

Reflections on Constructing an Indicator Framework

Presented to Center for Inland
Bays STAC

19 January 2007

Why the redesign effort:

Communication led to:

- Sometimes inaccurate/confusing messages being received → GAO
- Chesapeake Bay Program may not be the primary source of information
- Information not always presented in a timely fashion
- Information generally relates to the 'whole bay'. Not enough information about local waterways

Slide provided by Ben Longstaff, STAC, 6/06 “being scooped”



... “being Posted”

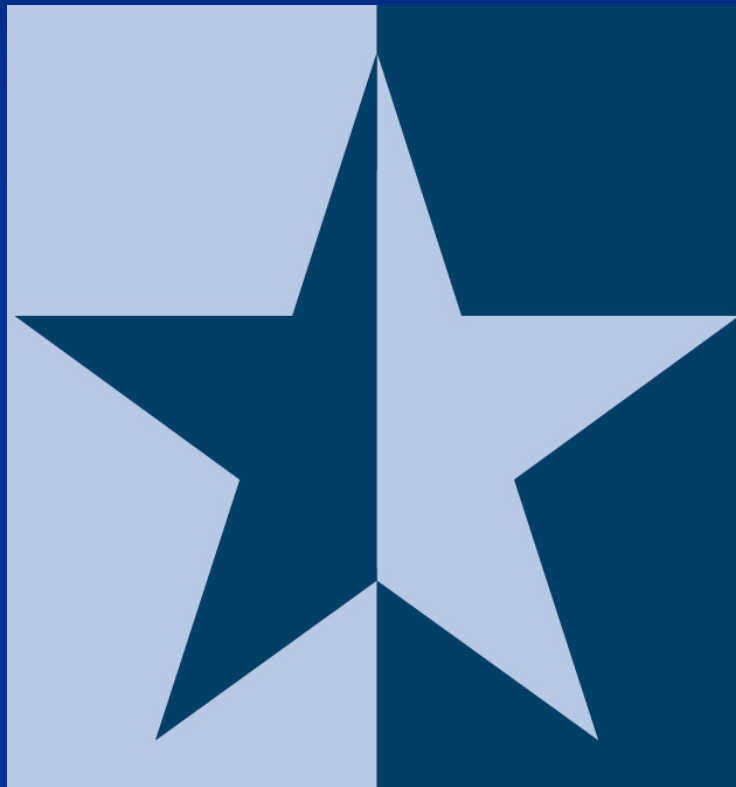


... reporting based primarily on qualitative information



QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Funding Source and Acknowledgements



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STAR Grants and Cooperative Agreements
administered by Barbara Levinson

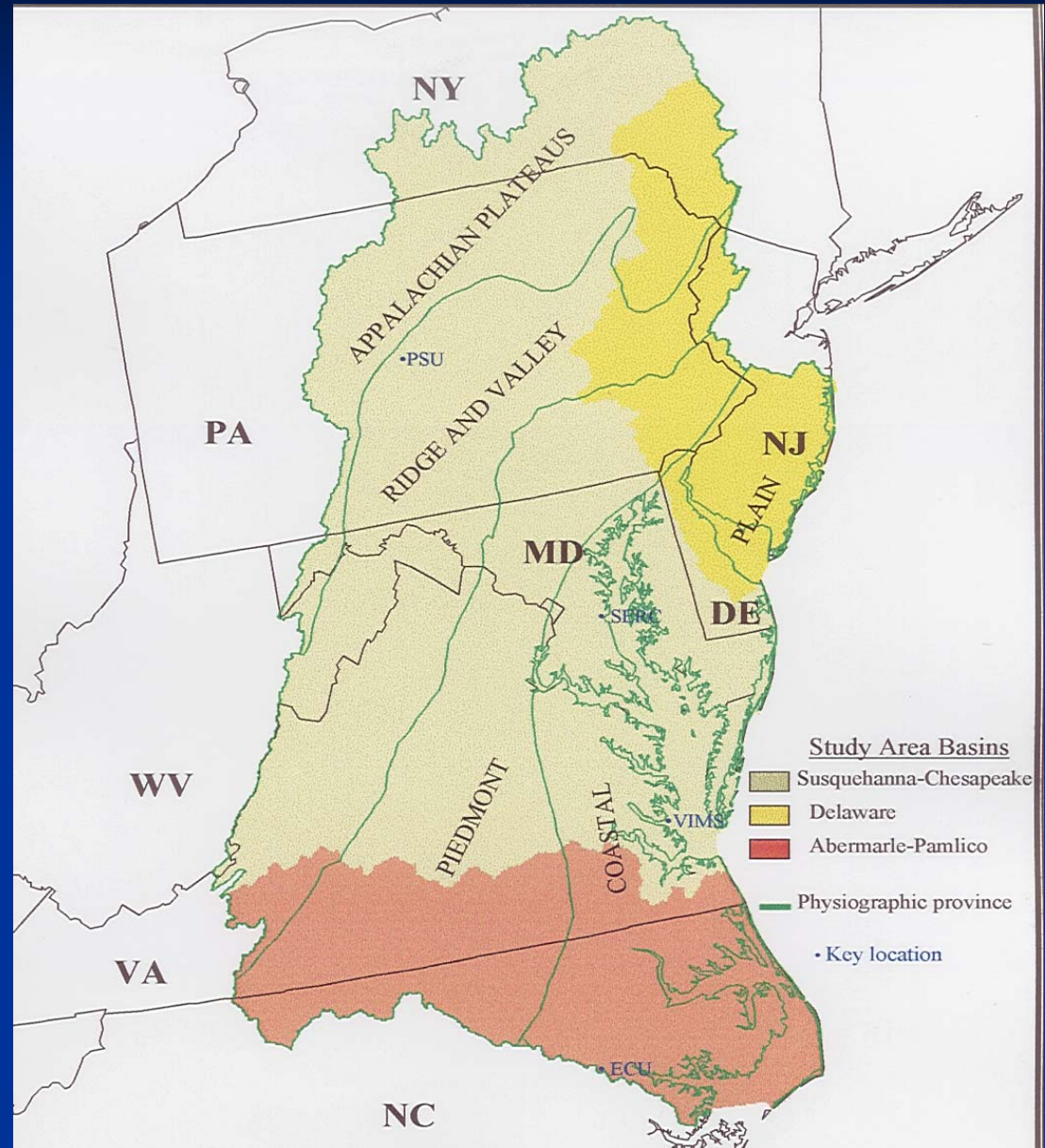


What's the question?

