Chesapeake Community Research Symposium 2024

Session 17: Co-designing solutions to support community resilience in the Chesapeake Bay Watershed

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Applying the COAST Card Transdisciplinary Framework in the Chesapeake Bay Watershed

To address complex socio-environmental challenges, we require advanced and transformative tools that encourage adaptive governance and collaborative actions. The COAST Card framework offers a transdisciplinary approach that combines socio-environmental report cards, system dynamics modeling, and social network analysis. This framework is based on the successful report card framework used in the Chesapeake Bay Watershed and is currently being implemented in different regions of the world, such as the Potomac watershed in the United States, Tokyo Bay and Sekisei Lagoon in Japan, Manila Bay in the Philippines, and the Goa Coast of India.

An inclusive process of developing a theory of change for each study site was also conducted, which includes describing the current situation, identifying what needs to be done, and establishing short- and long-term desired outcomes. This theory of change provides a framework for establishing a shared vision for a sustainable coastal socio-environmental system. Project partners are also producing various training materials, including edX Professional Certificates and a handbook on stakeholder engagement.

In the Chesapeake Bay, the COAST Card project has been enhanced by the inclusion of Global Sustainability Scholars who helped develop and implement interactive stakeholder listening sessions across the Watershed. These listening sessions provide an opportunity to gather input from a diverse range of stakeholders on their vision, prioritized actions, potential indicators, values and threats, and existing and desired partners. The theory of change and vision for the Chesapeake Bay is also continually being developed through these listening sessions.

Our Listening Sessions revealed that although priorities may vary, core values are interconnected. Therefore, a comprehensive and inclusive approach is necessary to guide decision-making. Emphasis on co-designing solutions and co-producing knowledge creates opportunities to connect and engage with stakeholders, giving credibility and legitimacy to the process, and resulting in better buy-in and a more significant impact.

Claire Welty, Benjamin Zaitchik, Ken Davis, James Hunter, Darryn Waugh, Antonia Hadjimichael, Tonya Sanders-Thach, and the BSEC Team

The Baltimore Social-Environmental Collaborative (BSEC) seeks a new paradigm for urban climate research. It is a people-centered, transdisciplinary initiative to co-generate the

knowledge needed for equitable pathways for Baltimore under climate change. BSEC begins with community priorities (human health and safety, affordable energy, transportation equity, and others) and city government priorities (clean waterways, decarbonization, functioning infrastructure) and designs observation networks and models that will deliver the climate science capable of supporting those priorities. This means that BSEC takes the form of an iterative collaborative cycle, in which an initial observation and modeling strategy is continuously updated in conversation with community partners. The guiding objective of this cycle is to produce the urban climate science needed to inform community-guided “potential equitable pathways” for climate action. In doing so, we address a number of fundamental urban science questions from across natural science and social science disciplines.

Lili Badri, Vanessa Vargas-Nguyen, Bill Dennison, Sidney Anderson, Veronica Lucchese, Joseph Edgerton, Kameryn Overton

Enhancing Socio-Environmental Assessments through Community Listening Sessions in the Potomac Watershed

Community stakeholder engagement through listening sessions allows members of the public to voice their socio-environmental concerns and to speak with experts about how their concerns can be addressed. Community stakeholders understand the nuances of their local area and can provide greater insight into the problems they face. For the socio-environmental assessment of the Potomac River and Watershed, a series of listening sessions were held in public spaces across the watershed, where community members could engage in thoughtful conversations and activities. Participants were asked to identify their environmental values and concerns, think about existing or missing methods of measuring the status of those concerns, and examine how different concerns might be linked together. A diverse array of responses was recorded, yet there were notable similarities in identified values and concerns across the various locations. Common values across sites fell into the following categories: environmental, aesthetic, and recreation. Common concerns were typically more broad and focused on human actions. Stakeholders also identified new indicators focused more on flooding, suggesting a need for analyses on climate change adaptation. Such engagement allows for community trust building, a deeper understanding of the needs of a community, and effective co-creation of socio-environmental assessments.

