Climate Change Impacts of Most Concern for CB Agreement Goal & Outcome Attainment

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Chesapeake Bay Program
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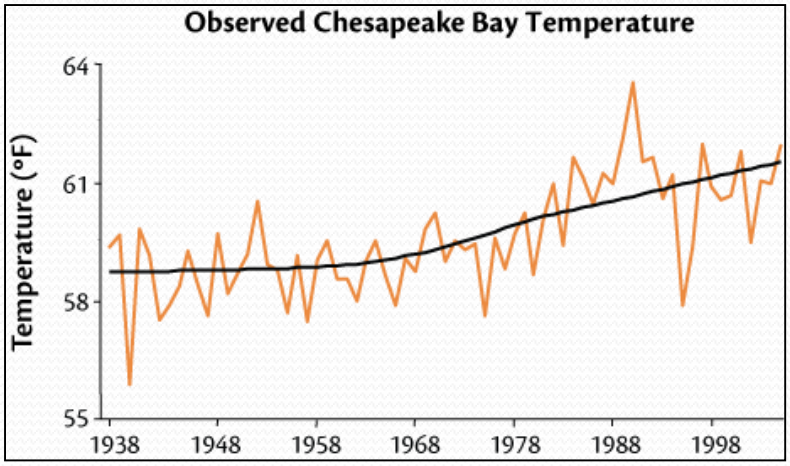
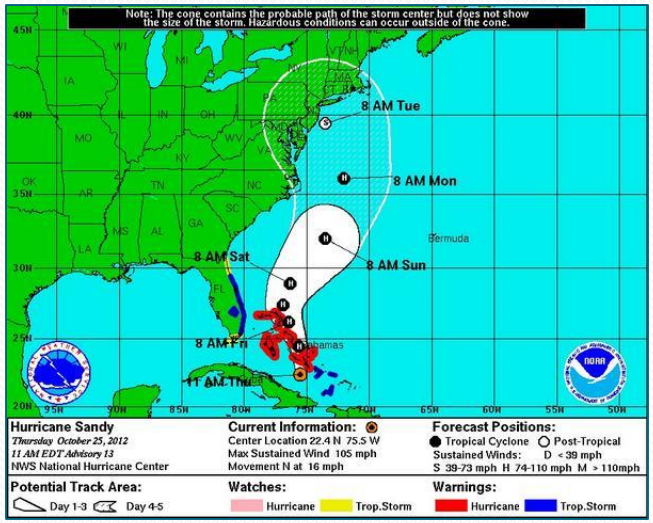
Climate Change: Real Consequences

Sea level has risen approximately one-foot in the last century.



Chesapeake Bay has warmed by more than 2°F.

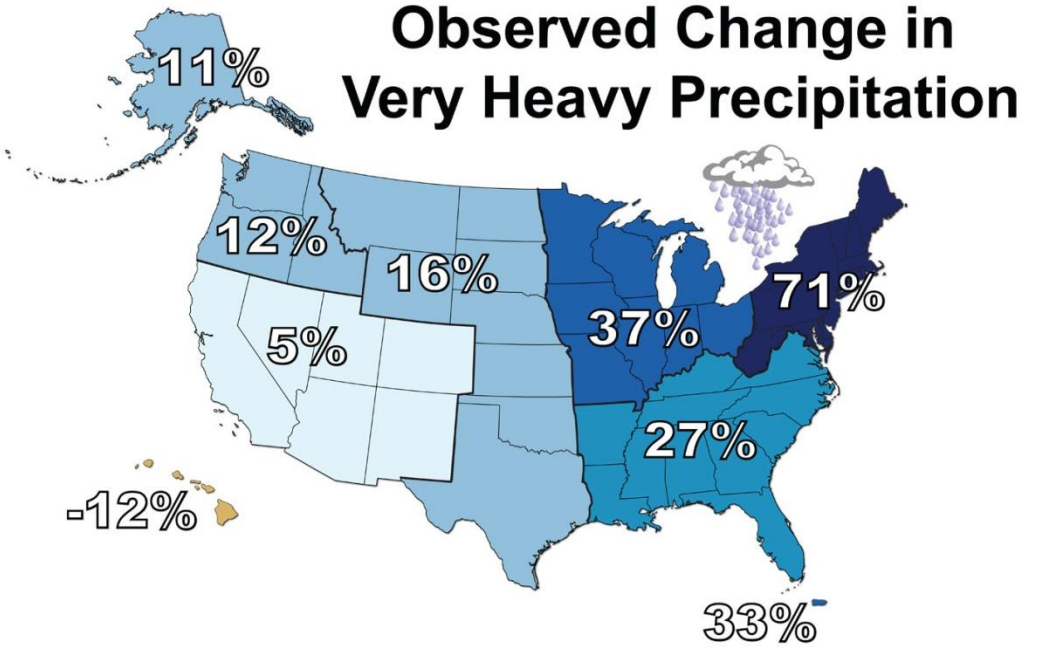


Extreme Events, such as Hurricane Sandy in 2012, foreshadow the Watersheds vulnerability to climate change impacts.

