

Using Diverse Indicators to Assess Environmental Health for Ecosystems and Communities



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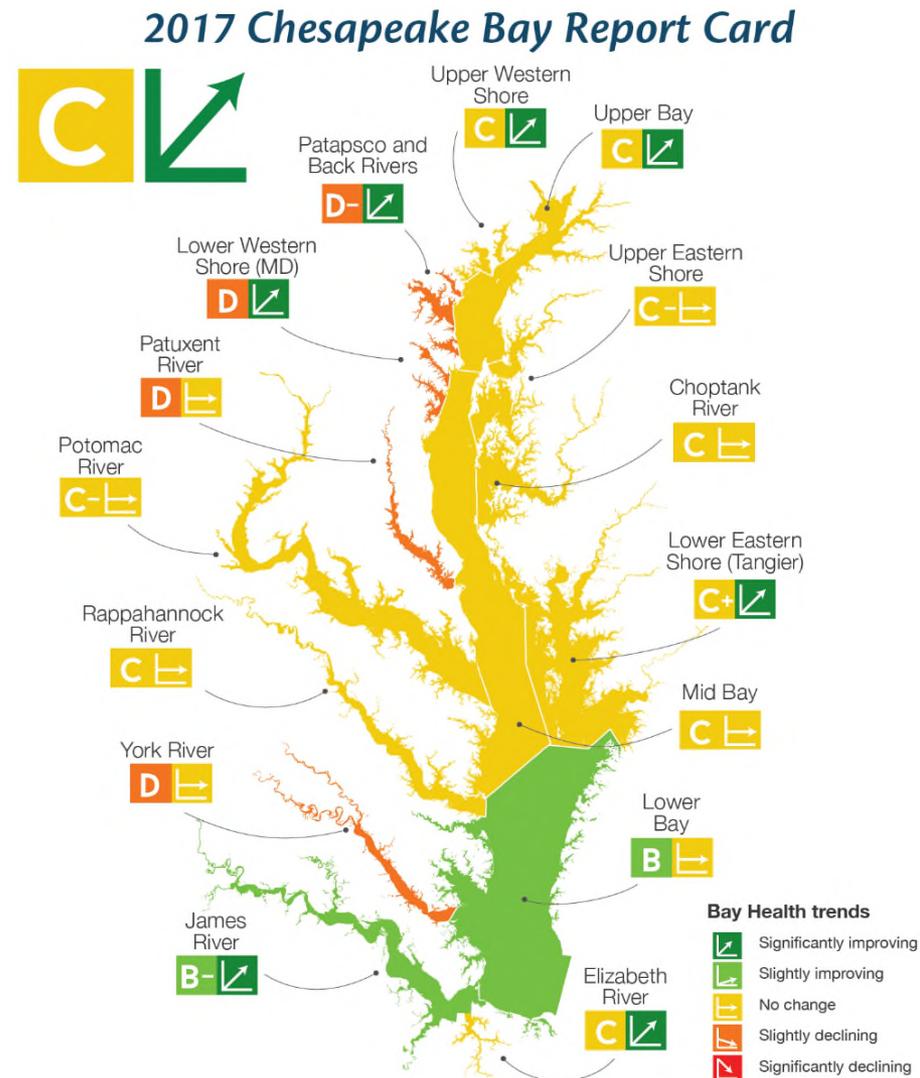
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What is an ecosystem health report card?

- Broad-level assessments of a region or system
- Communicate complex information
- Based on real data: transparent and defensible
- Provide accountability
- Engage communities



Outcomes of ecosystem health report cards



- Well received and influential
- Comprehensive package – goes beyond simple grading
- Visually appealing
- Being local – sense of ownership
- Educational



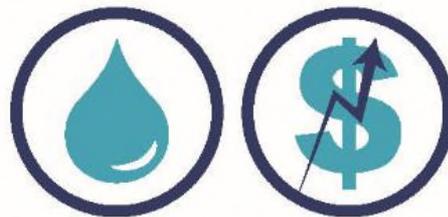
Report cards are a five step process

1 Create a conceptual framework



Create a framework defining goals and major aspects of each goal that should be evaluated over time.

