# Climate Science Needs

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CRWG Meeting

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# Current CRWG Climate Science Needs- Carbon Related

| Need | Engaged Resources | Potential Resources | Other Outcomes |
|---|---|---|---|
| Completed: Evaluation of science needs to implement blue carbon financing strategies | GIT Funding: FY19 GIT-Funded Finance Coaching hours | - STAC Workshops<br>- C-StREAM Internship | Fish Habitat / Forage Fish / SAV / Wetlands |
| Quantification of carbon sequestration from tidal wetlands and submerged aquatic vegetation (SAV) and potential application of conservation and restoration efforts of these resources in the carbon market<br><br>*Re-evaluate to include other nature-based practices (e.g., forest buffers) and how to quantify progress towards reducing carbon in the atmosphere. | | - EPA ROAR Funding | |

# Current CRWG Climate Science Needs- Habitat & Living Resources Related

| Need | Engaged Resources | Potential Resources | Other Outcomes |
|---|---|---|---|
| Changing climate conditions and their impacts on SAV | STAR FY20 GIT-funded project, "Modeling climate impacts on SAV in Chesapeake Bay" | State of Maryland: Maryland effort testing SAV module with SLAMM | SAV / Water Quality Standards Attainment and Monitoring |
| Climate impacts to key aquatic fish species abundance, life cycle and habitat | FY20 GIT-Funded project, Forage Indicator Development: Using Environmental Drivers to Assess Forage Status<br>VIMS: Vulnerability of oyster aquaculture and restoration to ocean acidification and other co-stressors in the Chesapeake Bay<br>NOAA Northeast Habitat Climate Vulnerability Assessment | STAC water temperature workshop / GIT 2 - Mid-Atlantic Panel on Aquatic Invasive Species | Fish Habitat |
| Better understanding of sea level rise and subsidence impacts related to wetland loss, marsh migration, and adjacent land use considerations | GIT Funding: FY20 GIT-Funded project, "Synthesis of Shoreline, Sea Level Rise, and Marsh Migration Data for Wetland Restoration Targeting" (Lead: Wetland Workgroup, Consulting: CRWG) | USGS potentially incorporating into new plan USGS Chesapeake Bay integrated science project / VIMS: Marsh migration efforts /Healthy Watersheds Assessment | Submerged Aquatic Vegetation (SAV) / Water Quality Standards Attainment and Monitoring / Wetlands |

# Current CRWG Climate Science Need- BMP & Stormwater Related

| Need | Engaged Resources | Potential Resources | Other Outcomes |
|---|---|---|---|
| Data and research needs for impacts of SLR, storm surge, increased temperatures, extreme precipitation events and saltwater inundation on BMP climate resilience | STAC-funded climate science synthesis project (Virginia Tech) – assessing climate resilience of urban, ag, and natural BMPs/ NOAA-EPA Inter-Agency Agreement Funding (Virginia Tech) – assessing climate change impacts to tidal water BMPs with habitat/fish co-benefits/ Chesapeake Stormwater Network-EPA Cooperative Agreement – climate vulnerability analysis of urban stormwater BMPs | STAC workshop on the enhancement of data collection and assessment needs for the monitoring network/ NRCS study on Conowago superstation sediment load reduction study/ UMD tool to assess climate resilience of green infrastructure for the Chesapeake Bay region | 2025 WIPs / Water Quality Standards Attainment and Monitoring |
| Better understanding of precipitation changes with regards to intensity, annual amounts, seasonal impacts, storm events and stormwater management | UC-Irvine: Nonstationary precipitation intensity-duration-frequency curves for infrastructure design in a changing climate/ ODU: Next-Generation Rainfall IDF Curves for the Virginian Drainage Area of Chesapeake Bay/ UMD: Changing Precipitation Patterns on Maryland's Eastern Shore/ RAND Corporation: Piloting the development of probabilistic intensity duration frequency (IDF)curves for the Chesapeake Bay watershed/ Tetra Tech: Climate Impacts to Restoration Practices | Cornell University: Cornell research with CBP (modeling work group) | Stream Health / Water Quality Standards Attainment and Monitoring |

# Current CRWG Climate Science Need- Shoreline Hardening Related

| Need | Engaged Resources | Potential Resources | Other Outcomes |
|---|---|---|---|
| Better understanding of green infrastructure (e.g., living shorelines) performance in building resilience to climate change impacts, cost-effectiveness of these strategies, and potential unintended consequences to other restoration metrics | | NOAA Chesapeake Bay Office (NCBO): Lessons learned from Middle Penninsula resilience-related efforts supported by NCBO and partners (i.e., metrics for living shorelines) | Water Quality Standards Attainment and Monitoring |
| Effective designs for combining gray-green infrastructure approaches | | | Fish Habitat / Forest Buffers / Submerged Aquatic Vegetation (SAV) / Water Quality Standards Attainment and Monitoring / Wetlands |

# Current CRWG Climate Science Need- Other Needs

| Need | Engaged Resources | Potential Resources | Other Outcomes |
|---|---|---|---|
| Social Science - human behavior - implications of the human response (positive and negative) to climate change, flooding, sea level rise as well as motivation and needs of communities to adapt | GIT Funding: FY20 GIT-Funded project, "Chesapeake Bay Program Social Science Assessment and Integration Road Map Development" | | All |
| Method/metrics to track climate resilience progress related to Chesapeake Bay Watershed Agreement goals | | EPA - EnviroAtlas Team/ EPA ORD ROAR project | |
| Establishment of an Ocean Acidification Monitoring Network. | | | |