- How do we develop a useful, relevant, and defensible set of indicators for the Atlantic Slope?
 - We know how to do “defensible”
 - This story is all about combining defensible ecology with “relevant” and “useful” in the Atlantic Slope

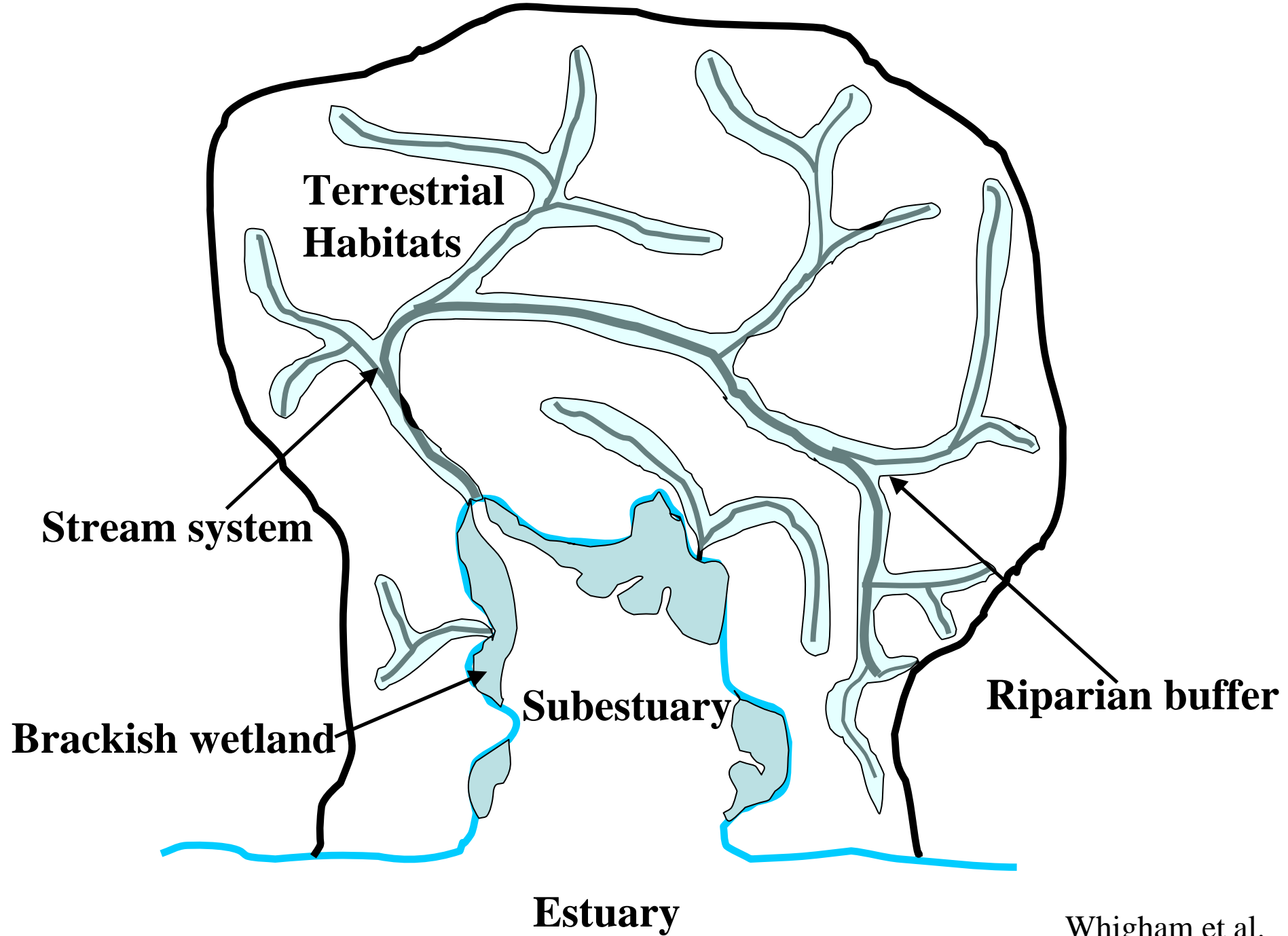
Atlantic Slope Project

- Penn State University
- Smithsonian Environmental Research Center
- Virginia Institute of Marine Science
- East Carolina University
- Environmental Law Institute
- FTN Associates



What did we have a sense of?

- Humans are a BIG part of the system
- Condition of coastal systems are not divorced from watersheds
- There are different aggregate social choices (i.e., patterns of land use) across the Mid-Atlantic
- There isn't one appropriate reference standard for all places



ASC Manager's Survey

Personal interviews with 46 govt. officials:

- How are indicators used by managers
- What characteristics were desired
- State agency officials
- River Basin Commission officials
- Federal agency officials
- Nongovernmental water organizations
 - e.g. watershed associations

Respondent Recruitment

- “Reputational Method”
- State agencies (28 interviews)
 - NJDEP, Delaware DNREC, PADEP, MDDNR, VAMRC, VADCR, VADEQ, NCDENR and NYDEC
- Interstate Watershed Commissions (6 interviews)
 - DRBC, SRBC, ICPRB, and CBLAD

“Managers preferred suites of indicators with issue-dependent elements rather than a single index or indicator because they were able to construct a more complete picture of environmental condition and the factors contributing to this condition with suites of indicators.”

Integration of Ecological and Socioeconomic Indicators for Estuaries and Watersheds of the Atlantic Slope. February, 2006.

When did they use what?

- Individual indicators were used in assessing attainment of individual water quality standards (WQS) (e.g., dissolved oxygen concentration or fecal coliform bacteria counts)
- Indicators were considered most useful when they also provided insight into sources and factors responsible for existing conditions, including non-attainment of WQS.
- Environmental indices that provided a single number (e.g., fish index of biotic integrity), but that did not provide diagnostic information about environmental condition were not considered as useful as suites of indicators.

“Differing perspectives on indicator development were also apparent between managers and scientists. Managers used indicators as information to contribute to decisions, while scientists used indicator information to understand relationships (e.g., cause-effect) in ecosystems. A significant challenge identified by respondents was achieving consistency between the metrics that scientists obtain and the data that managers need.”

Integration of Ecological and Socioeconomic Indicators for Estuaries and Watersheds of the Atlantic Slope. February, 2006.