Source: www.umces.edu/climateimpacts/

Increased Precipitation & Extreme Rainfall Events

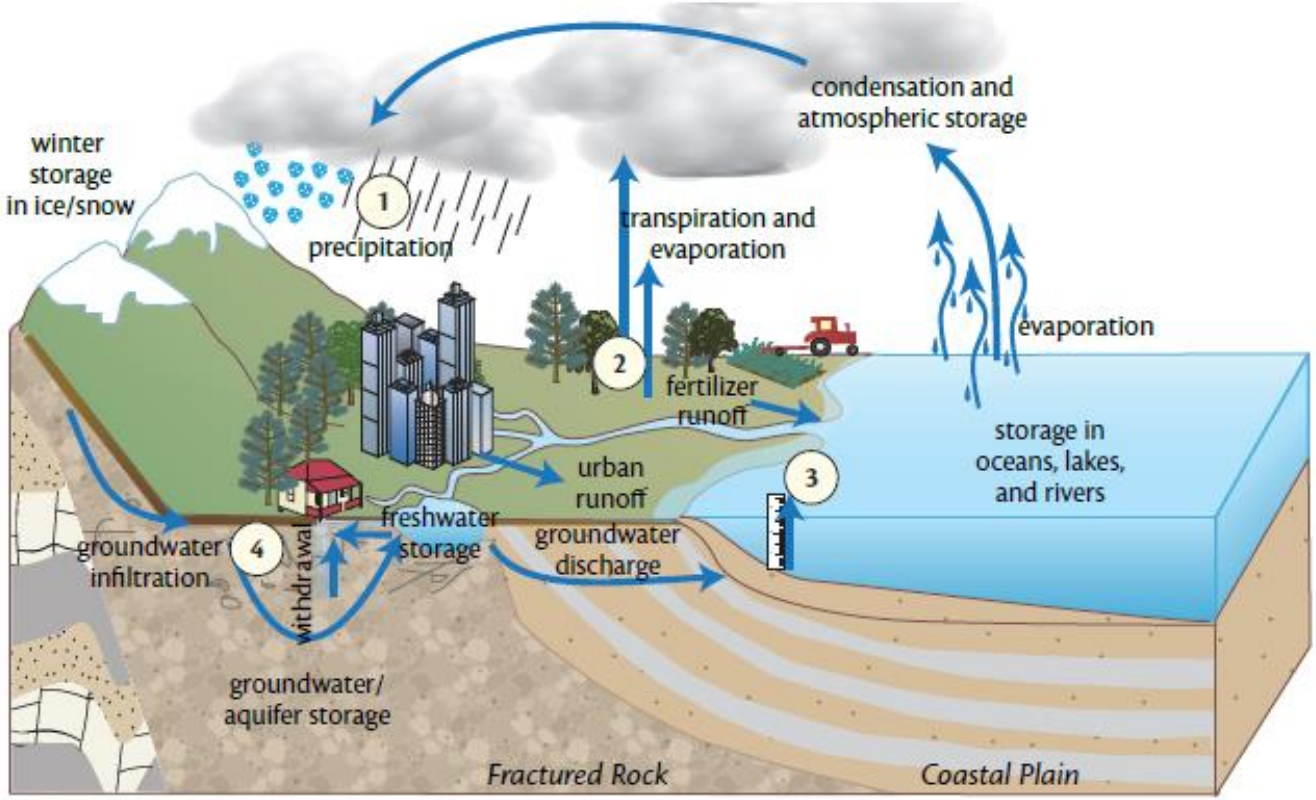
There is a clear national trend toward a greater amount of precipitation being concentrated in very heavy events, particularly in the Northeast and Midwest.



Percent changes in the amount of precipitation falling in very heavy events (the heaviest 1%) from 1958 to 2012 for each region.

Source: National Climate Assessment (2014)