2 Choose indicators



Select indicators that convey meaningful information and can be reliably measured.

3 Define thresholds



Define status categories, reporting regions, and method of measuring threshold attainment.

4 Calculate scores

| Source | Station | Region | Date | DO Value |
|--------|---------|--------|---------|----------|
| DNR | CCC0008 | | 4/29/09 | 9.00 |
| DNR | CCC0008 | | 4/29/09 | 9.50 |
| DNR | CCC0008 | | 4/29/09 | 9.70 |
| DNR | CCC0008 | | 5/28/09 | 8.90 |
| DNR | CCC0008 | | 5/28/09 | 9.00 |
| DNR | CCC0008 | | 5/28/09 | 9.00 |
| DNR | CCC0008 | | 5/28/09 | 9.00 |

Calculate indicator scores and combine into index grades.

5 Communicate results

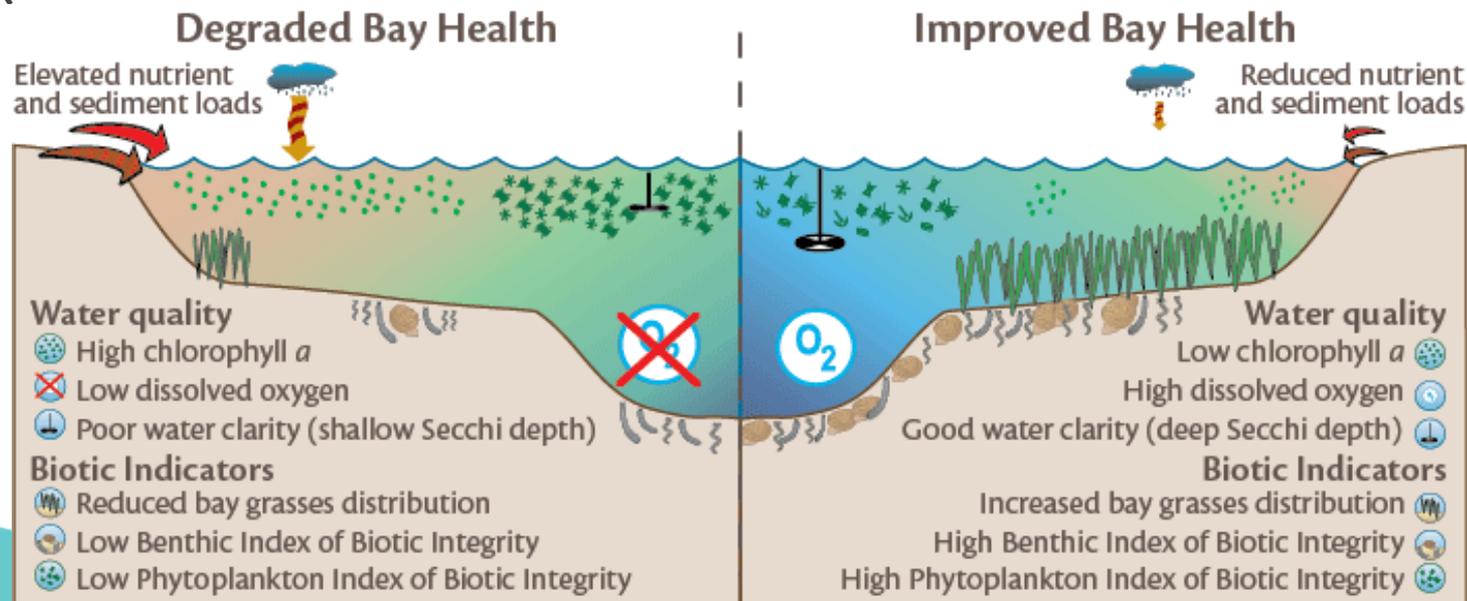


Communicate results using visual elements, such as photos, maps, and conceptual diagrams.