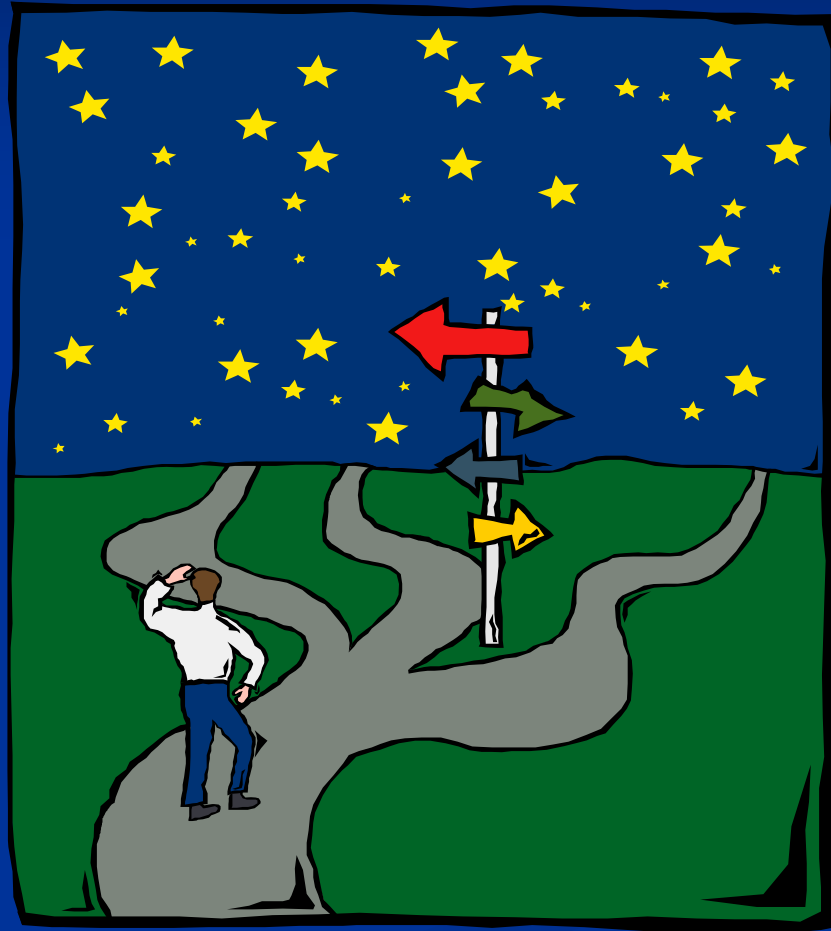
Desired attributes

- For *monitoring and assessment*, indicators must be sensitive to the relevant spatial and temporal scale, and must be adaptable to improving technology.
- For *setting priorities*, managers considered the ability to measure impairment as the most useful indicator attribute.
- For *regulatory enforcement*, managers considered scientific accuracy and consistency in measuring standards as the most important attributes.
- For *communication*, indicators must be adaptable to different audiences and concerns.

What's most useful?

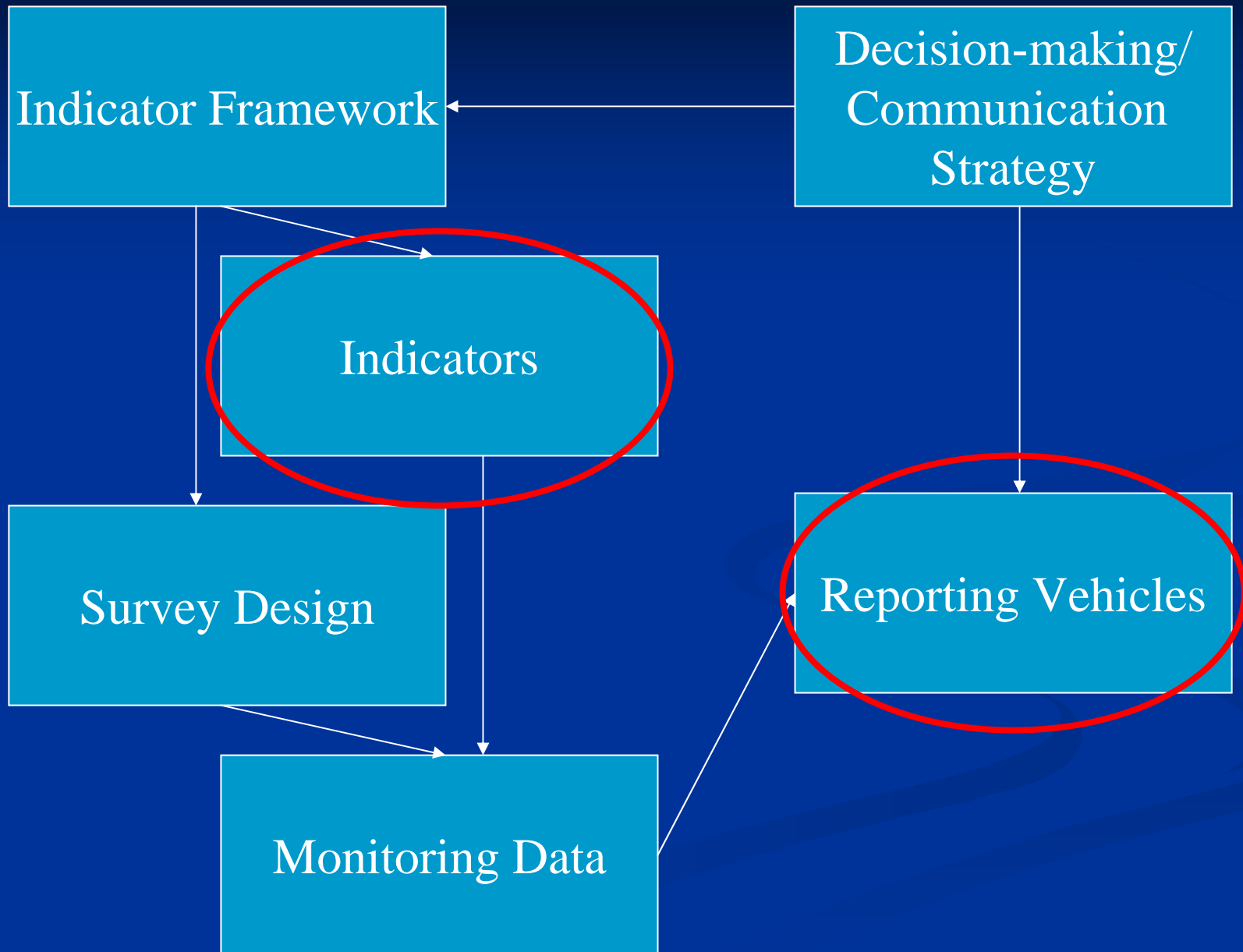
- Indicators must provide information about specific endpoints used for management and policy decisions.
- Indicators must be appropriate for the geographic or spatial scale of the decision.
- Clear and interpretable indicator information must be able to be delivered to decision-makers when and where they need it.