Consequences - Changes to Water Supply



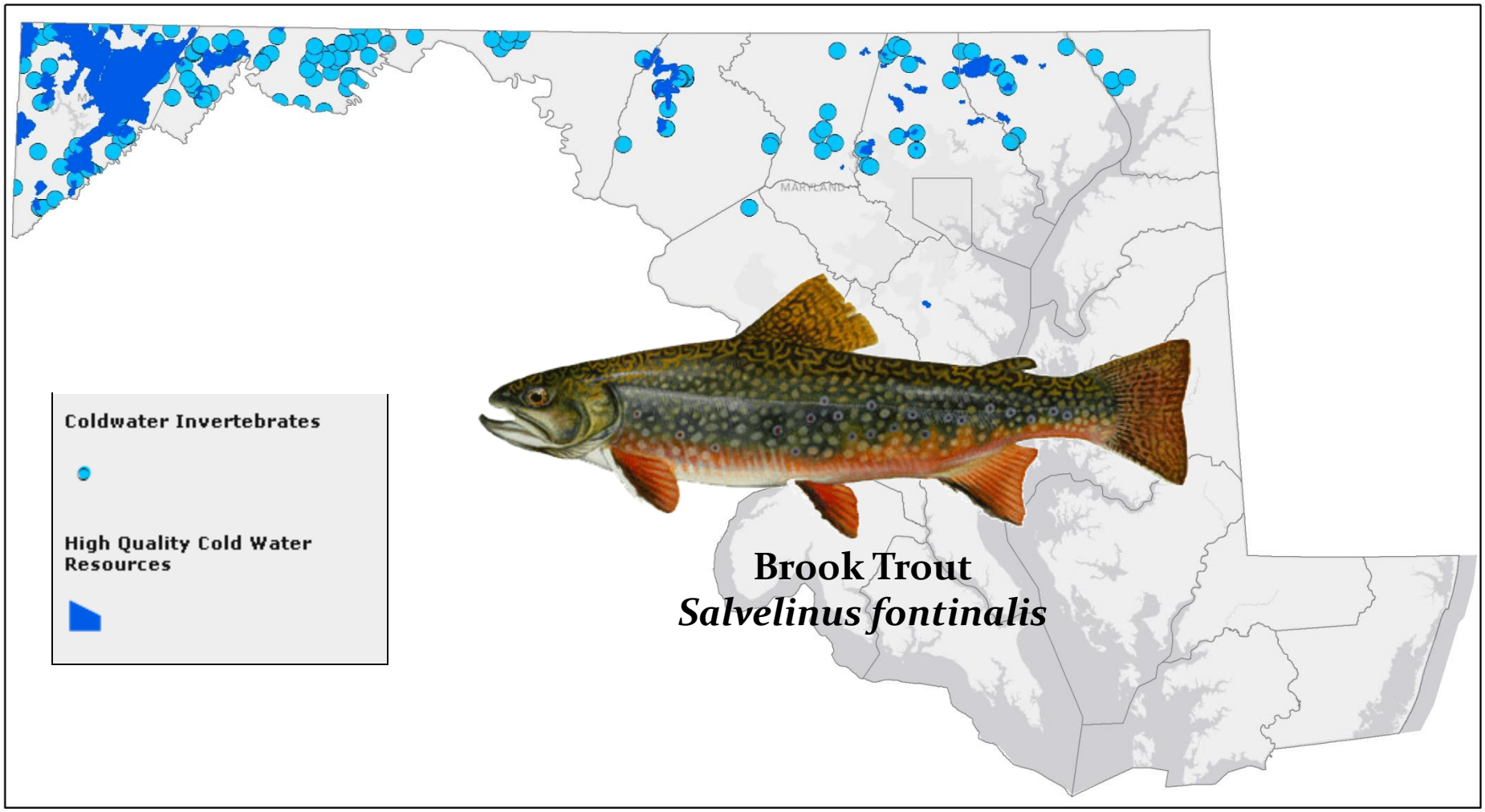
Climate change impacts

1. Increased frequency and variability of extreme rain may lead to flooding, surface runoff, and high energy flows, impacting water quality, stormwater infrastructure, and water and wastewater treatment infrastructure.
2. Increased likelihood of summer drought may affect stream ecosystems, lead to increased demand for irrigation, and result in water shortages.
3. Saline intrusion of freshwater resources may occur as a result of the combined effects of sea level rise and storm surge, and as a result of increased rates of groundwater withdrawal.
4. Increased withdrawal due to drought may reduce groundwater supplies.

Source: www.umces.edu/climateimpacts/

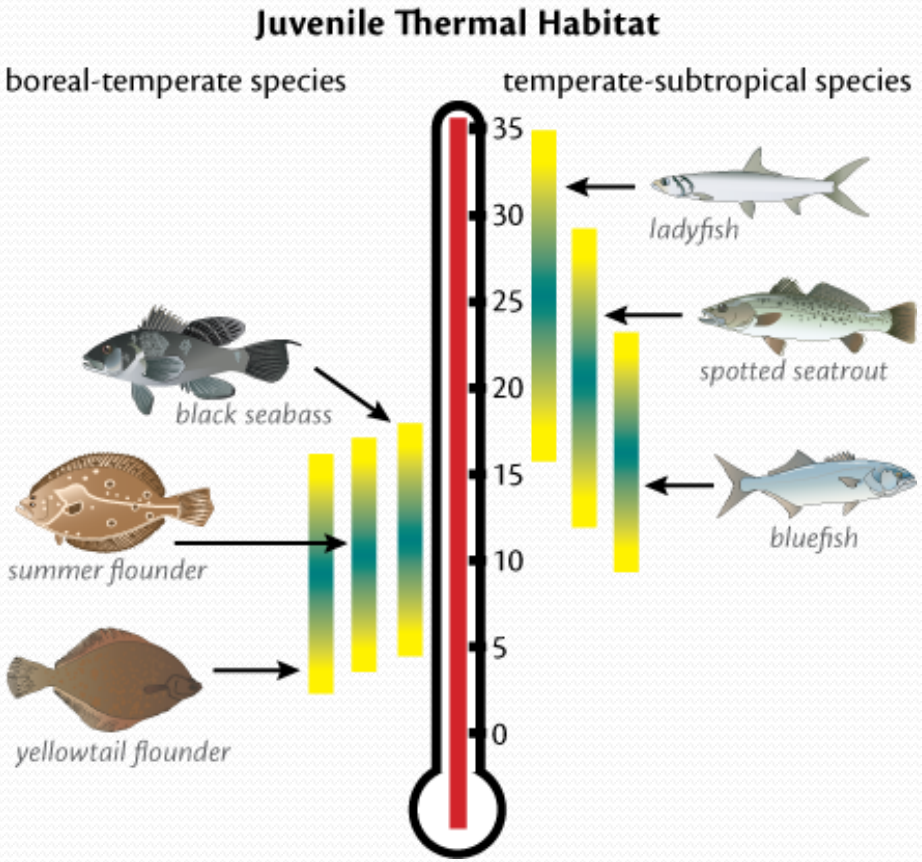
Consequence: Increased stormwater discharge