Chesapeake Bay report card was original ecosystem health report card

- 2006 – 2011 report card
- 3 water quality indicators (DO, water clarity, and chlorophyll)
- 3 biotic indicators (benthic IBI, phytoplankton IBI, seagrasses)
- Water Quality Index and Biotic Index averaged into overall Bay Health Index



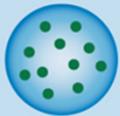
Changed indicators within ecosystem health category

- 2012 report card
- Phytoplankton IBI was discontinued
- Added total nitrogen and total phosphorus
- Averaged all seven indicators into overall Bay Health Index
- Back calculated scores to 1985 to look at trends

Before 2012

2012

Water Quality Index



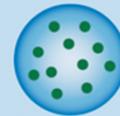
Chlorophyll *a*



Water clarity



Dissolved oxygen



Chlorophyll *a*



Water clarity



Dissolved oxygen

Biotic Index



Benthic community



Phytoplankton community



Aquatic grasses



Total nitrogen



Total phosphorus



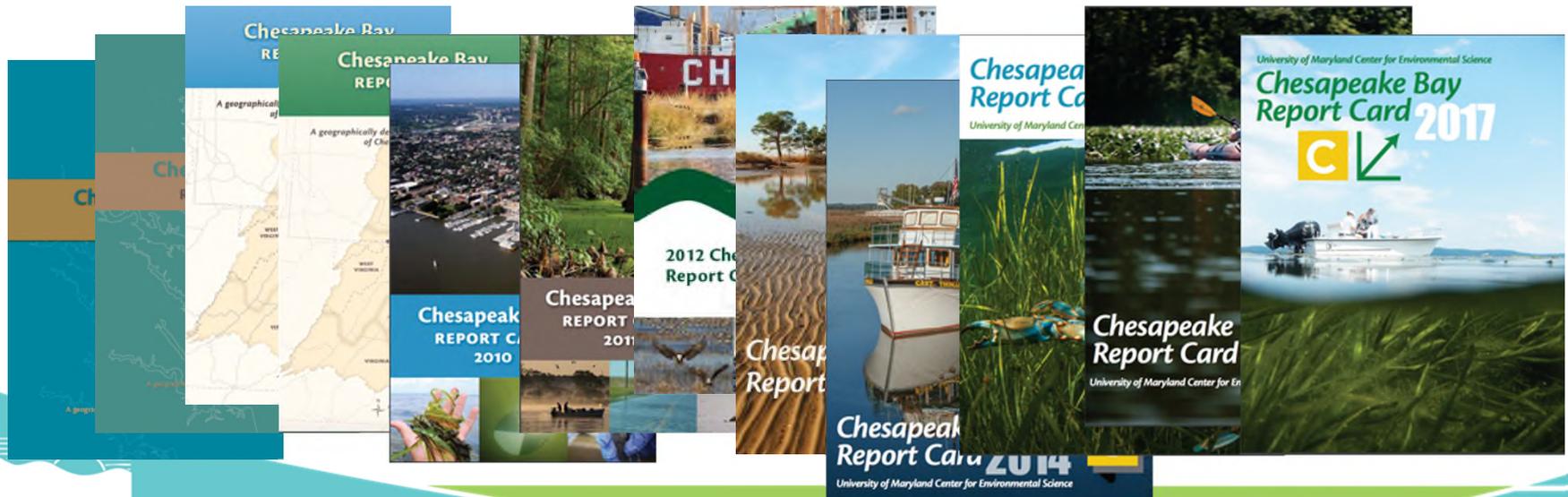
Benthic community



Aquatic grasses

Chesapeake Bay – Ecosystem health

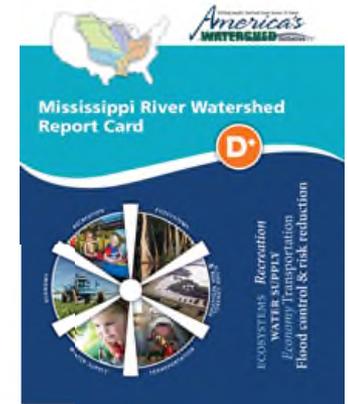
- 2006 – 2017 report card
- Ecosystem indicators only
- Tidal estuary only
- Trends over time