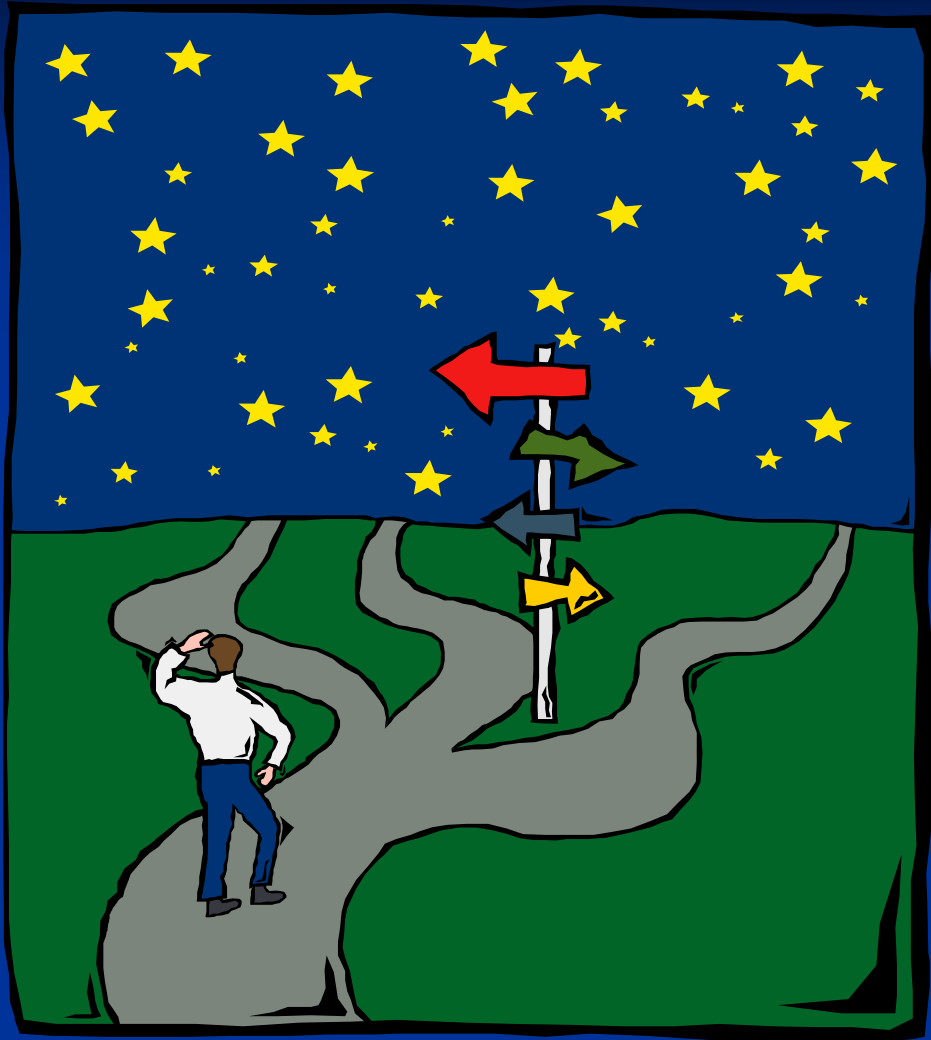
Why do we need a framework?



Why do we need a framework?

- It is imperative to provide a comprehensive framework for indicator selection and use. The same framework would also be used to evaluate the utility of any given indicator.
- Environmental managers need a roadmap; project scientists need an organizing framework to identify gaps





- Specific endpoints used for management and policy decisions

- Appropriate for the geographic or spatial scale of the decision

The framework should follow the reality of environmental decision-making

- Managers are faced with answering one (or more) of the following:

- How big is the problem?

Condition
Assessment/State

- Is it getting better or worse?

Trends Condition
Assessment/State

- What's causing it?

Diagnose
Stressors/Pressure

- What can be done?

Futures
Forecast/Restore

- Is management making a difference?

Evaluate
Performance

- How do I communicate any of the above to the public?

Communication
w/ Public

What's your type of question (indicator)?

Condition
Assessment/State

Evaluate
Performance

Diagnose
Stressors/Pressure

Communication
w/ Public

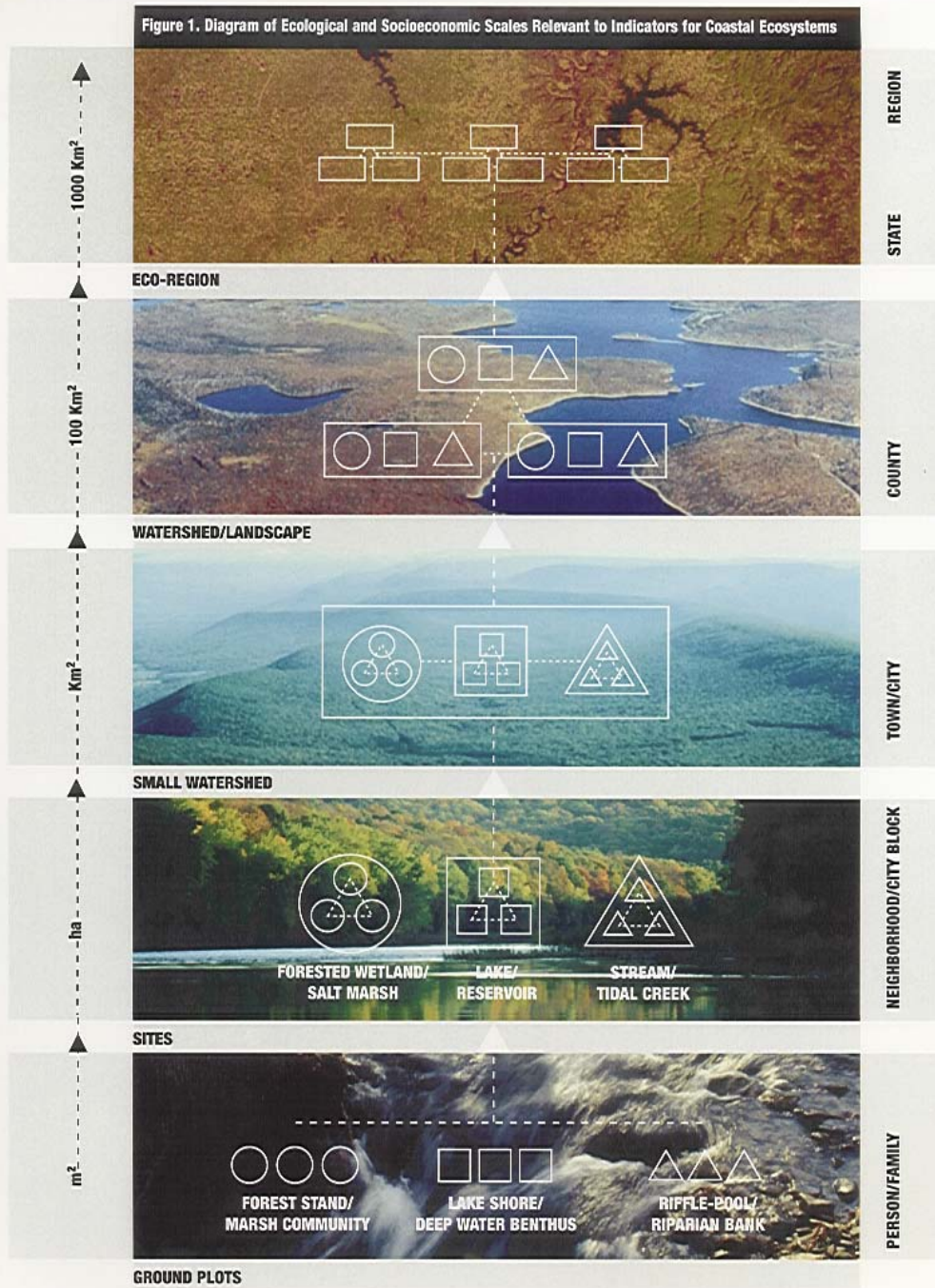
Futures
Forecast/Restore



- Specific endpoints used for management and policy decisions

- Appropriate for the geographic or spatial scale of the decision

Spatial/Temporal Scales



Human Scales

What's your type of question (indicator)?