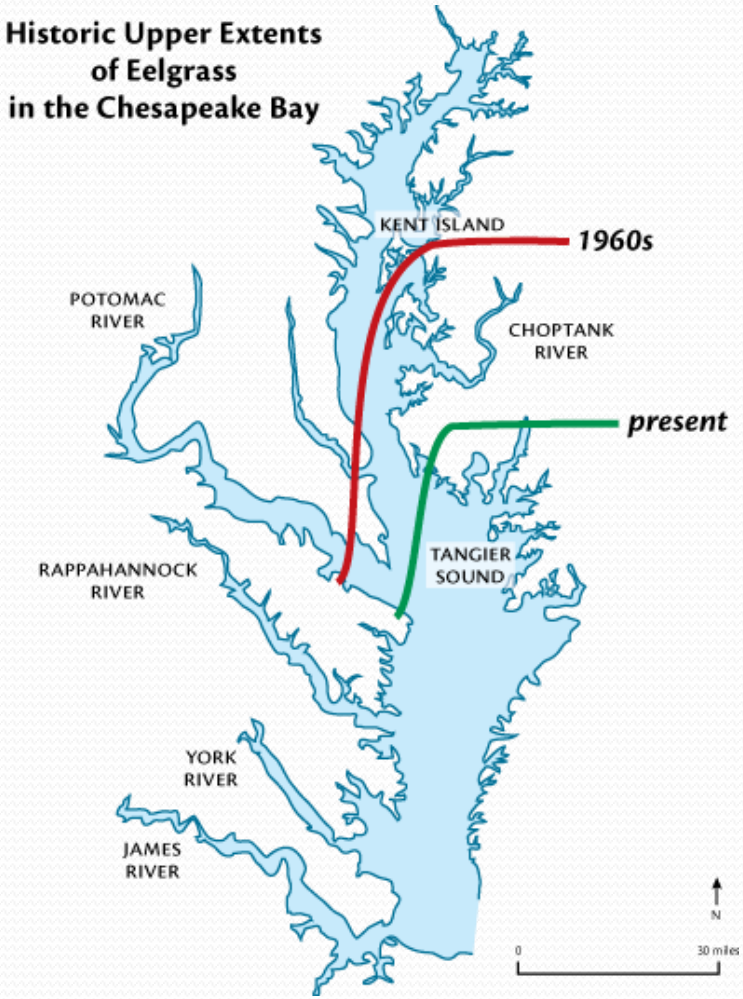
Consequences – Impacts to High Quality Cold Water Resource Areas



