**Climate Resiliency Workgroup In-Person Meeting**
**Cross-Workgroup Meeting**

Monday, January 27, 2020
10:00 AM – 3:00 PM

Meeting Materials:
https://www.chesapeakebay.net/what/event/climate_resiliency_workgroup_january_2020_in_person_meeting
CBPO Location: Fish Shack, 410 Severn Ave, Annapolis, MD 21403

**Minutes**

**10:00 AM** **Welcome and Meeting Overview – Co-Chair Mark Bennett (USGS) and Erik Meyers (The Conservation Fund) and Kristin Saunders (UMCES)**

- Connect the climate indicator work to the goals and outcomes and indicator work under healthy watersheds, fish, submerged aquatic vegetation (SAV), wetlands, and forests.
- Strategize which new climate indicators to focus development on to aid workgroups in tracking climate resilience.

**10:10 AM** **Climate Resiliency Goals and Indicator Framework Vision – Julie Reichert-Nguyen (NOAA)**

Julie N. provided an overview of the climate resiliency goals and actions and present on a draft framework for the climate indicator work moving forward.

- Current indicators focus on physical changes. Eventually would like to have indicators related to impacts and progress in implementing resilient policies/practices to address impacts.
- Kevin pointed out that the term "readiness" has a very specific meaning for DOD which is military readiness and it will cause confusion for DOD and army corps.
- Action: Replace "readiness" in proposed climate indicator framework with a different word.

**10:20 AM** **Climate Indicator Status – Cuiyin Wu and Breck Sullivan, CRC**

Cuiyin and Breck informed the workgroups on the status of developed and proposed climate indicators. Nine indicators currently exist and can be found on Chesapeake Progress. Seven are specific to tracking changes related to climate (relative sea level rise, increase in total annual precipitation, upstream flooding magnitude and frequency, stream temperature change, annual and extreme air temperature changes). Two indicators from other workgroups that could be linked to a climate indicator (wetland restored on ag land, acres of restored oyster reefs). ERG report from previously GIT funded project also included 21 additional indicators and information on what is needed to develop.

- Mike commented that upstream river flooding indicators were done at a national scale and then curved out for the Chesapeake Bay region. He can provide another way to customize the river flooding indicator if needed.

**10:40 AM** **Healthy Watersheds – Renee Thompson, USGS and Nora Jackson, CRC**

Renee and Nora presented on climate metrics of interest related to the healthy watershed's goals and outcomes and indicator development. Renee shared Chesapeake Watersheds Assessment which was done on 84,000 catchments, and how it related to the indicator development. The Healthy Watershed developed a Chesapeake Bay watershed health index which includes multiple categories and a lot of the dataset is high resolution land cover data. The GIT chairs identified several additional climate related factors that are not factored in the watershed vulnerability index and health index. Renee talked about how Healthy Watersheds would utilize the climate indicator framework in healthy watershed assessment using brook trout as an example based on 6°C change and locating more resilient areas to ensure protection. Overlay of stream temperature indicator could be used to inform trends (change in stream temperature = change in brook trout habitat). Also sea level rise indicator could assist in evaluating impacts on forests and tidal marshes.

Nora shared preliminary data analysis to evaluate why other areas are not as resilient. Appears that % impervious surfaces in the riparian zone is likely negatively affecting resiliency.

Discussion:

- Wittman pointed out that to answer the question why brook trout is doing well in certain areas and not others, it may be useful to look into each of the watershed catchments as replicates to understand the common attributes which is available through various datasets via statistical analysis. Renee responded that this is HW 2020 GIT funding project which intends to start a pilot project in Maryland to further integrate stream survey data.
- Julie Mawhorter asked what is driving the purple areas (less climate stress). Renee responded that she would need to look into the NALCC climate dataset. Also mentioned that it is not good science to incorporate an index to develop an indicator, so need to pull out information from NALCC dataset and incorporate into a new indicator or just overlay the information.
- Julie M. added that preserving the area that are resilient is also as important as increasing resilience in the areas that are not so resilient. Renee added that it is critical to understand why these areas remain resilient and summarize the management strategies to sustain their resiliency.
- Bruce mentioned other information to identify more resilient areas: Landscape Conservation Cooperatives, Delmarva Conservation Network, Nature Conservancy, Fish and Wildlife Service. Colleen mentioned that

MDNR has green infrastructure layer prioritizing hub and corridors and prioritization for conservation corridors (land conservation climate mapping tool).

- Action: Renee will share brook trout change with 6 degrees layer with Jennifer and CRWG.