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Assessment/State

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Performance

Diagnose
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Communication
w/ Public

Futures
Forecast/Restore

What's your spatial/temporal scale of interest?

Site

Reach

Small Watershed/
14-digit HUC

County

Large River

Days

Months

Seasons

Years

Decades

Application of the Framework to a Program

- Chesapeake Bay Program has 82 metrics;
30 assumed to be indicators
- Developed over 20 years
- How do these indicators “map” onto the
framework?
- What can we learn from “mapping”?

What's your type of question (indicator)?

Condition
Assessment/State

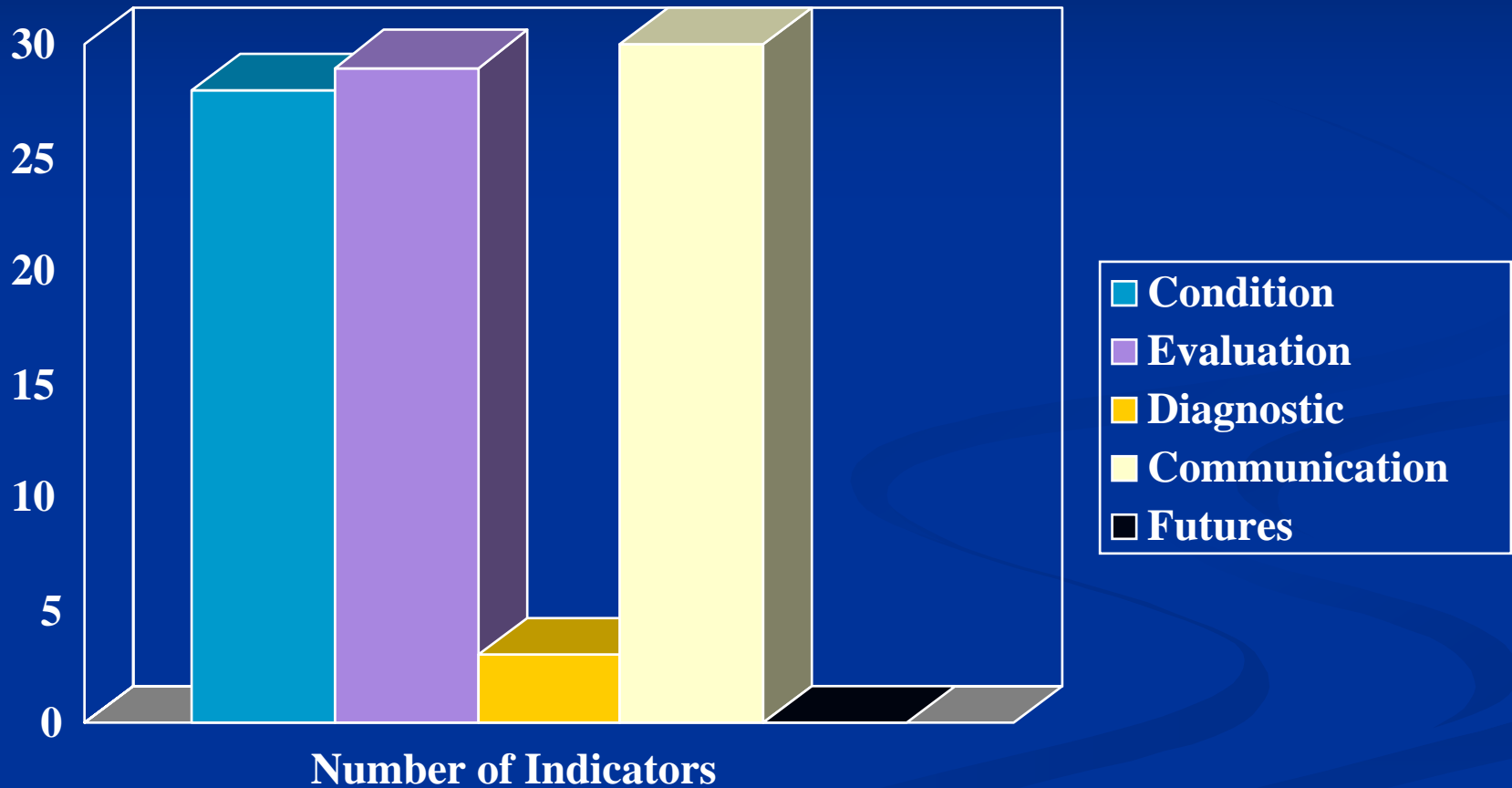
Evaluate
Performance

Diagnose
Stressors/Pressure

Communication
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Futures
Forecast/Restore

Chesapeake Bay Program Indicator Distribution (n=30)



Chesapeake Bay Program Indicators

- Indicator Function
- Condition
 - Evaluate
 - Diagnose
 - Communicate
 - Futures

Mapping of CBP Indicators

- 28 of 30 CBP Indicators are “condition” ones; 2 have no reference standard
- 29 of 30 are “evaluation” indicators, tied to specific management actions
- 0 of 30 are “futures” indicators
- 3 of 30 are “diagnostic” indicators
- 30 of 30 are “communication” indicators

What's your type of question (indicator)?

