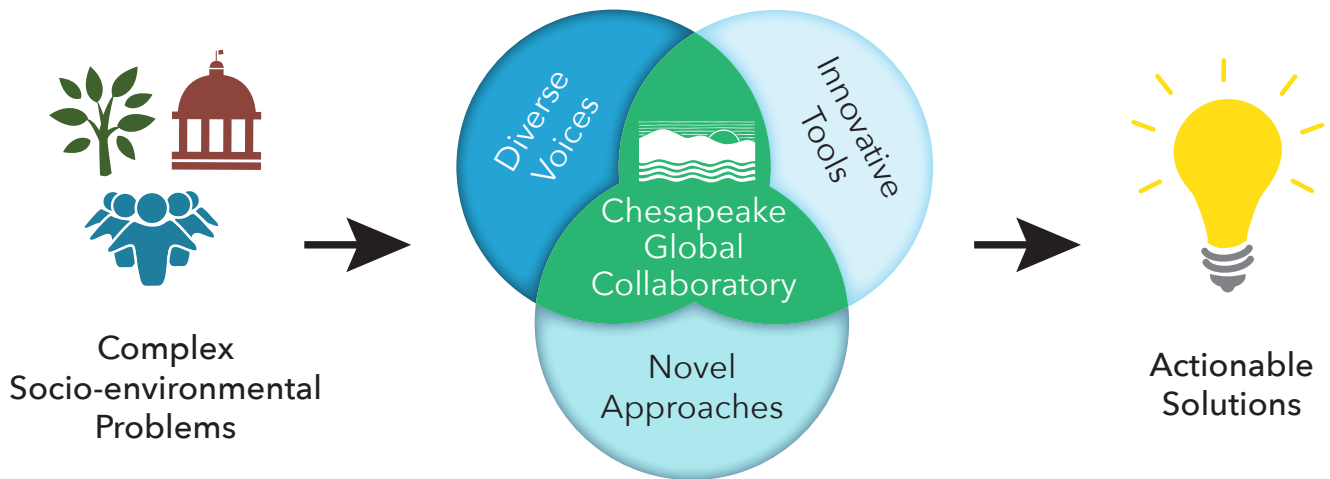
RESULTS OF THE SUMMIT
28-29 SEPTEMBER 2023

ABOUT THE COLLABORATORY APPROACH

The Chesapeake Global Collaboratory will be at the center of UMCES' next century of scientific discovery, bringing together people, technology, and a shared passion for the environment in the service of our natural world.

Complex Socio-environmental Problems → **Diverse Voices** / **Innovative Tools** / **Chesapeake Global Collaboratory** / **Novel Approaches** → **Actionable Solutions**

CYBERINFRASTRUCTURE

Providing new, integrated high-performance computing systems, data storage and management, advanced networking capabilities, and software tools.
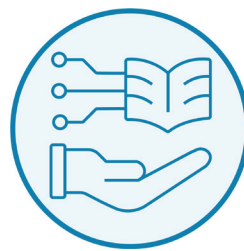
DATA SCIENCE EXPERTISE

Engaging skilled personnel who provide technical support, training, and guidance to researchers on how to effectively use available resources and tools.

SCIENCE COMMUNICATION

Leveraging existing expertise for effective communication of relevant research to non-scientists with a focus on open data approaches.

EDUCATION AND TRAINING

Enhancing our existing graduate education programs, and providing extensive and innovative new education resources and training for environmental professionals.

STAKEHOLDER ENGAGEMENT & WORKSHOP FACILITATION

Assisting effective engagement with stakeholders in the co-production, execution, and implementation of actionable, science-based solutions.

ABOUT THE SUMMIT

The Chesapeake Global Collaboratory Summit gathered a diversity of experts from academia, government agencies, NGOs, and businesses to explore how this initiative could enhance our ability to address the pressing environmental issues facing the world. The focus of the 1.5 day Summit was to create opportunities for input from diverse voices using high level plenaries, panel discussions, and facilitated small group breakout sessions. This summary attempts to capture the key takeaways from the Summit.

Leadership Presentations

Jay Perman: Chancellor, University System of Maryland

"We are at an inflection point. Now is the time to collaborate and try new approaches, new models to solve the problems we haven't yet solved. Who better to innovate those models than the University of Maryland Center for Environmental Science."

Josh Kurtz: Secretary, Maryland Department of Natural Resources

"It is critical to answer tough questions and build robust solutions. Using this information to drive our management decisions, bringing us together to learn from each other is important."

Serena McIlwain: Secretary, Maryland Department of the Environment

"This is exactly where it starts. Great minds sitting around tables working towards a common goal. Using data and science and collaborating is how we solve complex issues together."

Kevin Atticks: Secretary, Maryland Department of Agriculture

"Collaboration is key. The key to preserving our environment, preserving the Bay, is all of us collaborating together."

Joaquin Esquivel: Chair, California Water Resource Control Board

"We have an opportunity to use artificial intelligence, machine learning, and data systems to do what they do best, so that humans are freed up to do what we can do best."