**11:10 AM** **Sustainable Fisheries – Morgan Corey, CRC and Mandy Bromilow, NOAA Affiliate**

Morgan presented on behalf of the Fish Habitat Action Team and Mandy for the Forage Action Team on efforts that could inform indicator development, such as the fish habitat suitability study, and current indicator plans related to climate impacts on forage fish.

Morgan talked about the outcomes under Fisheries GIT: blue crab, oysters, Forage, Fish Habitat, and the tools needed to support these outcomes. For fish habitat action team, temperature, precipitation and sea level rise are important factors for fish habitat. Morgan mentioned several ongoing efforts by USGS and CBP GIS team on mapping the habitat.

Mandy talked about the forage action team's interest in developing forage indicators. The indicators the team is developing are vernal warming indicator and habitat suitability index. Vernal Warming Indicator uses a temperature index for the timing of warming water temperatures in the spring. Habitat suitability index will quantify suitable habitat for forage fish and assess the relationship between extent of available habitat and forage abundance. Mandy summarized the climate factors that Fisheries are interested in: Warming water temperatures, freshwater flow/precipitation, salinity regimes, sea level change, SAV composition, shoreline condition change, fish population distribution, harmful algal blooms/phytoplankton.

Discussion:

- Wittman asked for a copy of Ryan Woodland's report on forage and environmental variability (Link)
- Kristin asked if the Fisheries GIT is using the information on Chesapeake Progress to incorporate into the assessment. Mandy and Morgan were not sure if they have used it in the development process. Bruce mentioned that they need datasets that are spatially more explicit. How temperature affects different species at different life stage are very different. Blue crab adapts better under rising temperature. Peter added that spatial resolution and detail will be super helpful for the indicator development.
- Mike asked the target area for the vernal warming, streams or the whole bay, and this information will be helpful when improving the temperature datasets in the future. Bruce did not have the answers for the moment but will keep in mind for future process.

- Bruce also talked about the northeast and shellfish climate vulnerability assessment. NOAA scientists applied a new methodology to assess the climate vulnerability of 82 fish and invertebrate species in the Northeast region. Similar assessments are also underway for the Bering Sea and California Current Ecosystems.
- Julie N. mentioned that there are several ongoing efforts for striped bass and forage fish. She asked if these efforts look into temperature and if these efforts feeds information to each other. Julie N. added that it would be great not to duplicate effort since she is considering putting a GIT funded project for Bay water temperature this year. Peter added that modeling team is running several wide range scenarios including DO, temperature, and salinity regimes - may help explain habitat condition. Results will be discussed during WQGIT Climate Assessment Meeting on Feb 10-11.

**11:40 AM** **Forestry Workgroup – Katherine Brownson, USDA and Julie Mawhorter, USFS**

Katie Brownson and Julie Mawhorter presented information on the urban tree canopy indicator and other indicators of interest related to forests and climate.

Riparian Forest Buffer Outcome: Restore 900 miles per year of riparian forest buffer and conserve existing buffers until at least 70 percent of riparian areas throughout the watershed are forested.

Tree Canopy Outcome: Continually increase urban tree canopy capacity to provide air quality, water quality and habitat benefits throughout the watershed. Expand urban tree canopy by 2,400 acres by 2025.

Katie B. presented several physical stressors that are related to forestry indicators: Average Air Temperature Increases, Change in High Temperature Extremes, Change in Total Annual Precipitation, Relative Sea Level Rise, River Flood Frequency, and River Flood Magnitude. The implications for these physical stressors are: shifting tree species ranges, altered disturbance regimes (wildfire, flooding), longer growing seasons (shifting planting schedules), mortality from late season “flash droughts”, increased pressure from invasive species, disease, pests, and forest loss due to sea level rise and marsh migration.

Possible indicators for resilience and response could include: overlay of tree canopy and urban heat island data to demonstrate priority areas to plant and conserve trees for public health, overlay of forest buffers and high priority aquatic habitat areas, forest diversity (stand age, species composition), forest fragmentation, forest migration corridors (coastal and inland).

Katie B. mentioned during the urban tree canopy summit, Rebecca Hammer recommended us to rethink the current stream temperature monitoring network. Katie demonstrated how Seedlot selection tool can be useful to increase forest climate resiliency.