Leah Staub, Andrew Sekellick, Tristan Mohs

Assessing water quality conditions in vulnerable communities in the Chesapeake Bay watershed

The conditions that affect public health often disproportionately impact specific communities due to a history of neglect and marginalization. Factors such as poverty, minority status, housing, and access to transportation are known to impact human suffering and financial loss during a disaster, but links between social vulnerability and the water quality conditions that can negatively impact public health are less clear. Excessive nutrients in streams and water bodies

can lead to harmful algal blooms, drinking-water issues, and other negative effects. To investigate whether social vulnerability is correlated with water quality, we use a social vulnerability index (SVI) from the Centers for Disease Control to identify vulnerable communities in conjunction with an existing SPAtially Referenced Regression on Watershed attributes (SPARROW) water quality model developed for the Chesapeake Bay watershed. Estimates of annual average nitrogen, phosphorus, and sediment loads based on 2012 conditions at more than 85,000 stream reaches were compared with select SVI risk factors for 2014 suggest a possible relationship between estimated in-stream loads and social vulnerability metrics. Areas of the Chesapeake Bay watershed were identified with among the top 10% in percent minority population, the top 10% in percent of population with limited English language proficiency, as well as areas with both vulnerability factors present. Preliminary analysis suggests that there is a significant difference ($p < 0.01$) in predicted nutrient loads between these groups and other areas of the watershed.
With enduring historical influences, present-day challenges, and anticipated future effects from climate change, identifying and addressing environmental justice issues is a priority topic that is outlined in the Executive Order to Revitalize Our Nation's Commitment to Environmental Justice for All and other federal initiatives. Improving our understanding of how water quality varies across different communities can help managers target nutrient mitigation and monitoring efforts in an equitable way.

Alisha Yee Chan

Displacement of Racially and Ethnically Minoritized Groups after the Installation of Stormwater Control Measures

Stormwater control measures such as green infrastructure are advantageous methods of stormwater management. However, urban greening may be associated with gentrification, displacing racially/ethnically minoritized groups due to increased housing costs and loss of feelings of belonging. We studied displacement of racially/ethnically minorities after SCM installation in Washington, DC. We compared the change in percentage of persons in racial/ethnic groups at the Census block group level with varying levels of SCM installation. We stratified findings by SCM type, pre-installation income, and SCM size. DC installed a higher density of SCMs in areas with a higher percentage of Black and/or Hispanic/Latino residents. Nonetheless, findings suggest SCM installation is associated with displacement of Black residents. The percentage of residents who are Black decreased by 2.2% [95% Confidence Interval: 1.7, 2.7] and 4.1% [95% Confidence Interval: 3.4, 4.8] after low and high levels of SCM installation, respectively. In turn, the change in percentage of residents who are White increased with increasing levels of SCM installation. Compared to ecological studies on SCMs, studies about social impacts are scarce. This research intends to help optimize SCM installations so more residents can enjoy their health, economic, and ecological benefits.

Veronica Malabanan Lucchese

Tackling inequity: web scraping for social network analysis on the Patuxent River Watershed