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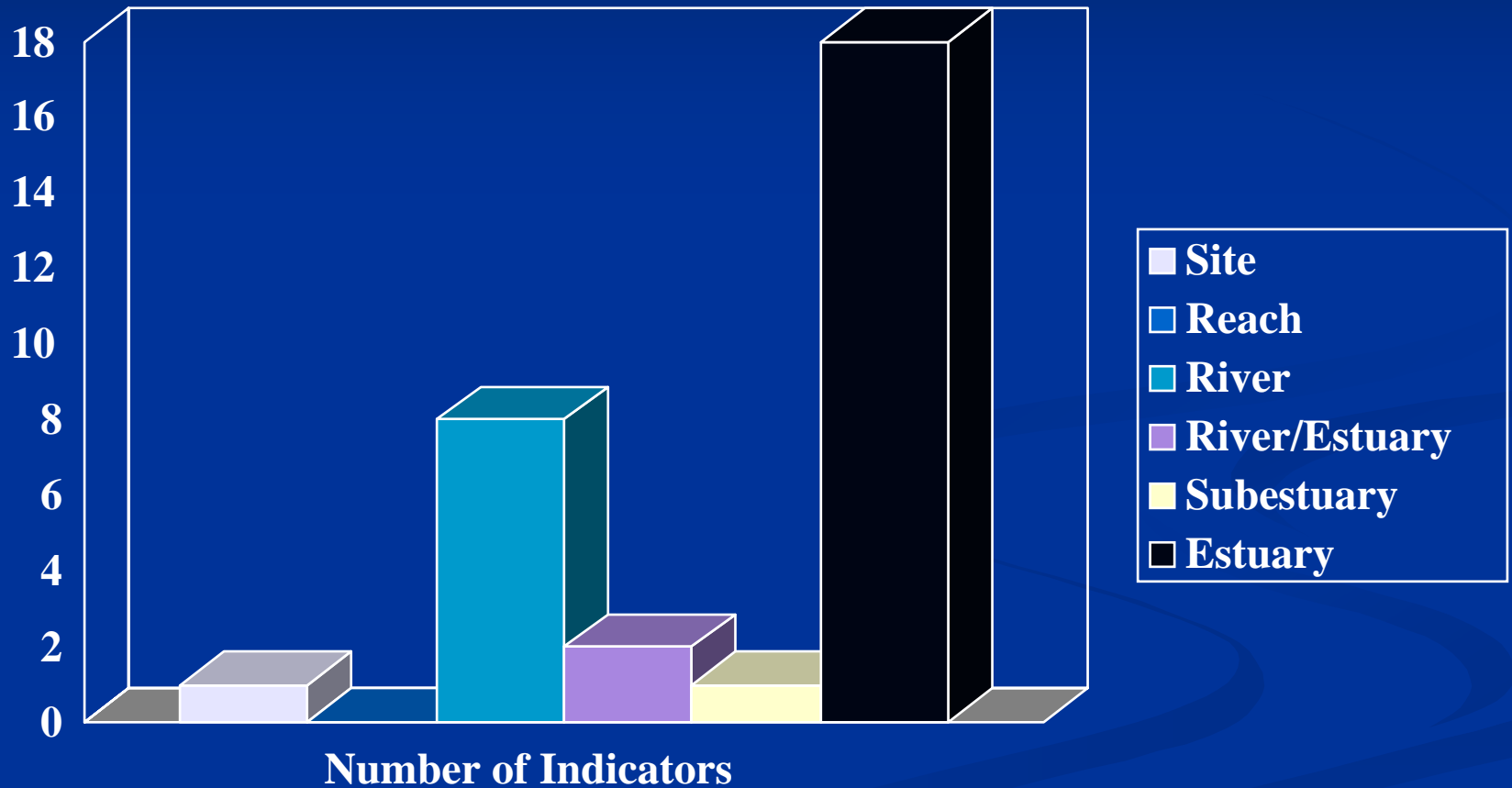
Months

Seasons

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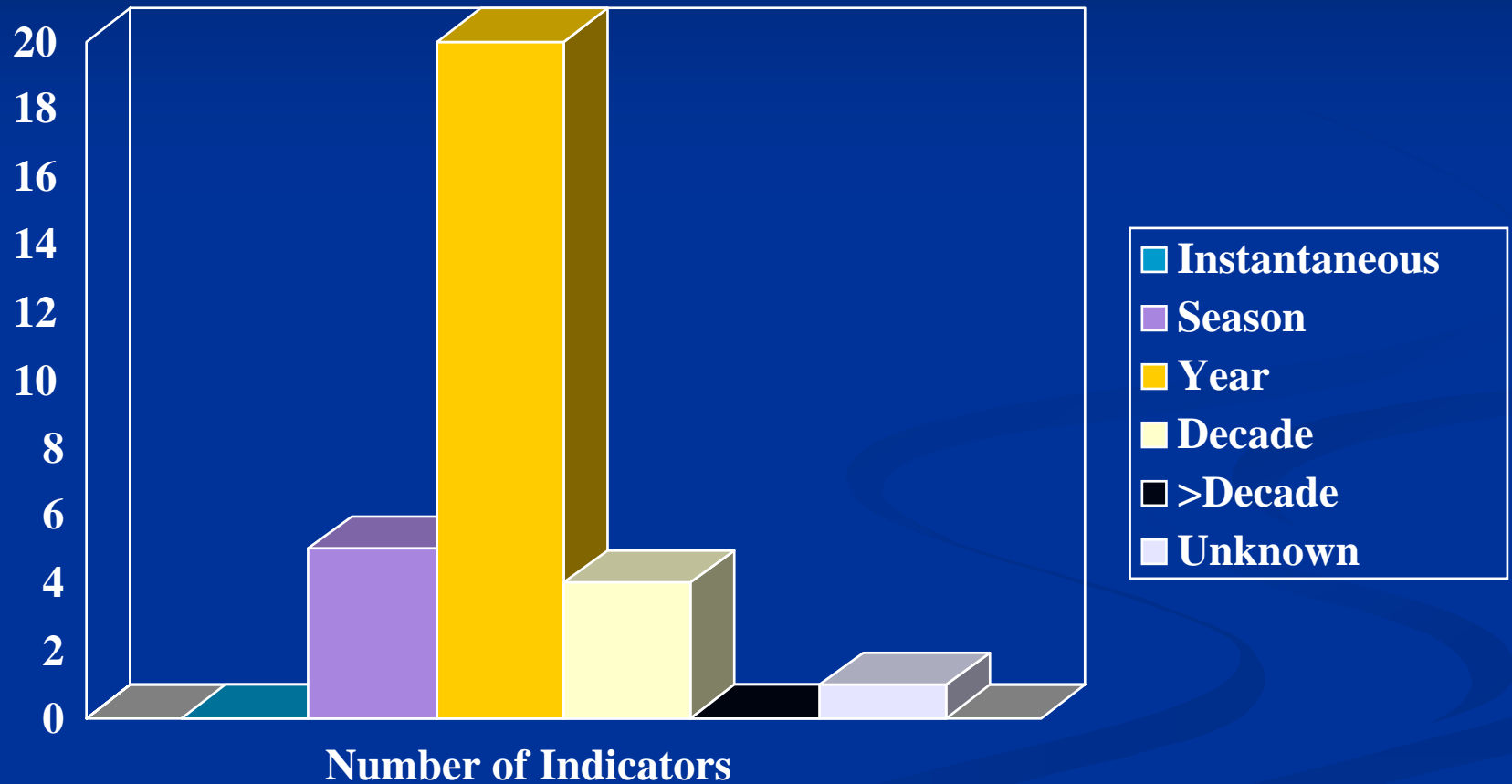
Decades