Discussion:

- Erik recommended to connect the restoration studies to the Delmarva restoration strategies.
- Bruce mentioned the importance of considering species tolerance to changes in migration corridors along with change in temperatures.
- Julie N. mentioned that seasonality would be useful to add to the current climate indicator list given its importance across the different workgroup goals.
- Kristin recommended adding Enviro Atlas to the current resources list for indicator development.
- Adaptive plantings will be important. Need a climate response framework to figure out strategies that are doing well, such as groups being proactive in planting species that do well under changing climate conditions. Kristin mentioned that forestry management
- Colleen mentioned that for indicator of forest diversity, stand diversity and age diversity is our concerned.
- Katie Matta mentioned that she used to work on super fund site restoration work, they would include future climate regime into consideration.
- For forest fragmentation, Katie B. mentioned that the latest work on forest fragmentation in the Chesapeake Bay Watershed is in 2005. Peter added that USGS has a study related to unconventional gas extraction effects on brook trout and bird connections, which could have information to help assess forest fragmentation.

**1:00 PM** **Habitat Goal Implementation Team, Brooke Landry, MDNR (SAV Presentation) and Pam Mason, VIMS (Wetland Presentation)**

Brooke and Pam presented information on the SAV and Wetlands Workgroups' interests related to climate.

Submerged Aquatic Vegetation (SAV) Outcome: Sustain and increase the habitat benefits of SAV (underwater grasses) in the Chesapeake Bay. Achieve and sustain the ultimate outcome of 185,000 acres of SAV Bay wide necessary for a restored Bay. Progress toward this ultimate outcome will be measured against a target of 90,000 acres by 2017 and 130,000 acres by 2025.

Brooke talked about several concerns/indicators regarding climate change:

- Increasing water temperatures and the loss of eelgrass in the southern Bay
- Rain shifts and changes in freshwater flow into the Bay both chronic and acute altering species composition
- Increase in frequency of extreme storms damaging SAV
- Shoreline armoring associated with sea level rise as well as nearshore development) hindering SAV migration
- Pathogens and invasive plants and animals that shift north with the tropicalization of the bay

- Ocean/coastal acidification

Brooke discussed how oligohaline (low salinity) environments can result in more SAV diversity allowing more resilience. However, there has been a dramatic loss in eelgrass associated with climate change and a switch to species that are not as good as eelgrass in high energy environments. Research is looking into genetically modified SAV species to handle temperature increases.

There exists a Chesapeake Bay-wide aerial survey dataset from 1984 from VIMS; just started using citizen science (SAV watchers) to fill in information gaps and allow changes over time to be assessed. Have sentinel sites for SAV – allows more in depth surveys. Overall using a 3-tier approach to acquire SAV data (Bay-wide monitoring via aerial surveys, citizen science to fill gaps, and SAV sentinel sites).

SAV Discussion

- Julie asked if Brooke have tried to introduce SAV species from the southern state such as North Carolina to increase resiliency. Brooke responded yes and there are implications associated with and those plants may not survive the winter coldness. Brooke mentioned there is an ongoing project to study SAV's buffering capacity for ocean acidification.
- Bruce suggested planting species that adapt better in harden shoreline environment.
- Kevin pointed out that SAV is not incorporated in many living shoreline designs because the water clarity does not support it.

Wetland restoration goal is to restore 83,000 acres by 2025. Only have reached 11% of goal (less than 10,000 acres). Federal policy states no net loss of wetlands. Challenge is the variability of management around wetlands – includes regulatory and voluntary actions.

Wetland loss and degradation are influenced by development and climate change (combined impacts result in more adverse effects). Projections of development would be useful to target wetland restoration efforts along with information on climate change impacts (vertical growth, horizontal migration). Wetlands are hydrology-based and influenced by changed in precipitation. Climate impacts will affect tidal and nontidal wetlands differently. Development more of a concern for nontidal wetlands while sea level rise is an issue for tidal wetlands. Also, salinity changes from changes in precipitation are a concern. Tracking wetlands progress (trends/status) needs to be tackled by more than one workgroup. Need to consider that the baseline is changing.

Wetland Discussion

- Katie asked if drone technology helpful in collecting data. Brooke responded that for SAV coordinating the drone monitoring is quite challenging. Pam responded that VIMS uses drones for national wetland condition assessment, which is an important piece for understanding wetland trend and response. Large scale of wetland monitoring using drones is challenging though.
- Erik asked Pam to clarify enhancement goal. Pam explained that the expert panel defined enhancement as habitat change for wetland.
- Renee mentioned two top data needs of land-use workgroup – development extent and trends and hydrology data and models. Contact Peter Claggett for more information. Data could be placed in the format needed.
- Peter Tango asked if survey design instead of indicator would help estimate wetland acreage to deal with uncertainty around wetland estimate. Overall, wetlands need a long-term monitoring strategy.