The Patuxent River Watershed (PRW) faces sustainability challenges due to increasing populations and expanding agriculture and urban development. Environmental injustices, including pollution, poor water quality, and a lack of stakeholder inclusion, continue to negatively impact the PRW. To address these issues, improved stakeholder engagement with and inclusion of underrepresented actors in PRW management is critical. Stakeholder listening sessions were held throughout the watershed to better understand who the local stakeholders are and their environmental needs. We also conducted a Social Network Analysis (SNA) of PRW management using RStudio packages dplyr, igraph, and stats. Data were gathered through web scraping of management related documents, webpages, and social media accounts. County government (EIGENV 26.96%), federal government (EIGENV 20.40%), state government (EIGENV 15.54%; BC 61.82%), and nonprofit organizations (EIGENV 11.10%) were identified as the most influential and well-connected using SNA centrality measures. Specific organizations, such as the Maryland Department of Natural Resources (state government), Patuxent River Commission (state government), Washington Suburban Sanitary Commission (government–private partnership), Prince George's County (county government), and Maryland-National Capital Park and Planning Commission (state government), were also identified as influential nodes.The least connected and influential nodes include local government (EIGENV 5.86%), the public (EIGENV 1.86%), federal-state partnerships (EIGENV 1.47%), Indigenous groups (EIGENV 0.83%), academia (EIGENV 0.67%), and international groups (EIGENV 0.16%). Our analysis confirms the dominance of a select few actors in PRW management and the lack of inclusion of marginalized groups, including Indigenous communities. Future PRW social network analyses and surveying should strive to include broader diversity of communities and web resources for a more comprehensive understanding of public opinion.

Nazia Nowshin, Jaleel Shujath, Medyaf Al Rousan, Annabelle Arnold, Lirane Mandjoupa, Mamatha Hanumappa,, JiaJun Xu, Kibria Roman, William Hare, Hongmei Dang, . Harris Trobman, Hossain Azam

Sustainable Urban Agriculture in the Chesapeake Watershed: The Triple-Yield System

Urbanization and population growth are causing resource strain, and urban development impacts environmental resiliency. Urban and peri-urban agricultural production is threatened by competition over land use, increasing profitability of solar farming, and rising demand for renewable energy farming in urban areas. Combining agricultural production and rainwater harvesting with solar energy production can protect ecosystems and ensure sustainable synergy. Implementing such innovative agricultural systems can help build community and environmental resiliencies. We have developed a triple-yield (food, water, and energy) system incorporating solar panels and cisterns into an agricultural system to capture energy and water while producing high-value specialty crops in protected microclimates. We hypothesize that

such a system is feasible in urban areas by using solar energy to pump water for drip irrigation and cisterns to collect rainwater from the panel surfaces. This system includes four treatment groups with six replicate plots: 30° solar panels, 45° solar panels, 60° solar panels, and no solar panels. A range of crops, predominantly leafy greens, has been grown in the system, including arugula, collard greens, kale, mustard greens, spinach, and Swiss chard. Current field scale experiments determine overall productivity with respect to the different conditions. Ongoing data collections include plant size and health, solar energy collection in kWh/m2, and rainwater collection quantity. Results indicate that the crops grow best beneath the panels, particularly the 30° and 45° solar panels, and that the 30° solar panels capture the most solar energy and rainwater. Thus, our research incorporates natural elements such as sustainable agriculture, water reuse, and canopy shading into the popular practice of solar farming to decrease land competition while meeting increasing resource demand.

Adrienne Hobbins

Data-driven decision making: a Central Pennsylvania case study on delisting agriculturally impaired streams and improving ecosystem resilience

This presentation will explore how high-resolution data created by Chesapeake Conservancy has been leveraged by on-the-ground professionals in central Pennsylvania to implement restoration practices to improve local water quality and increase ecosystem resilience. The central PA restoration partnership has paired data-driven decision making and local on-the-ground partner knowledge to identify small agriculturally degraded watersheds where streams could be removed from the federal impaired waterways list by 2030. This talk will review how the partnership will achieve short (farm economy), medium (stream delisting), and long term (ecosystem/climate resilience) goals of its stakeholders and review progress metrics to-date.

Tom Ihde

Reflecting on the paradigm – is the science community able to provide the necessary information to rigorously evaluate the benefits of living shoreline implementations?

Living shoreline implementations are expensive in both time and limited resources. Planning, permitting, and implementation must be carefully choreographed, and well-planned projects may never break ground for a variety of reasons. Attempting to evaluate the impacts of such projects adds another layer of difficulty. Yet, we must accomplish this task with care and scientific rigor if we are to fully comprehend and share the multi-dimensional benefits of these costly societal investments with their stakeholders and the wider community of practitioners and scientists. Existing evaluations of living shoreline approaches are too often limited to unidimensional observations over limited timeframes and poorly controlled implementation sites. Current funding mechanisms are generally inadequate to allow for rigorous scientific evaluation of the full range of benefits that natural designs for coastal shoreline protection may provide.