Spatial Scale of CBP Indicators (n=30)



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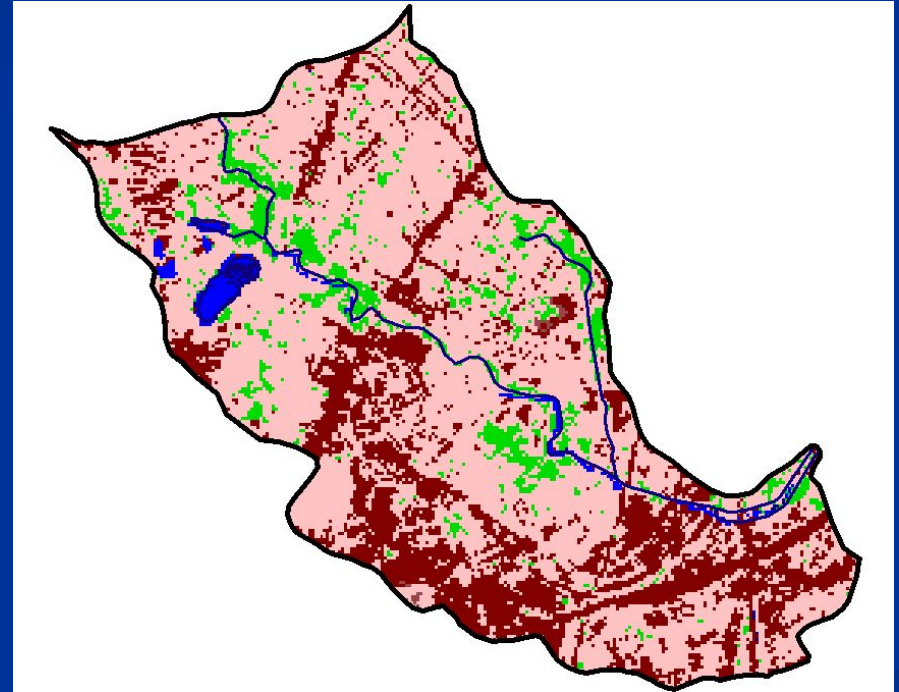
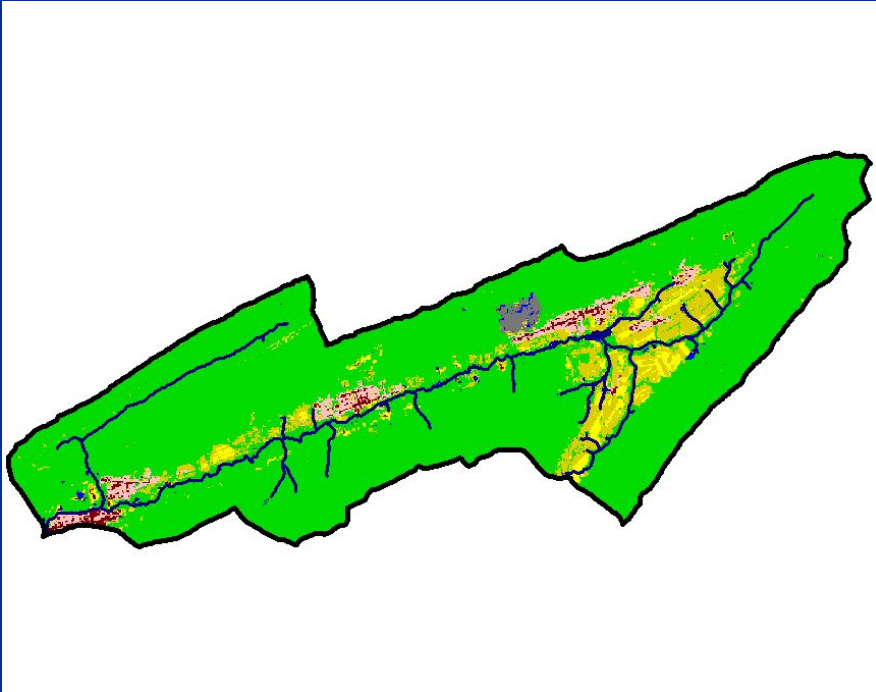
Temporal Scale of CBP Indicators (n=30)



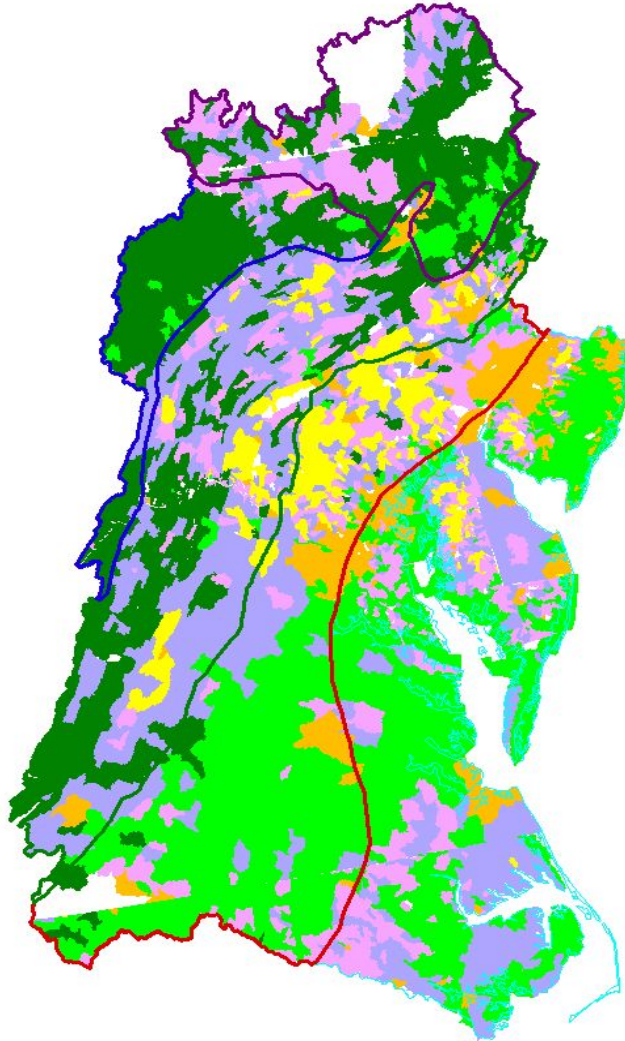
What's a useful comparison?