Source: Maryland Dept. of Natural Resources

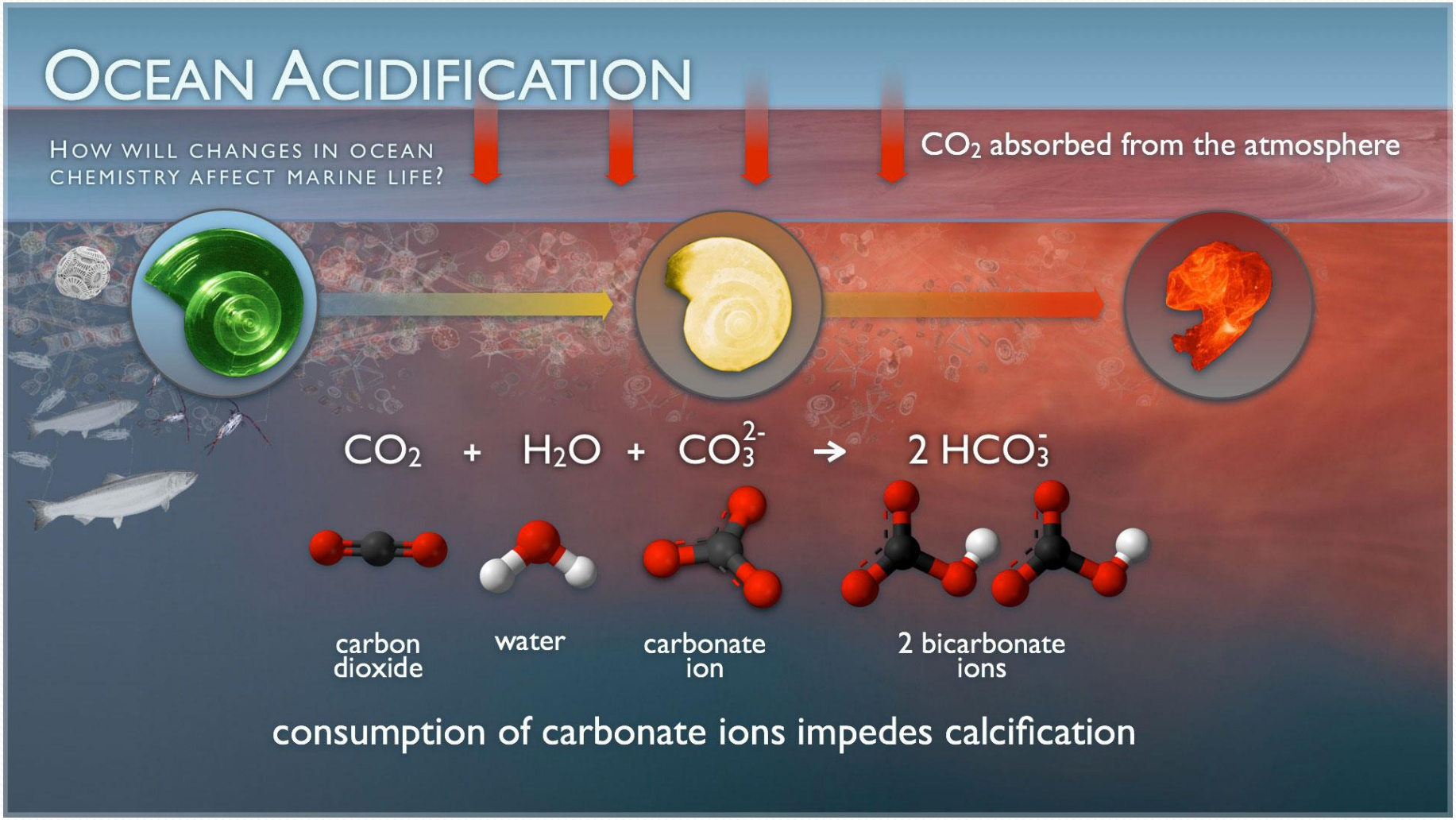
Consequences - Impacts to Bay & Aquatic Resources





Source: www.umces.edu/climateimpacts/

Consequences – Bay Acidification



Consequences – Loss of Vital Habitats

Photo Credit: Zoe Johnson

Consequences – Increased shoreline erosion

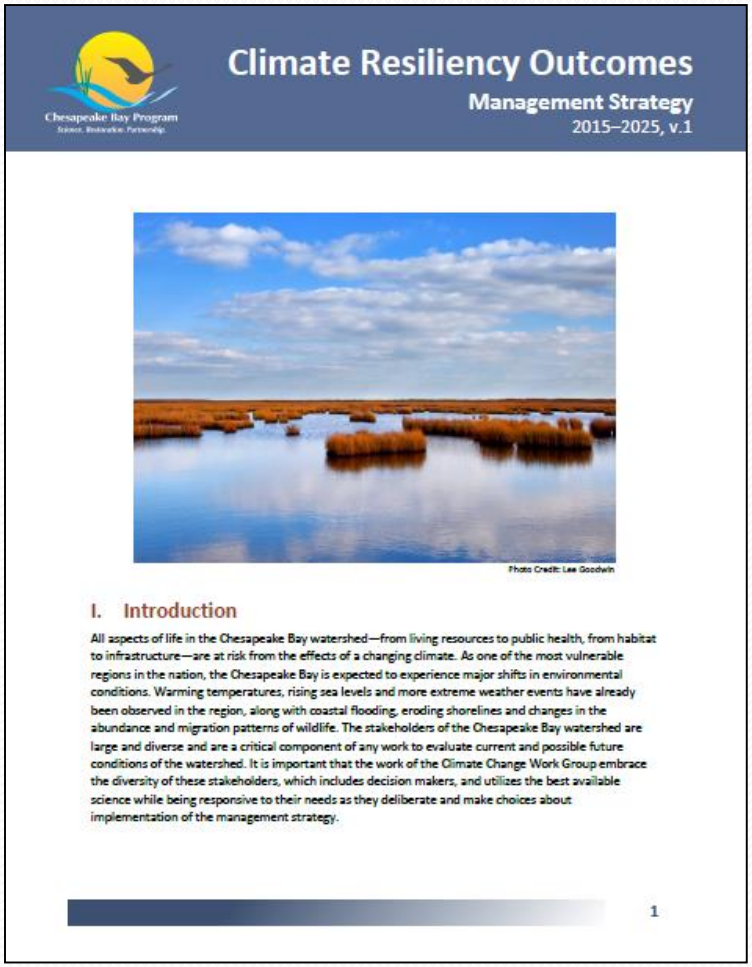
Photo Credit: Zoe Johnson

Consequences – Coastal Community Impacts

Photo Credit: UMCES, IAN

Key Partnership Climate Change-Related Commitments and Recommendations

- *2009 Presidential Executive Order 13508*
- *2010 Chesapeake Bay TMDL*
- *2010 Executive Order 13058: Strategy for Protecting and Restoring the Chesapeake Bay Watershed*
- *2014 Chesapeake Bay Watershed Agreement*