Nancy Merrill: Merrill Family Foundation

"I want all of you, today, to make a commitment that in ten years time, you are going to be talking to a graduate student, or an intern, and you're going to say to them, 'I helped create the Collaboratory.' Thank you for being here. Thank you for being part of making environmental history."

Plenary Speakers

Plenary speakers highlighted key elements of the Chesapeake Global Collaboratory: 1) Innovative tools, 2) Diverse voices, and 3) Novel approaches. These talks served to identify emerging trends, and the speakers themselves shared their knowledge of advancing science applications as a blueprint for the creative and collective framework that lies at the heart of the Collaboratory.

Dr. Erica Key (Future Earth, U.S. Hub) spoke about transdisciplinary research approaches, sustainable development, institutional change, leadership models, empowered transparency, and decision-making. She also highlighted the annual Sustainability Research and Innovation Congress that fosters community action using transdisciplinary approaches.

"Transdisciplinary co-design and co-implementation has the potential for transformation...to inform decisions that change policy and practice."

Fred Tutman (Community Organizer, Patuxent Riverkeeper) provided a personal history that emphasized the multiple dimensions of diversity, going beyond skin color. Fred pointed out that the environmental movement has been largely driven by people with privilege. But he also identified initiatives that are attempting to bring more diverse voices into the environmental conversation.

"People of color can be adventurers, explorers, scientists, and all kinds of things... not just diversity."

Shashi Shekhar (Director, AI-CLIMATE, University of Minnesota) connected the development of global positioning systems (GPS) with google maps and Uber as an example of spatial computing that uses "Big Data." He provided examples of the spatial data revolution with global crop monitoring, COVID tracking, eco-routing travel planning, monitoring high seas fishing, and investigating cancer occurrence.

"The story has only just begun, with a lot of exciting things coming—this new technology can open new doors to solving problems."

Chaopeng Shen (Associate Professor, Pennsylvania State University) talked about machine learning and differentiable modeling approaches used in hydrology and water quality assessments. Using these approaches, the models can better extrapolate data, especially for extreme conditions, and reveal unknown relationships.

"We are trying to leverage the fundamental technology that is powering machine learning and combine it with process-based models.."

Session One: Innovative Tools
TRANSFORMATION THROUGH CYBERINFRASTRUCTURE (CI)

Left to right: Moderator Dr. Andrew Elmore (Professor, University of Maryland Center for Environmental Science), Panelists Dr. Victoria Coles (Professor, University of Maryland Center for Environmental Science), Dr. Marco Masciola (Senior Partner Solutions Architect for the Global Sustainability Partner Segment, Amazon Web Services), Dr. Vandana Janeja (Professor and Chair of the Information Systems Department, University of Maryland Baltimore County).

QUESTIONS

1. What challenges and bottlenecks limit applying novel computational tools to problems and issues that you or your teams encounter?

Training and education challenges: Tool availability and integration are key obstacles to applying novel computational tools effectively. **Data quality**: Integrity, accessibility, and the need to ensure reliability and consistency are pervasive concerns when applying computational tools.

2. How have open data and code practices advanced science for environmental solutions, and what challenges limit the further implementation of FAIR and open-source practices?

Citizen science: Open data can empower communities to participate in research and environmental monitoring, leading to increased environmental awareness and advocacy. **Challenges:** Inadequate representation of communities. Lack of diversity can lead to data coverage limiting the scope of solutions.

3. How can we retain professionals with computational skills in environmental science? E.g. Training opportunities, knowledge co-production, solution-oriented work?

Incentives: Offer competitive pay and benefits, along with sustainable funding models. Include solutions to bridge the salary gap between environmental science and data science fields. **Collaboration**: Establish peer-to-peer networks, and create pathways for those interested in science but lack traditional education and experience.

4. How can we bring CI tools and training to enhance our environmental science through graduate and broader training?

Interdisciplinary approach: Offer courses that span across departments, and emphasize quantitative methods, data management, and meaningful modeling. **Engage:** Use CI to engage broader audiences, including K-12 students by designing and curating data as an educational tool.

5. The Collaboratory is considering a summer institute to train researchers to work with CI experts. What topics should be included in the summer institute?

Cyberinfrastructure fundamentals: Cover topics such as data interoperability, data visualization, basic coding skills, data access and security, standards and ethics in data management, and determine what CI can and cannot accomplish. **Interdisciplinary approach**: Include policy experts, journalists, etc., promote practical applications of CI.

Session Two: Broadening Participation in Cyberinfrastructure
EQUITABLE, AUTHENTIC ENGAGEMENT WITH DIVERSE VOICES

Left to right: Moderator Dr. Lora Harris (Professor, University of Maryland Center for Environmental Science), Panelists Fred Tutman (Patuxent Riverkeeper), Briana Yancy (Knauss Executive Fellow, National Oceanic and Atmospheric Administration), Dr. Fredrika Moser (Director for Maryland Sea Grant, University of Maryland Center for Environmental Science).