In this presentation, comparisons will be made, and lessons learned will be discussed from unrelated restoration efforts in other habitats. Recommendations for an improved paradigm of living shoreline implementation will be made for both funding agencies and coastal scientists.

John Wolf

Virtual Crisfield – Climate Communication and 3D Visualization

Crisfield is a waterfront town on the eastern shore of the state of Maryland with a history of nature tourism and a thriving seafood industry. Unfortunately, Crisfield's geographic setting makes it particularly susceptible to the effects of climate change, including impacts from sea level rise and coastal flooding. As a result, Crisfield is now the focus of multiple coastal resiliency planning efforts.

Three-dimensional landscape modeling provides an innovative approach to incorporate temporal and spatial considerations into community-based resiliency planning. It can provide a common, visual platform for evaluating impacts that resonate with both scientific and general audiences.

This presentation will describe an approach for developing science communication products illustrating potential impacts of coastal flooding to local stakeholders by leveraging high-resolution elevation data, imagery, and flood model outputs. These data can then be used in conjunction with local environmental and socioeconomic data to communicate impacts and potential co-benefits of natural and other adaptation strategies.

A "digital twin" of Crisfield has been created to help evaluate alternative scenarios using GIS software and local knowledge of important community assets. Three-dimensional (3D) web scenes have been integrated into an interactive web application/story map and a complementary immersive experience accessible through virtual reality. The resulting products can be used in local climate change visioning efforts to communicate risk, vulnerability, and mitigation scenarios to a range of stakeholder groups.

Sidney Anderson

Creating a Community Vision to Enable Lasting Change

Active community participation is key to environmental decision-making and creating effective, lasting change. Through a series of exercises at listening sessions throughout the Potomac River Watershed, participants identified characteristics of a sustainable community that they hope to see in the future. They also provided specific actions that could help achieve that vision, which allow decision-makers to consider what changes community members would be willing to make to support sustainability and resiliency. By including community members in the process of assessment creation and decision-making, we can ensure that the work being done is relevant and applicable to that specific community. Every community is different and solutions

that work in one area may not work in another; despite these differences, communities are concerned about similar issues and–most importantly–are willing to support change that will have a lasting impact for future generations. Across all locations, residents identified water quality, air quality, sustainable development, recreation, recycling, flood reduction, and social unity as characteristics they would like to see improved in the future. These types of collaborative activities allow researchers to understand current community concerns and characteristics and use the goals for the future to identify specific actions that could contribute to meeting those goals.

Bryan Bay

A Resilient South County

A Resilient South County is a Virginia Tech Architectural Thesis that focuses on sea level rise and the Shady Side Peninsula in the year 2100. It dives into what the area will look like based on various predictions, how we might adapt it both through infrastructure and planning projects, and how it could lead the way for small towns and communities across the Chesapeake Bay in an uncertain future.

The project proposes an education center and infrastructure project centered around Franklin Point State Park that creates a new way of managing water, inspired from precedents such as Venice, New Orleans, and Rotterdam (and the greater Delta Works project). The project implements numerous strategies across the region; pairing resiliency infrastructure with bike paths and roads, promoting targeted marsh creep to higher elevations, selective abandonment of built spaces, and zoning that promotes smart density. The project represents an idea of how one of the most at-risk populations can adapt and envision a resilient future.

This project is the start of the Chesapeake Project, which is a non-profit in the process of being created. An organization with the mission to help small towns and communities thrive in the adverse future ahead, to promote every idea and person equally, to make every voice heard, every party equal. Our goal is to educate and advise those at risk of the tools at their disposal so they can come to their own conclusions, with the goal to not force change but help aid change to those who want it.