Chesapeake Bay Program

Climate Resiliency Outcomes

Management Strategy

2015–2025, v.1

Photo Credit: Lee Goodwin

I. Introduction

All aspects of life in the Chesapeake Bay watershed—from living resources to public health, from habitat to infrastructure—are at risk from the effects of a changing climate. As one of the most vulnerable regions in the nation, the Chesapeake Bay is expected to experience major shifts in environmental conditions. Warming temperatures, rising sea levels and more extreme weather events have already been observed in the region, along with coastal flooding, eroding shorelines and changes in the abundance and migration patterns of wildlife. The stakeholders of the Chesapeake Bay watershed are large and diverse and are a critical component of any work to evaluate current and possible future conditions of the watershed. It is important that the work of the Climate Change Work Group embrace the diversity of these stakeholders, which includes decision makers, and utilizes the best available science while being responsive to their needs as they deliberate and make choices about implementation of the management strategy.

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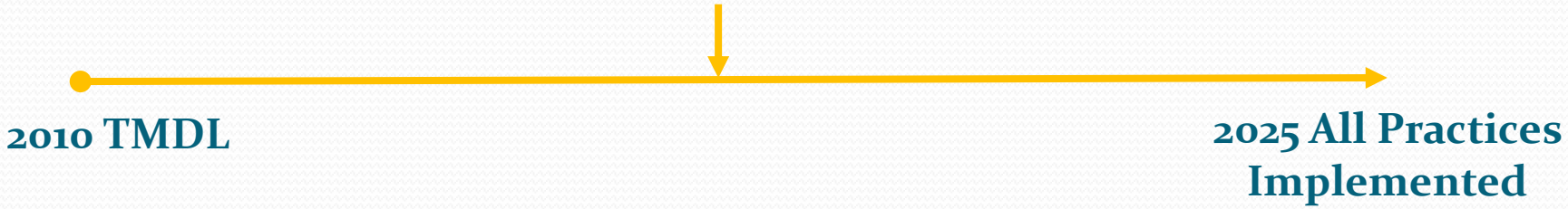
Chesapeake Bay 2017 Mid-Point Assessment



Goal: Determine whether the implementation the CBP Partnership's restoration strategies by 2025 will achieve water quality standards in the Bay.

Objective: Make this determination based on the best available science data, tools, BMPs, and lessons-learned.

Commitment: Conduct a more complete analysis of climate change effects on nitrogen, phosphorus, and sediment loads and allocations in time for the mid-course assessment of Chesapeake Bay TMDL progress in 2017 (Chesapeake Executive Order 13508)

2014 Chesapeake Bay Agreement

CLIMATE RESILIENCY

Chesapeake Bay Program
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GOAL: Increase the resiliency of the Chesapeake Bay watershed, including its living resources, habitats, public infrastructure and communities, to withstand adverse impacts from changing environmental and climate conditions.

- **Monitoring and Assessment Outcome:** Continually monitor and assess the trends and likely impacts of changing climatic and sea level conditions on the Chesapeake Bay ecosystem, including the effectiveness of restoration and protection policies, programs and projects.

- **Adaptation Outcome:** Continually pursue, design and construct restoration and protection projects to enhance the resiliency of Bay and aquatic ecosystems from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.

MANAGEMENT APPROACH

Develop a framework for engaging one-on-one with CB Partnership Goal Implementation Teams on climate related management needs.

Management Strategy	Baseline	Factor Influencing Success	Current Efforts & Gaps	Management Approach	Cross-Outcome Collaboration and Mutual Benefit	Adaptive Mgmt. & Monitoring Progress	No Mention	Rating
Water Quality		x		x	x	x		4
Black Duck		x	x	x		x		4
Brook Trout		x	x	x		x		4
Wetlands		x	x	x				3
Protected Lands		x	x	x				3
Public Access		x		x				2
Healthy Watersheds		x		x				2
Urban Tree Canopy			x	x				2
Blue Crab		x			x			2
Oyster Restoration		x			x			2
Fish Habitat		x			x			2
SAV		x						1
Diversity				x				1
Local Leadership		x						1
Fish Passage		x						1
Forage Fish		x						1
Toxics Research	x							1
Stream Health							x	0
Land Use Methods and Metrics							x	0
Land Use Options Evalations							x	0
Citizen Stewardship							x	0
Environmental Literacy							x	0
Toxics Prevention and Policy							x	0
Forest Buffer							x	0

x = climate change related element

Prioritizing Climate Change Impacts of Most Concern
STAC – December 2015

Discussion Question	Framing
1. What ecological impacts are of most concern to the resources managed by the Chesapeake Bay Program?	Rank resource vulnerability (low, medium, high) over time (25, 50, 100-years).
2. Which specific Chesapeake Bay Agreement Goals and Outcomes will be affected most?	Factor of risk (low, medium, high) in terms of the influence of impact on "goal attainment."

