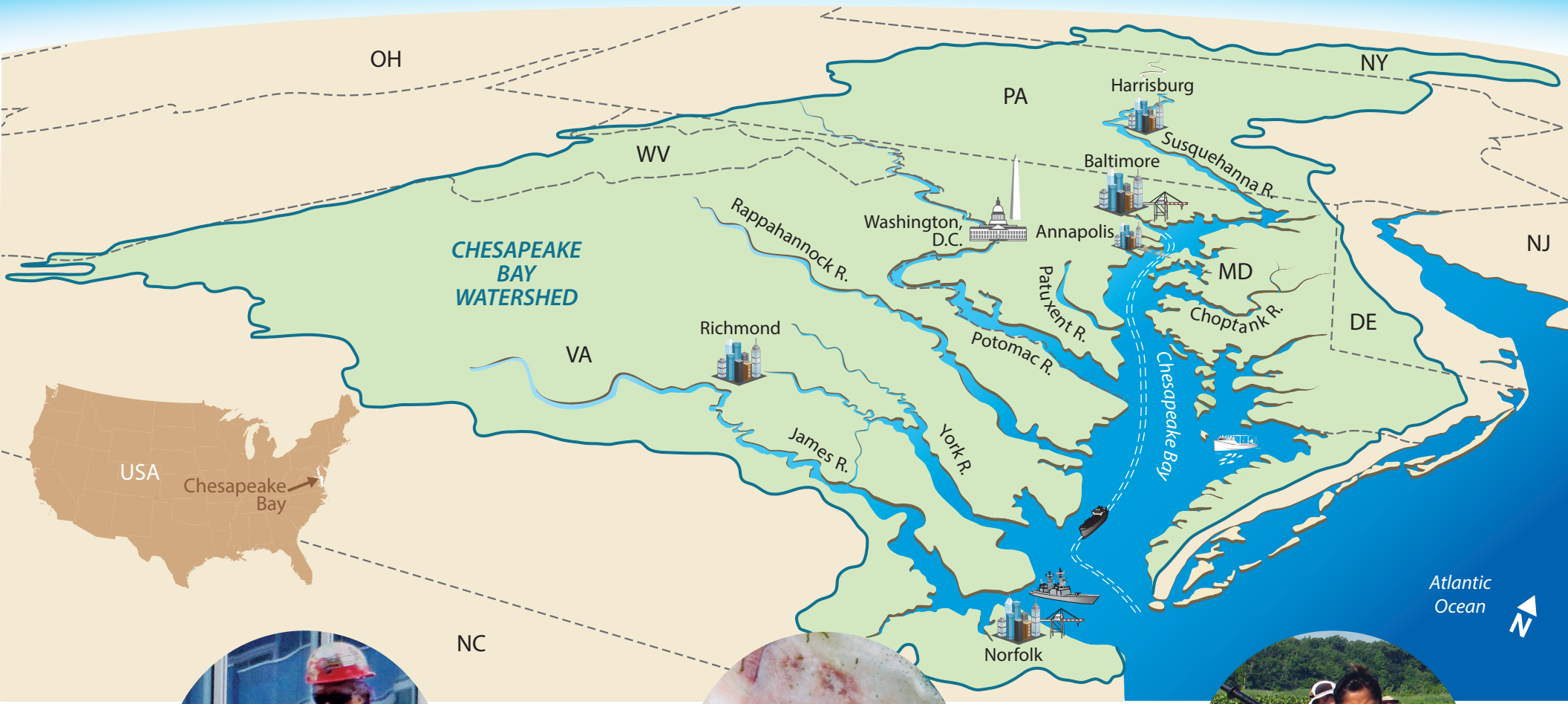
CHESAPEAKE BAY & WATERSHED

2021 REPORT CARD



Bay Indicators

Total phosphorus measures the amount of phosphorus in bay waters.

Total nitrogen measures the amount of nitrogen in bay waters.