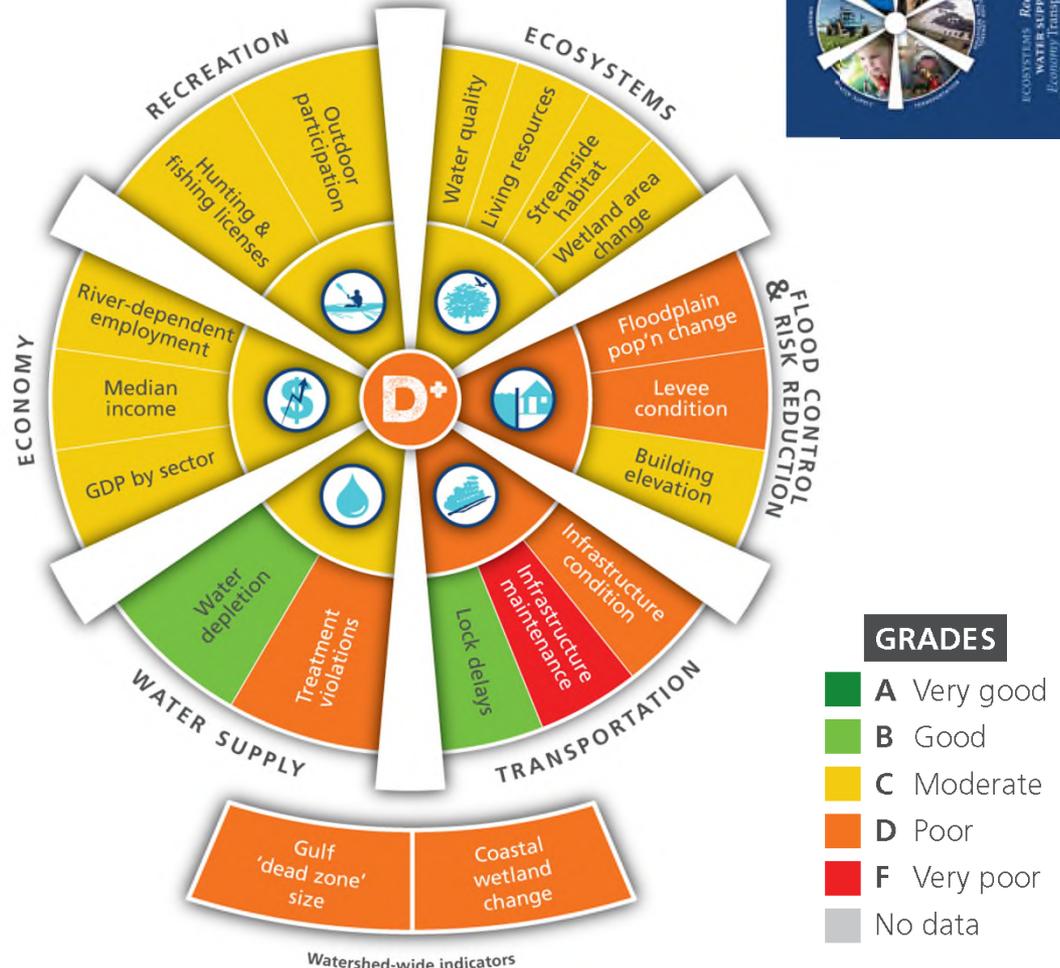
Expanding report cards around the world



Mississippi River – six goals, not just ecosystem



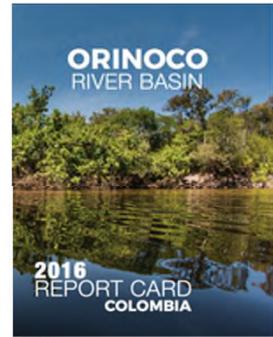
- Goals
 - Ecosystems
 - Recreation
 - Economy
 - Water supply
 - Transportation
 - Flood control
- Watershed report card