- All areas are compared to one standard
- Each area is compared to its “peers”

Watersheds are not all the same



ASC Watershed Clusters



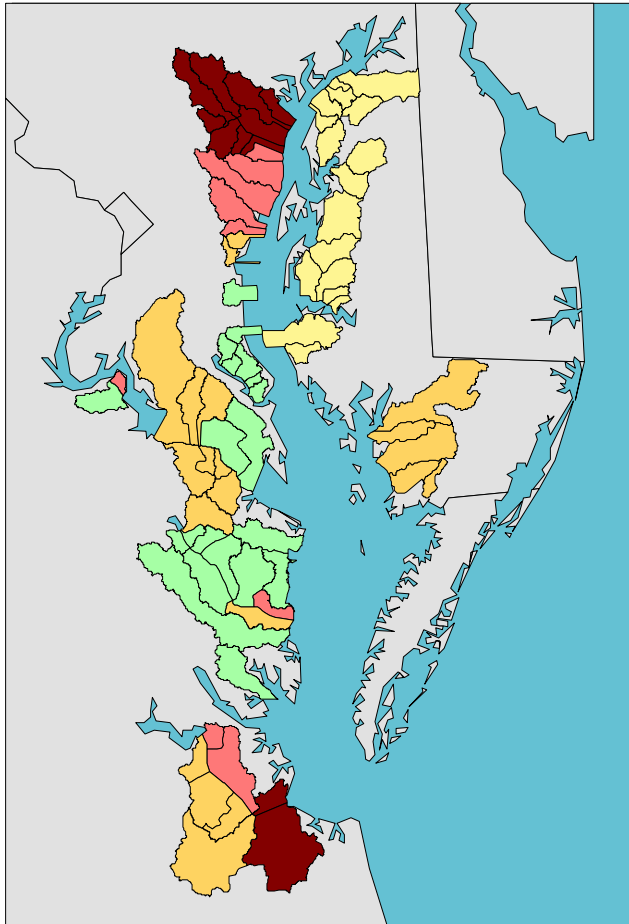
Legend

Clusters	Physiographic Province
1 - Forest/High Slope	COASTAL PLAIN
2 - Urban	PIEDMONT
3 - Mked /Low Nodal Var.	PLATEAU - GLACIAL
4 - Forest/Low Slope	PLATEAU - NON-GLACIAL
5 - Agriculture	RIDGE & VALLEY
6 - Mked /High Nodal Var.	

60 0 60 120 Miles



What types of estuarine segments will be selected and where will they occur?



- Forested (> 65 % Forest)
- Agriculture (> 50 % Agriculture)
- Urban / Suburban (> 50 % Urban / Suburban)
- Mixed-Agriculture (20 - 50 % Agriculture)
- Mixed-Urban / Suburban (20 - 50 % Urban / Suburban)

What's your type of question (indicator)?

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What's your spatial/temporal scale of interest?

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What's the context (i.e., social choice)?

High Slope
Forested

Low Slope
Forested

Agricultural

Urban

Mixed/High
Variance

Mixed/Low
Variance

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PCBs in White Perch

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- Developed land cover, weighted by proximity, and PCB concentration ($r^2=99\%$)
- Approx. 20% developed land cover predicts PCB levels at consumption advisory (1 meal/month)

Bio-optical Indicators

- Developed watersheds, higher optically significant WQ constituents
- WQ requirements in developed watersheds considerably more stringent

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What are we recommending to the CBP?

- For the existing Indicator framework, revisit the structure of reporting indicators to be more helpful to managers
- When reporting, incorporate the notion of relevant and appropriate comparison

What's useful?

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- Evaluate restoration progress
- Monitor condition
- Helps establish restoration goals
- Informs the public
- Make info and data available

What's your type of question (indicator)?

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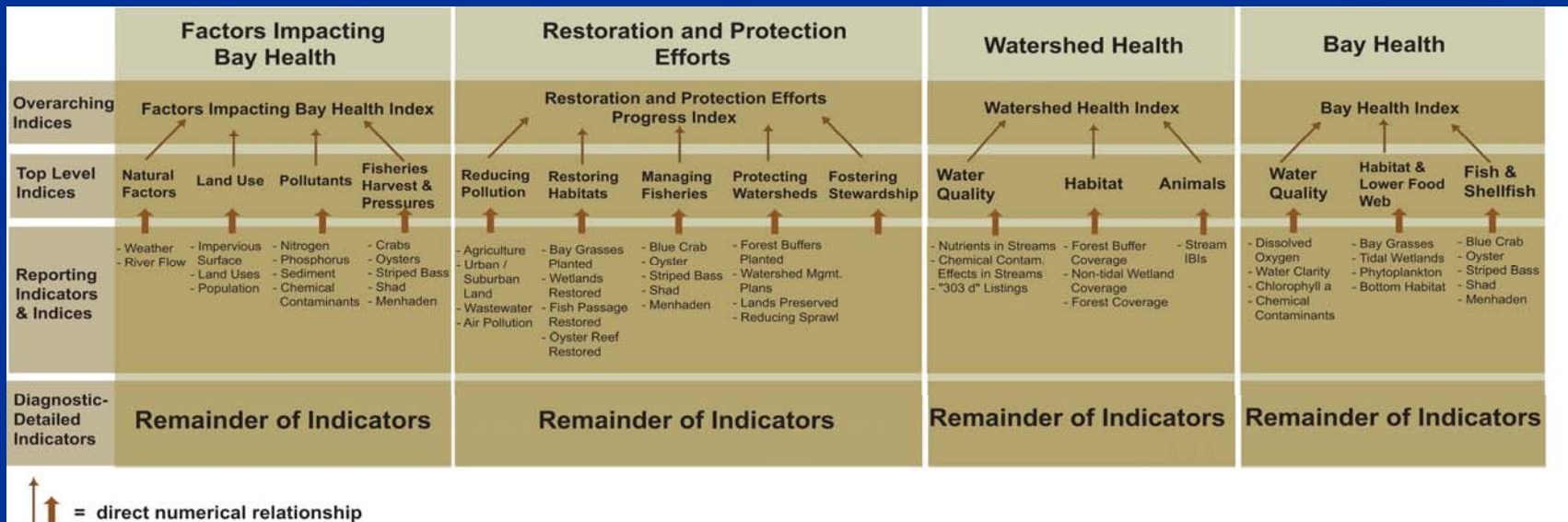
Are we meeting the larger objective?

What GAO Recommends

GAO recommends that the Administrator of EPA instruct the Chesapeake Bay Program Office to (1) complete its efforts to develop and implement an integrated assessment approach; (2) revise its reporting approach to improve the effectiveness and credibility of its reports; and (3) develop a comprehensive, coordinated implementation strategy that takes into account available resources. In commenting on this report, the signatories to the *Chesapeake 2000* agreement generally agreed with GAO's recommendations.

Developed a framework that:

1. Addresses separately the state of the Bay, Bay stressors, and the state of the Bay restoration
2. Provides a logical hierarchy
3. Facilitates communication of linked indicators
4. Is closely aligned with the Bay Program's overall communication strategy



→ Watershed health: STAC RESPONSIVE WORKSHOP REQUESTED