Goal Attainment

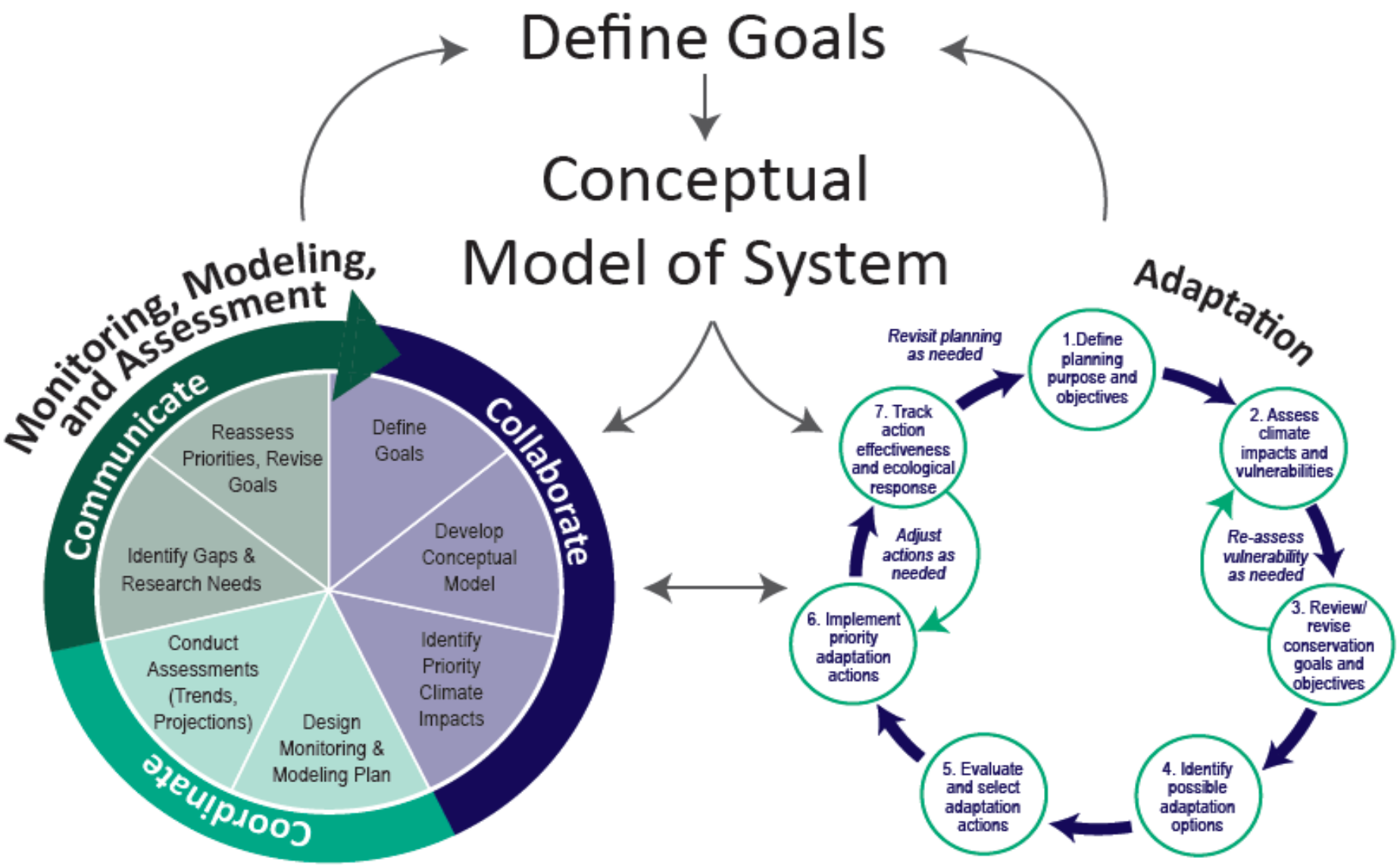
Qualitative Factor of Risk

Goal	Outcome	Qualtitative Factor of Risk	Primary Climate Drivers
Water Quality	2025 WIP Outcome	Medium	SLR, T, P, EE
	WQ Attainment	High (over long-term)	SLR, T, P, EE
Healthy Watersheds	Healthy Waters	Varied response	T, P, EE
Vital Habitats	Black Duck	High	SLR
	Brook Trout	High	T, P
	Wetlands	Medium (non-tidal)/High (tidal)	SLR, P
	Stream Health	High	T, P
	SAV	HIgh	SLR, T, EE
	Forest Buffer	Medium	SLR, P, EE
	Urban Tree Canopy	Medium	T, P
Land Conservation	Protected Lands	Low - Medium	SLR
	Public Access	Low - Medium	SLR
Susainable Fisheries	Blue Crab	Medium	T
	Oyster Restoration	Medium	T, OA
	Fish Habitat	High	SLR, T, P, EE
	Forage Fish	High	SLR, T, P

Climate Research Needs

Goal/Outcome	Research Need
Brook Trout	Assess species sensitivity to temperature change.
Forage Fish	Better understanding of climate drivers and cross-interactions (salinity, temp, disease).
Fish Habitat	Monitoring impact of sea level rise and extreme events on shoreline change.
Water Quality Standard Attainment	High resolution analysis of projected climate change at various scales across systems.
Water Quality Standard Attainment	Need for scoping studies that take a given climate scenario/projection and examine consequences of alternate behavioral (management) scenarios.