Assessing non-ecosystem indicators in Mississippi River watershed

- Flood control and risk reduction goal 
 - Floodplain population change
 - Desired condition is # of people most at risk is decreasing, or at least increasing less quickly than total population in the basin
 - GIS layer of population changed compared to FEMA 500-year floodplain maps
- Transportation goal 
 - Lock delays
 - Compares current amount of time that locks are unavailable compared to best performing between 10 years previous
 - USACE data available online

Orinoco River, Colombia – Human indicators



- Categories
 - People & culture
 - Management & governance
 - Water
 - Ecosystems & landscapes
 - Biodiversity
- International collaboration



Assessing non-ecosystem indicators in the Orinoco River, Colombia

- People and culture



- Human nutrition

- Assesses the percentage of children aged 0-4 with a healthy body weight, as this age group is most susceptible to dietary limitations.
 - Data was from the National Survey of the Nutritional Status in Colombia and the Colombian Institute of Familiar Welfare.

- Management/Governance



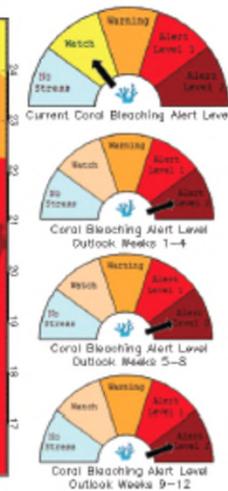
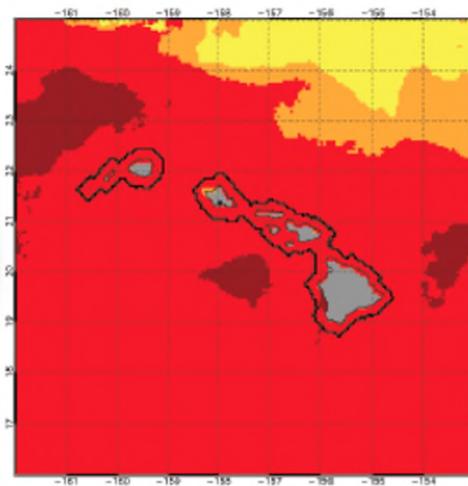
- Mining in sensitive areas

- The presence of mining concessions in sensitive ecosystems. National Environmental System Law of Colombia states these areas are under special protection, with agriculture and mining not permitted.
 - Data on mining concessions was from the National Mining Agency and the Humboldt Institute.

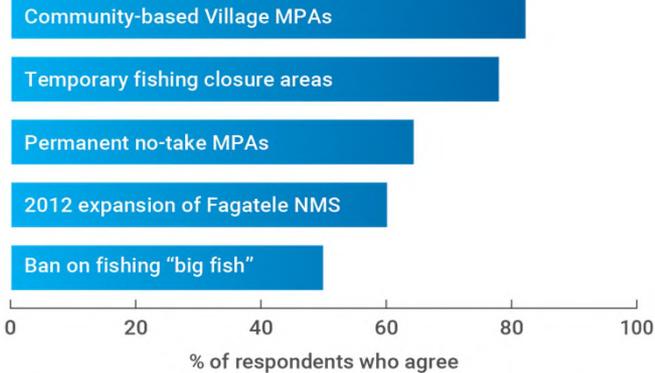


Coral reefs – climate, human

- Categories – corals, fish, climate, and human
- All U.S. jurisdictions in both Atlantic and Pacific



Samoans support reef management



NMS = National Marine Sanctuary MPA = Marine Protected Area

Assessing climate indicators on coral reefs around the world

- Coral Reef Watch
 - Degree heating weeks
 - Satellite data
 - Categorized into severity of potential bleaching
- Ocean acidification
 - Measured directly on the reef
 - Compare current number to pre-industrial level