Dissolved oxygen is critical to the survival of Chesapeake Bay's aquatic life.

Water clarity is a measure of how much light penetrates through the water column.

Chlorophyll *a* is used as a measure of phytoplankton (microalgae) biomass.

Aquatic grasses, or submerged aquatic vegetation, are one of the most important habitats in the Bay.

Benthic community, or the Benthic Index of Biotic Integrity, measures the condition of the organisms living in or on the bottom areas of the Bay.

Watershed Indicators

Median household income is a traditional measure of economic vitality and uses data from the U.S. Census.

Jobs growth measures the percentage of jobs gained or lost (net) per capita from the past four years.

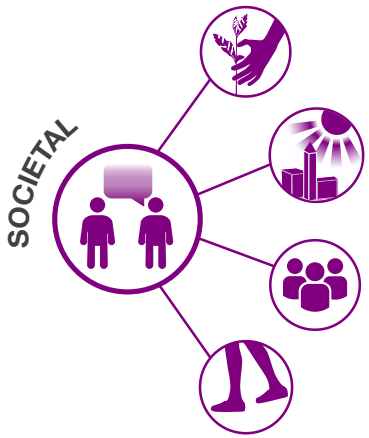
Income inequality uses the Gini Coefficient that measures the inequality in income distrubution.

Housing affordability measures the percentage of households that spend 30 percent or more of their income on housing costs.

Water quality indicators include total phosphorus, total nitrogen, and turbidity. Turbidity is a measure of water clarity.

Stream benthic community measures the condition of the benthic community living in streams.

Protected lands measures the amount of valuable lands that are protected in the watershed.



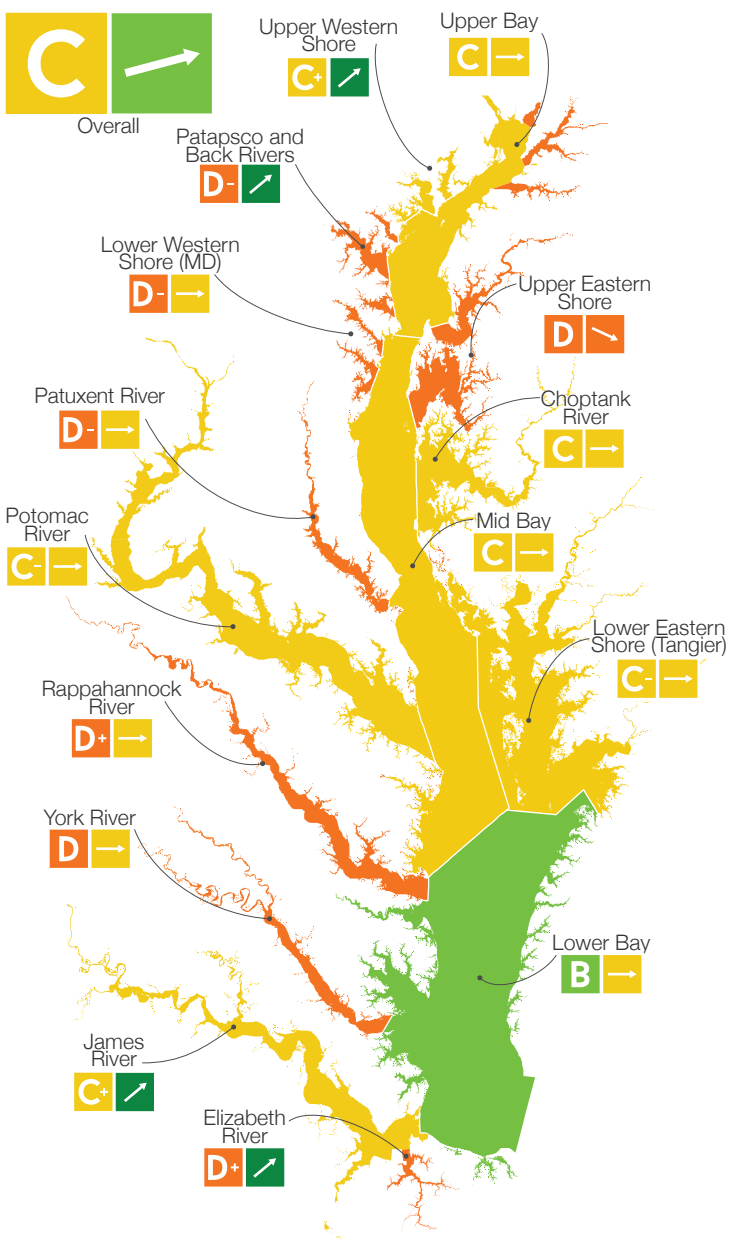
Stewardship index examines citizen stewardship in categories of behavior, volunteerism, and civic engagement.