# Identified CRWG Climate Science Need- PSC Monitoring Report Related

| Need | Engaged Resources | Potential Resources | Other Outcomes |
|---|---|---|---|
| Develop a suitable ocean acidification monitoring design and sampling strategy Bay-wide. Include assessment of discrepancies among methods between states and provide suggestions to align methods and outputs to support a regionally consistent story about ocean acidification measurements and effects. | | | |
| Research on improving our knowledge of carbon stock changes from sea level rise pertaining to marsh drowning and erosion and landscape conversions (e.g., mature forest to new marshland). | | | |

# Identified CRWG Climate Science Needs- Indicator Needs

| Need | Engaged Resources | Potential Resources | Other Outcomes |
|---|---|---|---|
| Development of an extreme temperature indicator as it relates to urban tree canopy in underserved communities | | | |
| Identify indicator focused on either river or coastal flooding as it relates to community resilience | | | |

# Identified CRWG Climate Science Needs- BMP Related

| Need | Engaged Resources | Potential Resources | Other Outcomes |
|---|---|---|---|
| Climate forecasting and scenarios at spatial and temporal scales needed to inform decision making. | | EPA Request For Applications (RFA) | *Need to check with WQGIT for specifics |
| Research and modeling studies on how climate change impacts runoff processes. | | | |
| A better understanding of how climate change influences landscape management particularly for agricultural production is critical. | | | |
| Research to help inform the selection, design and siting of cost-effective BMPs that are resilient to anticipated long-term changes in hydroclimatic conditions | | | |

# Identified CRWG Climate Science Needs- BMP Related

| Need | Engaged Resources | Potential Resources | Other Outcomes |
|---|---|---|---|
| Need for additional studies that evaluate the influence of climate factors on BMP performance | | | *Need to check with WQGIT for specifics |
| Social science research that includes social and environmental justice within the lens to understand the benefits or potential impacts of large scale BMP implementation for more than water quality benefits alone. | | | |
| Modeling studies that assess the performance of one or more BMPs under future climate conditions and consider short-or medium-term growth projections in coordination with BMP modeling to assess impacts to loads and BMP effectiveness | | | |

# Identified CRWG Climate Science Needs- STAC Rising Water Temperature Related

| Need | Engaged Resources | Potential Resources | Other Outcomes |
|---|---|---|---|
| Determining temperature and oxygen thresholds for Striped Bass and other key fish species in the Bay<br>*Should we refine to incorporate climate considerations | | | Fish and Habitat GITs/ Fish Habitat Action Team |
| Develop habitat suitability models and indicators for key fishery resources. | | | Fish and Habitat GITs |
| Communication research focusing on where there are gaps in current communication strategies around rising Chesapeake Bay water temperatures. | | | Fish GIT/ CBP Strategic Engagement Team |
| Improve environmental monitoring of surface and bottom temperature, dissolved oxygen and fish habitat condition. | | | |
| Explore a state of ecosystem report level synthesis for the Chesapeake Bay to track how climate change is progressing in relation to fisheries and SAV | | NOAA Chesapeake Bay Office | Fish GIT, SAV Workgroup |

# Identified CRWG Climate Science Needs- STAC Rising Water Temperature Related

| Need | Engaged Resources | Potential Resources | Other Outcomes |
|---|---|---|---|
| Explore assessments for emerging fisheries to facilitate management as climate change creates conditions for these fisheries to be economically viable. | | | Fish GIT |
| Develop a monitoring plan to monitor long-term changes in environmental conditions affected by climate change factors where there are significant fisheries habitat and spawning grounds (long-term monitoring currently is more set up to characterize large bay segments).<br>*Language was refined to incorporate climate considerations | | | |
| Evaluate need for zooplankton monitoring at spawning and nursery areas.<br>*Refine to incorporate climate considerations as it relates to phenological shifts and changes in predator/prey dynamics | | | |

# Identified CRWG Climate Science Needs- STAC Rising Water Temperature Related

| Need | Engaged Resources | Potential Resources | Other Outcomes |
|---|---|---|---|
| Review current definitions of marine heat waves (e.g. Hobday et al. 2016, Mazzini and Pianca, 2022) and conduct research to determine an appropriate definition for Chesapeake Bay (or tributaries as appropriate | | | |
| Explore real time monitoring of marine heat waves and need for forecast products. | | | |
| Consider a marine heat wave indicator that connects with living resource management and guidance to the public. | | | |
| Development of the warning system, which includes public outreach to understand and incorporate stakeholder needs | | | |

# Identified CRWG Climate Science Needs- STAC Rising Water Temperature Related

| Need | Engaged Resources | Potential Resources | Other Outcomes |
|---|---|---|---|
| Detailed analysis of costs of natural infrastructure versus hardened infrastructure (e.g. bulkhead, rip rap) including long term maintenance costs. | | | |
| Threshold analysis to determine when ecological impacts or benefits occur from natural infrastructure implementation. | | | |
| Development of criteria for targeting where multiple benefits and ecosystem services can be optimized. | | | |
| Use of models to increase understanding of habitat change from sea level rise as to leverage change for different restoration efforts (subtidal oysters versus intertidal). | | | |
| Development of pilot studies co-locating SAV and oysters to increase understanding of the synergistic benefits | | | |