QUESTIONS

1. How might we make cyberinfrastructure more meaningful and impactful for broader audiences?

   Communication: Create compelling visualizations, animations, and interactive tools to break through barriers of scientific jargon. Emphasize the practical applications of CI and its relevance to real-world issues. **Community:** Support citizen science projects, where people can actively learn about CI in scientific research and feel involved in the process.

2. What barriers exist to engaging under-resourced communities, and how do we bridge them?

   Trust: Establish two-way dialogues, listen with humility, and allow the community to have autonomy in order to build trust. **Empowerment:** Address internal biases, improve social infrastructure, surveying needs, and increase access to existing knowledge in order to empower under-resourced communities.

3. How might we enhance the potential for cyberinfrastructure to provide benefits equitably, especially to marginalized communities?

   Inclusivity: Embrace CI technologies that are relevant and create smartphone apps/platforms that cater to these communities' specific needs. **Learning opportunities:** Start co-production early and actively involve the community in the shaping of CI initiatives. Include youth training programs and award programs for advancements in CI.

4. How might cyberinfrastructure be used to address Environmental Justice?

   Data driven analysis: CI can facilitate predictive analysis, identify pollution hotspots, and offer real-time maps and dashboards to address emerging environmental injustices. **Education:** CI can help educate the general public on matters of EJ even before developing ways to address these concerns so that the community can be involved.

5. Who do we need to have a seat at the table to be inclusive and expansive in reaching new voices and communities?

   Directly impacted groups: Community members, local artists, local leaders. **Age-diverse groups:** Elders, retirees, religious groups, scout groups, students. **Expert groups:** Educators, journalists, enthusiasts, public health specialists. **Underrepresented groups:** Disabled people, immigrants, Indigenous peoples.

Session Three: Actionable Science for Solutions

Left to right: Moderator Dr. Kenny Rose (Professor, University of Maryland Center for Environmental Science), Panelists George Chmael II (CEO, Council Fire), Dr. William Bailey (The Bailey Wildlife Foundation), Dr. Nina Lamba (Assistant Directory, IMET, University of Maryland Center for Environmental Science), Dr. Cisco Warner (Chief Science Advisor & Director of Scientific Programs, National Oceanic and Atmospheric Administration), Dr. Ted Grantham (Associate Professor, University of California, Berkeley).

QUESTIONS

1. What do you think the Chesapeake Global Collaboratory should focus on in the short, medium, and long term?

   Short term: Clarify goals and identify deliverables that can demonstrate value. **Medium term:** Identify and collaborate with communities and implement a structured engagement strategy. **Long term:** Sustain partnerships and create a long-term commitment plan to address the Chesapeake region's impact within global climate efforts.

2. What did you hear from yesterday's and today's plenaries, panels, and breakouts that you would want the Collaboratory to focus on?

   Urgency: Focus on addressing climate change with collaborative efforts on a global, national, and local scale, and streamline processes to ensure timely decision making. **Practical use:** Prioritize the development of practical use cases and applications for predictive tools and data. These will help demonstrate the real world impact of research.

3. What might the cyberinfrastructure-enabled stakeholder engagement process look like?

   Holistic approach: Invite stakeholders into the process to encourage active participation and facilitate demonstrations of solutions. Address barriers and establish feedback loops. **Practicality:** Create hands-on, user-friendly applications and real-time tools as well as leverage diverse expertise. Balance traditional meetings with tech-based approaches.

4. How might a co-production process and cyberinfrastructure help solve issues that are relevant to you?

   Accelerated access: Co-production and CI facilitates sharing data and information, speeds up responses, and aligns policies for faster resolution. **Integration:** Co-production and CI can engage stakeholders, define goals, and enable data-driven community education and policy resources, bridging disciplines in order to target immediate needs.

5. How would you like to be engaged with the Chesapeake Global Collaboratory in the future?

   Collaboration: Host events for community engagement and involve a wide range of stakeholders, especially urban communities. Support citizen science participation, provide resources and fellowships. **Integration:** Bridge the gap between academia and the public by supporting policy change, industry engagement, and interpreting data.

COLLABORATORY NEXT STEPS

The National Science Foundation has awarded UMCES and UMBC a grant "Enhancing the transdisciplinary research ecosystem for earth and environmental science with dedicated cyberinfrastructure professionals." This will provide the Chesapeake Global Collaboratory an opportunity to hire data scientists and build cyberinfrastructure to support data acquisition, data storage, data management, data integration, data mining, and data visualization.

The State of Maryland is investing in the construction of a new building on the Chesapeake Biological Laboratory campus. This building, the Chesapeake Analytics Collaborative Building, is slated for construction in 2024, and it will provide cyberinfrastructure, meeting spaces, and house data scientists.

UMCES faculty are developing proposals that will be able to take advantage of the Collaboratory.

Finally, a major effort will be made to energize potential Collaboratory funders so that we can accelerate environmental solutions to the vexing issues that face our society. UMCES is the right place with the right people to lead this effort.

ACKNOWLEDGMENTS

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