Heat vulnerability Index indicates climate-safe neighborhoods and includes metrics for tree canopy, impervious surface, land surface temperature, and households in poverty.

Social index uses data about social vulnerability from the U.S. Census and measures how a community can respond to hazardous events.

Walkability measures how many people can walk to a park in 10 minutes and includes metrics for the total population and for diverse groups.

Bay health improving and new insights into Watershed health



Bay health somewhat improved with mixed results on trends

The Chesapeake Bay's overall score was 50% in 2021, up 5 points from the 2020 score. Seven reporting regions had improved grades due to better water quality, aquatic grasses, and benthic community. Both nitrogen and phosphorus concentrations continue to improve and the aquatic grass coverage is improving as well, but water clarity and chlorophyll continue to degrade.

The highest–scoring region was once again the Lower Bay (65%). The lowest–scoring regions were the Patapsco and Back Rivers and the Patuxent River (both 23%). Problems with the Baltimore wastewater treatment plants (Patapsco Wastewater Treatment Plant and Back River Wastewater Treatment Plant) have been identified and state of Maryland oversight has been initiated. Recent major investments in upgrades of these wastewater treatment plants, combined with better operational oversight, should lead to improved water quality and improved report card scores for the Patapsco and Back River reporting region.

Long-term trends still show significant improvements in the James River, Elizabeth River, Patapsco and Back Rivers, and Upper Western Shore. The bad news is that the Upper Eastern Shore score has begun a slightly declining trend, the first time a declining trend has been observed in any reporting regions since 2014. The positive news is that the overall Bay trend is still improving.

Aerial shot of Patapsco wastewater treatment plant before modern upgrades. Photo by Jane Thomas.

Health trends

Significantly improving · Slightly improving · No change · Slightly declining · Significantly declining

Health scale

Very good 100% A · 80 B · 60 C · 40 D · 20 F · 0 Very poor · N/A*

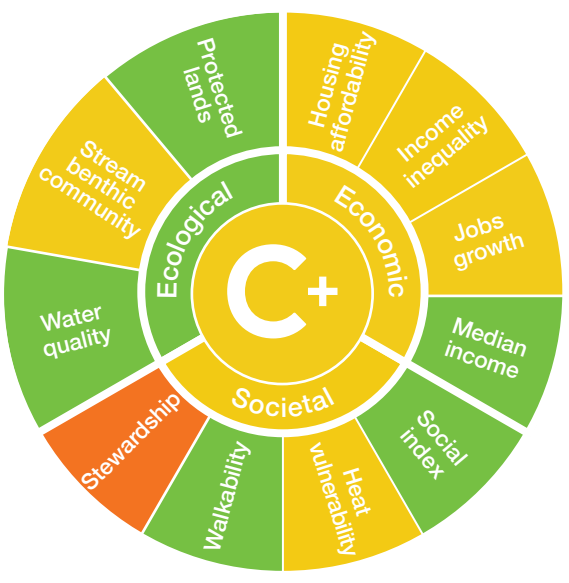
*Data Disclaimer

For 2021, we have changed our trend analysis for the Chesapeake Bay and the reporting regions to exclude the benthic community data. Due to an inadvertent misapplication of the Maryland Long-term Benthic monitoring program's random site selection process, Maryland 2021 data results should not be compared with those of previous years. Individual site data (species abundance and biomass) are correct, but summaries and interpretations such as real estimates of degradation and trends cannot be used confidently. Virginia data, while not impacted, was also excluded in the trends analysis for consistency.