Management Approach

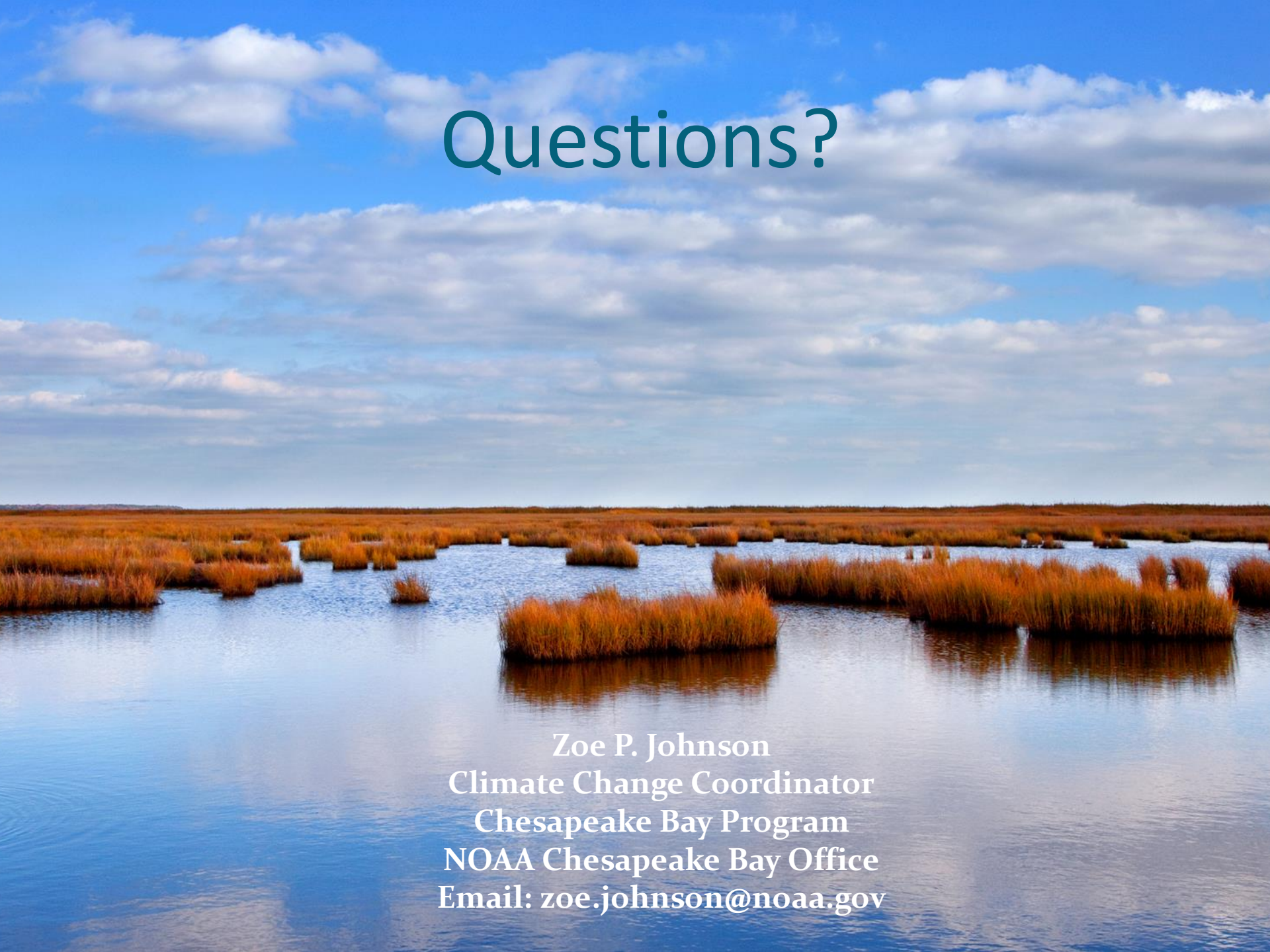


Climate Data & Information Needs

The Very Basics

- Define data needs
  - Historical observations/trends
  - Future projections
    - Climate variables
- Determine data requirements
  - Range of scenarios vs. sole variable
- Establish spatial extent
  - Evaluate geographic relevance
- Select temporal scale
  - Seasonal, inter-annual, decadal and beyond (25, 50, 100-year)

Questions?



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