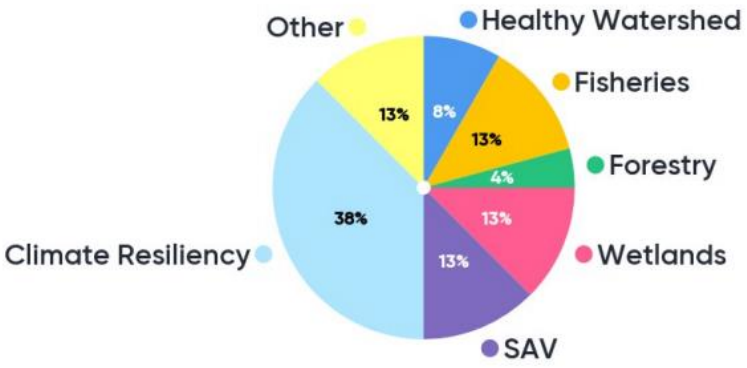
**1:30 PM** **Connecting Indicator Work (Mentimeter) – Kristin Saunders, UMCES**

Kristin lead an interactive activity to relate the workgroups' goals and outcomes with the climate indicators to determine which climate indicators have cross-GIT/workgroup benefits and feasibility to develop within the year.

- Julie asked how the wetland restored on ag land related to climate. Renee responded that wetland migration is important for potential wetland restoration. Erik added it helps mitigate impact from flooding. Emily added that wetland restored on ag land is quite helpful with flooding control.
- Beckie recommended better defining streams and rivers which is quite important for SAV.
- Mike commented that seasonal temperature change should be added.
- Mike added that coastal flooding can be put together easily by EPA.
- Morgan commented that VIMS has some shoreline data available for VA and is working on updating Maryland shoreline data. GIS team may be able to assist.
- Renee mentioned that vulnerability has different meanings to different groups. Also, healthy watersheds tend to be non-tidal; therefore stream temperature change is important.
- Useful resilience indicator could include miles of riparian forest buffer.

## Mentimeter Question Results:

### Which workgroup are you representing (choose one)?

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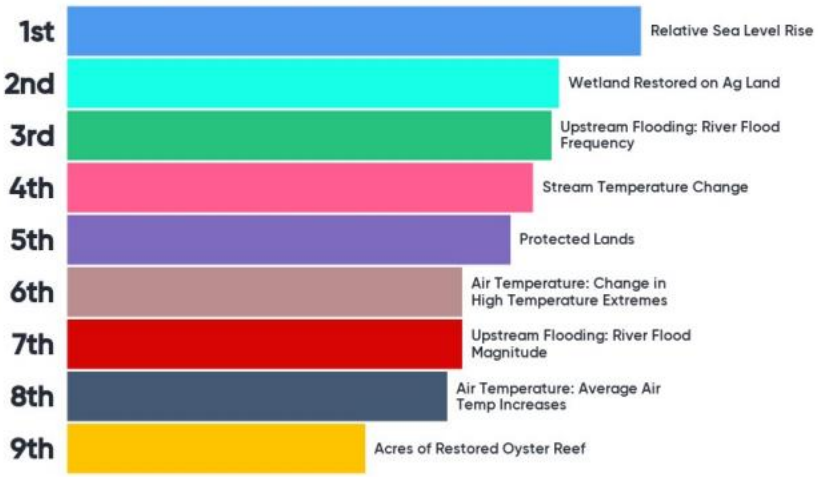
### Rank in order from most to least which ones you think are relevant to your workgroup's goals and outcomes:

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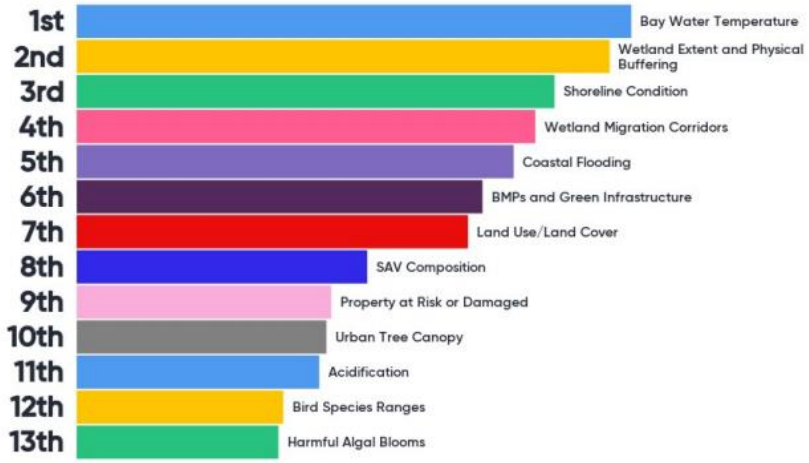
## Rank in order of most to least which indicator you would recommend the CRWG develop