Coral Reef Watch NCRMP Status report Scoring Table for a Four-Year Evaluation Period

| %Bleached | %Dead | Score | 0<N<4 | 4≤N<8 | 8≤N<12 | 12≤N<16 | 16≤N<20 | 20≤N<32 | 32≤N |
|-----------|-------|-------|-------|-------|--------|---------|---------|---------|------|
| <1% | | 100% | 0 | 0 | 0 | 0 | 0 | 0 | |
| 1% | | 95% | 1-2 | | | | | | |
| 10% | | 85% | 3-4 | 1 | | | | | |
| 20% | | 75% | | 2 | | | | | |
| 40% | | 65% | | 3 | 1 | | | | |
| 60% | 10% | 55% | | 4 | 2 | 1 | | | |
| 80% | 20% | 45% | | | 2c | 2 | 1 | | |
| 90% | 40% | 35% | | | 3 | 2c | 2 | | |
| 100% | 60% | 25% | | | 4 | 3 | 2c | 1 | |
| | 80% | 15% | | | | 4 | 3 | | |
| | 90% | 5% | | | | | 4 | 2 | |
| | 100% | 0% | | | | | | 3-4 | 1 |

Key

-  DHW Severity Ranges (N = DHW value)
-  Number of DHW occurrences in 4-Year period (2c = 2 years are consecutive)
-  Corresponding Score and Expected Impact on Corals



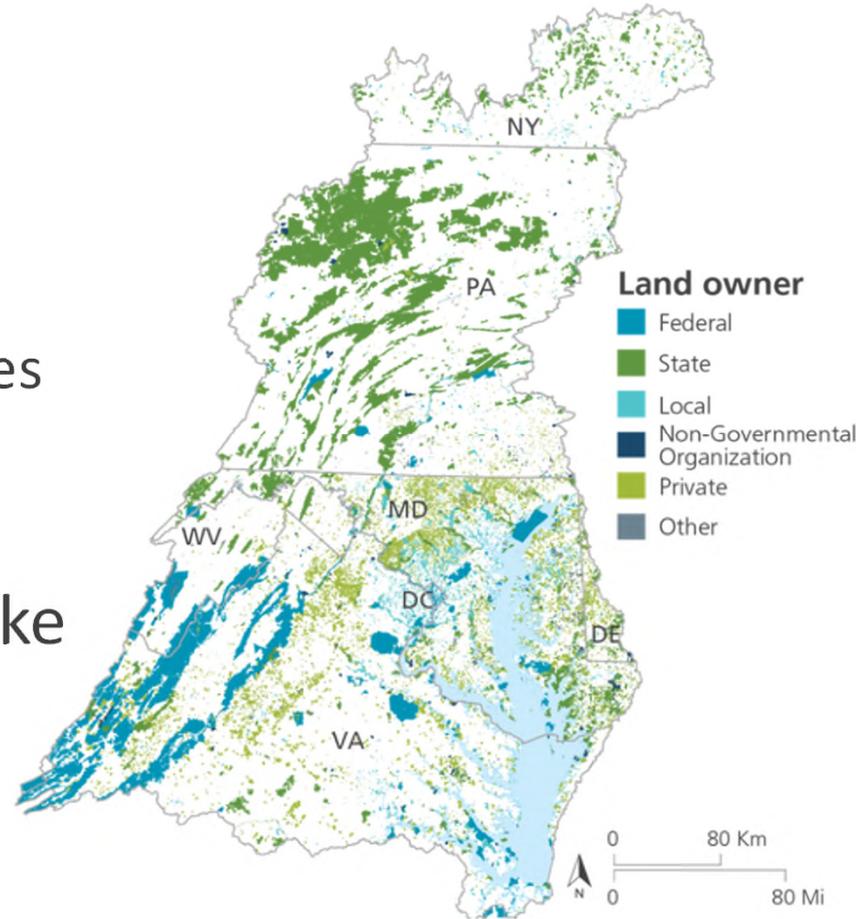
Stakeholder engagement

- Stakeholder-driven process
 - Workshops
 - Activities to reach consensus
 - Outcome is empowerment to use report cards as a tool, management action



Evolution - What did we learn?

- From new report cards
 - Social, cultural, and economic indicators
 - Engagement at the local level
 - Stakeholder analysis techniques like stakeholder mapping and stakeholder network analysis
- Implementing it in Chesapeake
 - Moving into the watershed
 - Indicators that resonate with citizens



Thank you!

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