Economic, Ecological and Societal indicators incorporated into watershed report card

The health of the Chesapeake Bay is a product of what is happening in its vast watershed. The Bay and its Watershed are a human and natural system, and we need to consider the economic, ecological, and societal factors to make an adequate assessment. This year's report card is the first to embrace this range of indicators fully. Overall, the Chesapeake Watershed scored 56%. The highest-scoring region was the Upper James (64%), and the Choptank (43%) was the lowest. However, when individual indicators are integrated into a single grade, the disparities between indicators often even out, masking specific issues in the regions. We encourage accessing the website (chesapeakebayreportcard.org) to explore the different indicators in the various regions.

The **Economic** category (51%) is new for 2021. The four individual indicators have different patterns across the watershed. Median household incomes (66%) were highest in the Baltimore-Washington area compared to rural areas. Housing affordability (40%) scores were higher in rural areas but lower in the Baltimore-Washington area. Income inequality scored 49%, highlighting economic disparity. Net job growth (48%) was consistent across the watershed.

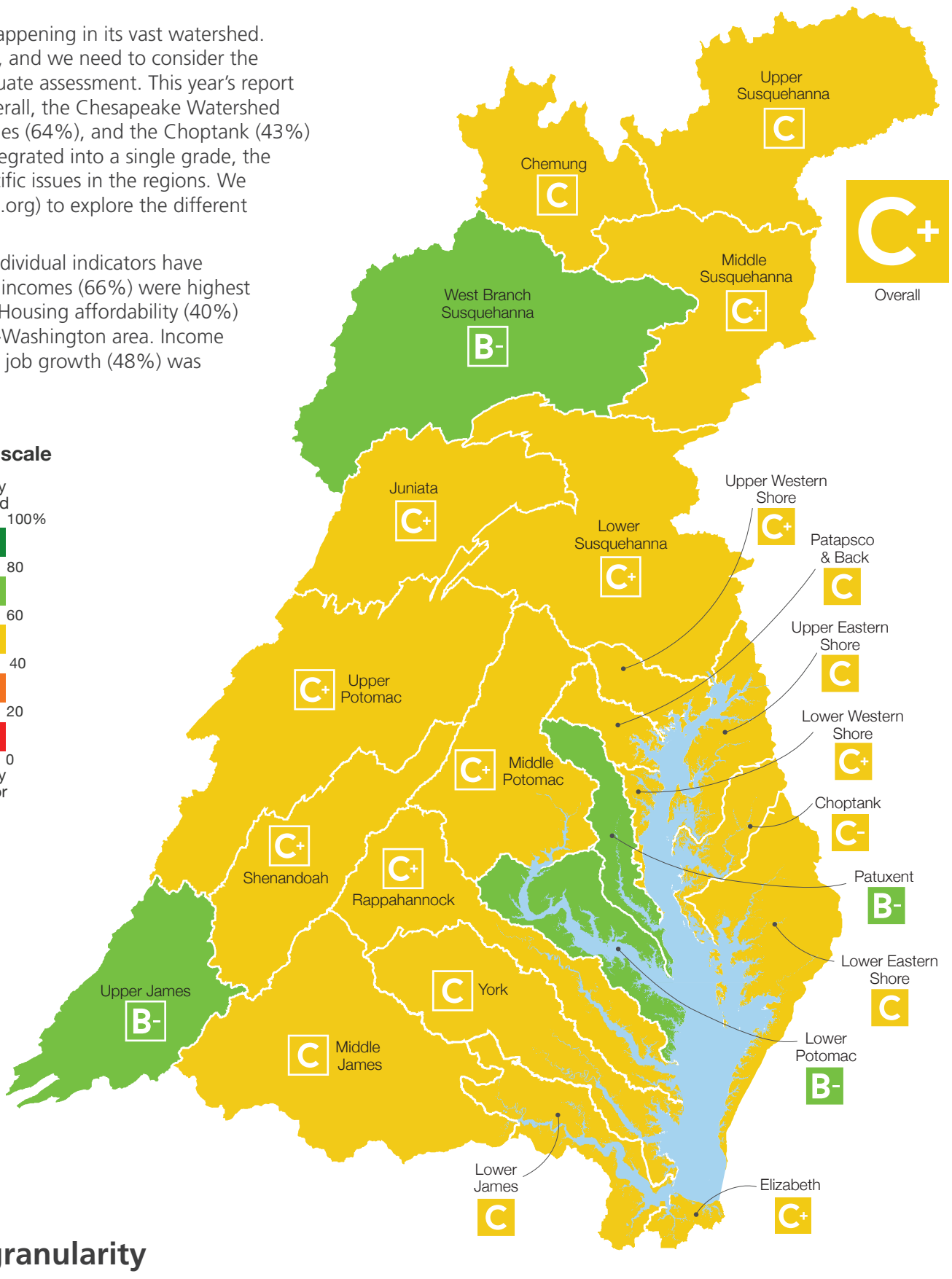


Health scale

Very good 100% A · 80 B · 60 C · 40 D · 20 F · 0 Very poor

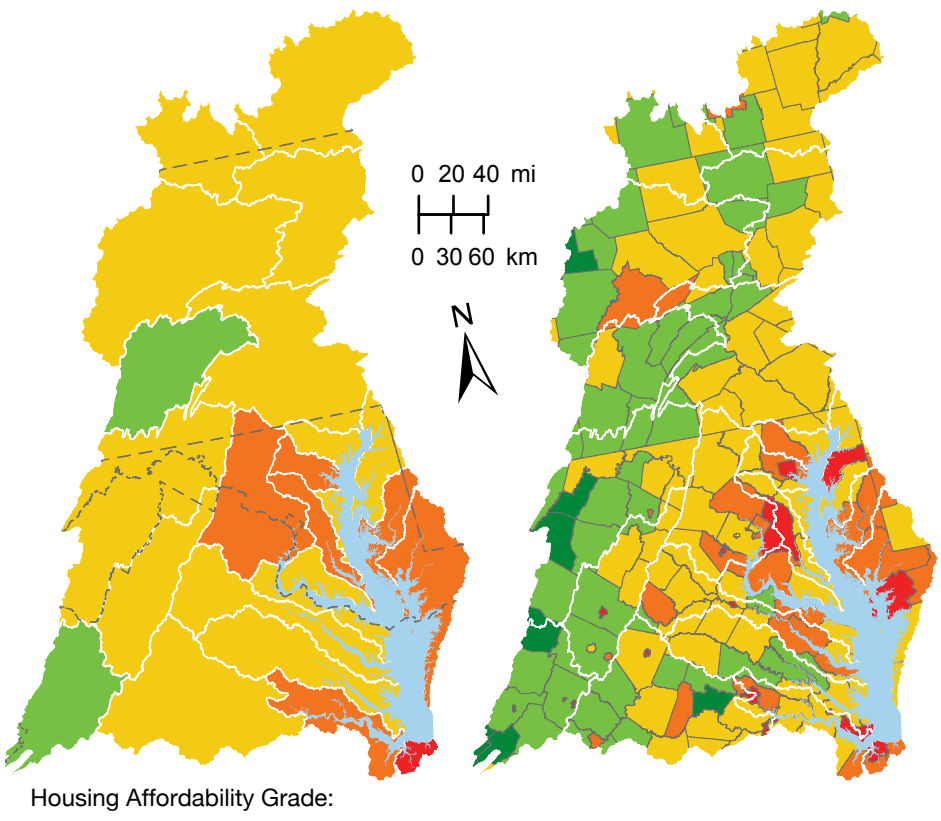
The **Ecological** category (64%) combines the terrestrial and aquatic categories used in the previous years. Indicators for total nitrogen (77%), total phosphorus (61%), and turbidity (64%) were combined into a water quality index (67%). Scores for protected lands (74%) and stream benthic community (51%) were from 2020 since no new data was available.