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## List any climate-related indicators not listed previously that you would be interested in (31 responses):

Changes in fish range, distribution, species shifts (new ones moving into bay from south)
Changes in Phenology
Changes in seasonal trends
CR relevancy changes with location
Drought risk?
Economic implications
Extreme precipitation and leadings amount
Forest fragmentation
Increase in sub-tropical species
Invasive species
Invasive species distribution
Invasive species distribution
Invasive species spread
Living shoreline inventory
Marsh mosaics
Oyster reef acreage
Pathogen spread
Pathogens
Repetitive loss properties
Riparian forest buffer coverage
Salinity
Salinity (function of increase precip)
Salinity extremes
Seasonal temperature change (air and/ or water)
Seasonality/phenology shifts
Shoreline loss

Something that addresses the vulnerability of historically underserved communities to climate change
Species diversity
Tracking saltwater intrusion
Vulnerability of multiple habitats to climate factors (riverine and estuarine)
Wildfire risk?

**2:30 PM** **GIS Support Projects – Jake Leizear, Chesapeake Conservancy**

Jake presented on the full cooperative agreement (5 years) between the Chesapeake Conservancy and the Chesapeake Bay Program followed by an initial discussion on what geospatial solutions there are that could support indicator work. Jake talked about the objective 4 of the cooperative agreement between Chesapeake Conservancy which is General Geospatial Support. This is to provide geospatial planning and support to CBP to allow partners to integrate geospatial data into management efforts. He also mentioned examples under objective 4. The Chesapeake Conservancy plans to send out survey to CBP Workgroups to gauge need/interest in geospatial support.

Discussion:

- Jeremy asked if Environ Atlas can be incorporated in this dataset. Jake responded they start with top 5 Bay specific goals. Jeremy added that Enviro Atlas will be helpful to fill the data gaps.
- Julie asked where the products will be housed. Jake responded that this open data will be housed either at Open Data website or the Conservancy website.
- Kristin pointed out that it would be helpful to remind people regarding how GIS can help their work. Jake responded that Conservancy team is coordinating with survey craft question in a way that don't involve with making maps. Meeting participants mentioned that high resolution forest cover (beyond satellite data) and maps showing where water will flow will be useful.
- Mike asked how EJ Chesapeake and EJ screen are different from each other. Jake responded that John Wolf is leading this effort at the Bay Program. He added that two versions have different interested parameters.
- Breck asked when the BMP mapping throughout the entire watershed will be completed. Jake responded that they anticipate the first version to be completed by fall 2020, and pointed out that this is a multi-year cooperative agreement.

**2:55 PM** **Announcements – Julie Reichert-Nguyen, (NOAA)**

- Climate Resiliency Workgroup internship announcements. Please share with your networks.
    - NOAA Chesapeake Bay Summer Internship Program in partnership with the Chesapeake Research Consortium (applications due February 20, 2020): Climate Change Indicator Development Support
    - C-StREAM (applications due February 15, 2020): GIS Analysis of Flooding and Sea Level Rise Impacts on Land Use and Communities
- STAC proposal ideas due February 10, 2020 – CRWG decided not to submit a proposal this year and instead work on a proposal for next year allowing time to assess recommendations from previous reports.

**3:00 PM** **Meeting Adjourn**

**Next Meeting:** February 18, 2020

**Meeting Participants:**

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|---|---|
| Briana Nancy | Katie Matta |
| Beckie Golden | Katie McClure |
| Brooke Landry | Kaycee Coleman |
| Bruce Vogt | Kevin Du Bois |
| Carrie Kennedy | Kristin Sanders |
| Cassandra Davis | Lindsay Byron |
| Colleen Kenny | Lisa Wainger |
| Cuiyin Wu | Mandy Bromilow |
| Dave Goerman | Mark Bennett |
| Emily Trentacoste | Melissa Deas |
| Erik Myers | Mike Kolian |
| Jackie Specht | Morgan Corey |
| Jake Leizear | Nicole Carlozo |
| Jennifer Greiner | Nora Jackson |
| Jim George | Peter Tango |
| Joe Winters | Rebecca Chillrud |
| Juliana Greenberg | Renee Thompson |
| Julie Mawhorter | Sarah Widman |
| Julie Reichert-Nguyen | Taryn Sudol |
| Katie Brownson | Tyler Mckee |
| Katie Dyer | Wittman Miller |