The **Societal** category scored 54%. No new data was available for the Stewardship Index (36%) and the Social Index (60%), and the grades were from 2020. The Heat Vulnerability Index (58%) was also from last year. Walkability has a score of 67% in 2021, up 5% from 2020.



Economic data provides increased granularity

The data used to generate the new economic indicators is available at the county scale. To be comparable to the ecological and social data, we have aggregated these county–level economic data (below, right) into the reporting regions (below, left). Since the geographic specificity that the county-level data provides is useful and informative, both the county–level data and the population-weighted reporting region data are available on the chesapeakebayreportcard.org website.



Housing Affordability Grade:

80-100% · 60-80% · 40-60% · 20-40% · 0-20%

Chesapeake Bay · States · Counties

More insights into environmental justice

We are committed to better representing environmental justice in our annual Chesapeake Bay and Watershed Report Cards. In addition to the social vulnerability index, heat vulnerability index, and walkability indicators, this year's report card also includes two new economic indicators with environmental justice implications: income inequality and housing affordability.

Rising cost of housing impacts ability to adapt to climate and environmental change. Photo by Jane Hawkey.

Aerial image of Baltimore, MD, a region with a high income inequality. Photo by Jane Thomas.

Chesapeake Bay report card serves as a model

Coastal Adaptation

The first-of-its-kind Maryland Coastal Adaptation Report Card was released in January 2022. Maryland scored a B- in coastal adaptation. This indicates that although progress toward adaptation is being made, more work is needed to ensure that the state is prepared for increasingly severe climate-related events. The score is based on the current condition of 15 stakeholder-selected indicators.

Preparedness to flooding is a key part of coastal adaptation. Photo by Nathan Miller.

Future Earth Coasts

UMCES's close association with Future Earth Coasts (a Global Research Network of Future Earth), has enabled the Chesapeake Bay Report Card to be used in comparative studies of sustainability in numerous coastal systems worldwide. This is both advancing our ability to fully understand sustainability in coastal areas, and we've learned new techniques for application here in Chesapeake Bay.

Coastal systems, like Chesapeake Bay, face sustainability issues. Photo by Sky Swanson.

Healthy Rivers for All

In a partnership with the World Wildlife Fund, UMCES has developed materials to facilitate report card production in other locations.The partnership released "Selecting Indicators for Basin Health Report Cards" in May 2022, as a companion to a previous booklet "Practitioner's Guide to Developing Basin Health Report Cards." UMCES also has produced an edX online course, "Storytelling with data using socio-environmental report cards."

UMCES and WWF helped develop the Tuul River Basin Report Card in Mongolia. Photo by Dylan Taillie.

COAST Card

The Coastal Ocean Assessment for Sustainability and Transformation is a Belmont Forum-funded international and transdisciplinary program that aims to foster solutions to global sustainability challenges by merging socio-environmental report cards, social network analyses, and system dynamics models. It builds on the framework that we are using and developing for the Chesapeake Bay and is emulated in Manila Bay, Tokyo Bay, Ishigaki Island, and the Goa Coast of India.

Manila Bay in the Philippines is one of the COAST Card study sites. Photo by Brian Evans (flickr).

Acknowledgements

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University of Maryland
Center for Environmental Science
Integration and Application Network

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