

AN INTRODUCTION TO EFFECTIVE SCIENCE COMMUNICATION

Caroline Donovan

University of Maryland Center for
Environmental Science's
Integration and Application Network
May 5, 2016

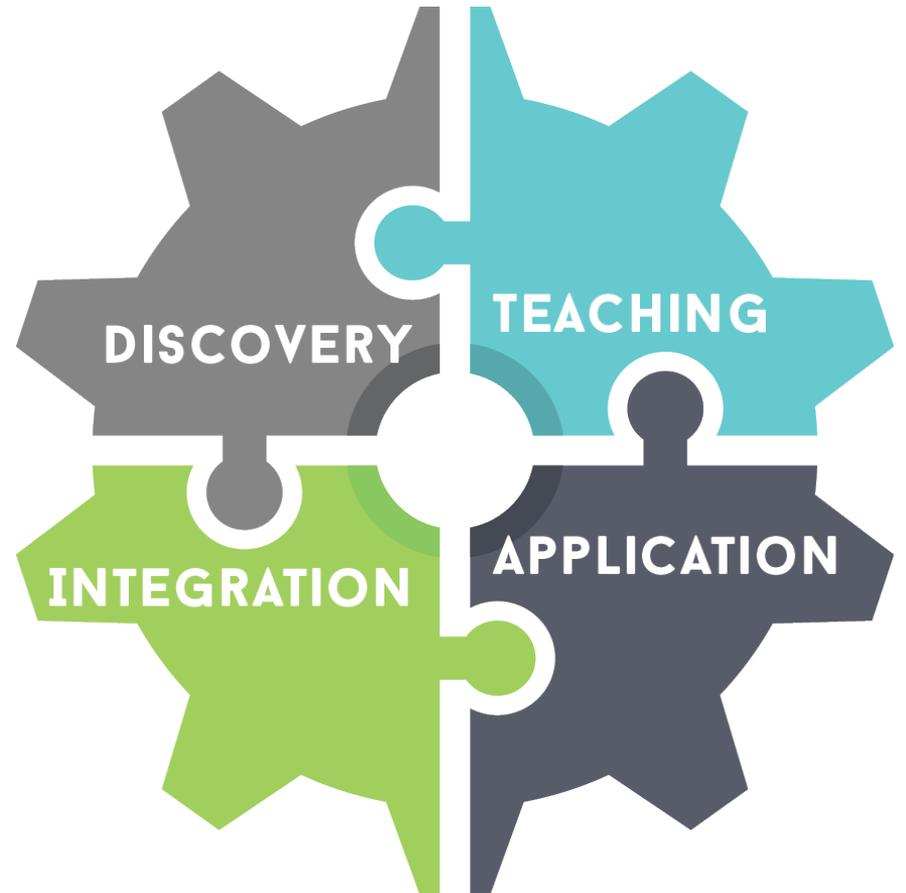
OVERVIEW

- What is the Integration and Application Network?
 - Who are we?
 - 3 Key areas: Report Cards, Integrated Assessment, Science Communication Training
- Science Communication
 - Bit of theory
 - Applications
- About this course

INTEGRATION & APPLICATION NETWORK

IAN's aim is to enable better communication to empower change.

ian.umces.edu



SOLVING, NOT JUST STUDYING ENVIRONMENTAL PROBLEMS

STUDY

- Dispassionate
- Embrace complexity
- Publish & funding via peer review
- Getting it right



SOLVE

- Passionate
- Simplify
- Publish & funding via stakeholders
- Getting it done

IAN PERSONNEL

Recruiting and retaining talented and committed people

- Science Integrators
 - PhD scientists
- Science Communicators
 - MS scientists
- Interns
 - Undergraduate scientists



IAN THEMES



COMMUNICATING SCIENCE EFFECTIVELY



REPORTING ECOSYSTEM STATUS



TEACHING & TRAINING



CATALYZING CONSERVATION OUTCOMES



ADVANCING CHESAPEAKE BAY RESTORATION



BUILDING STRATEGIC PARTNERSHIPS



CREATING GOOD CITIZENSHIP MODELS



COMMUNICATING SCIENCE EFFECTIVELY

Creating innovative ways to
visually present science



130,561,717

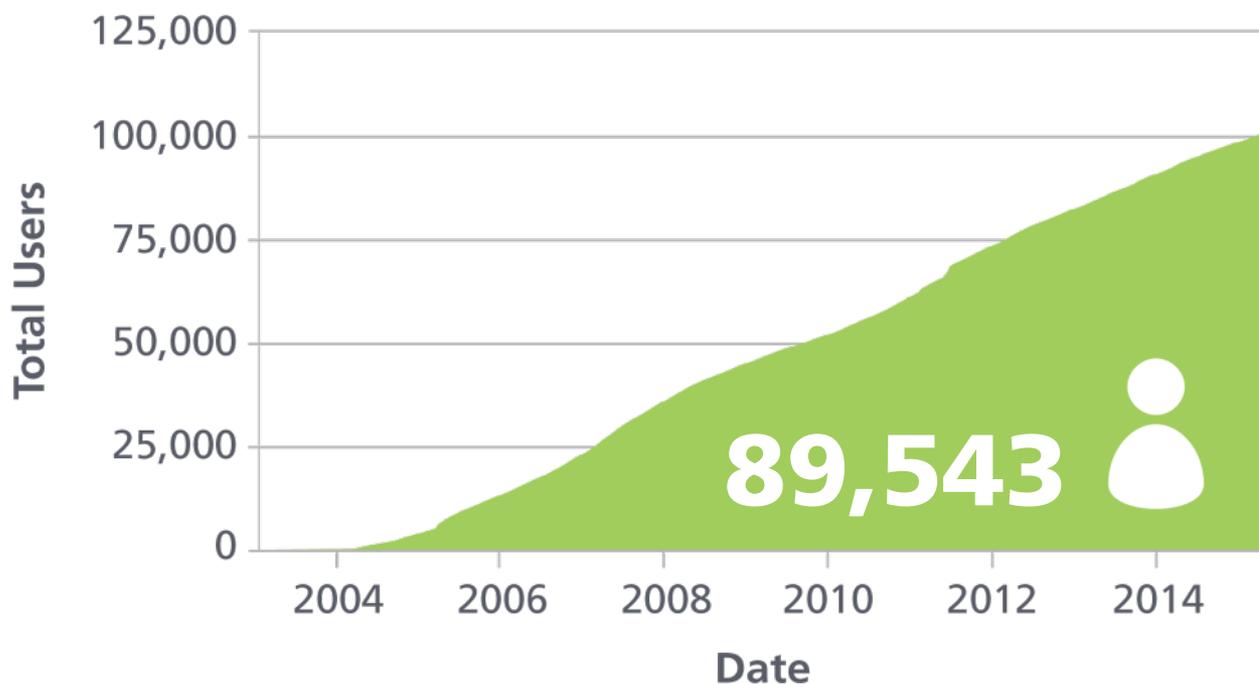
images downloaded



COMMUNICATING SCIENCE EFFECTIVELY

Creating innovative ways to
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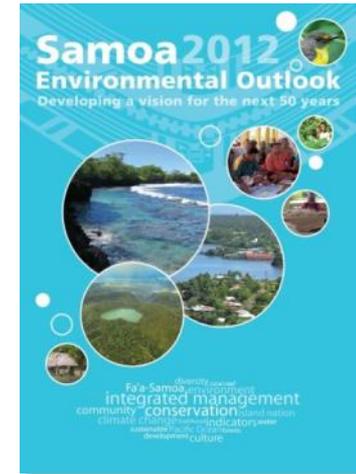
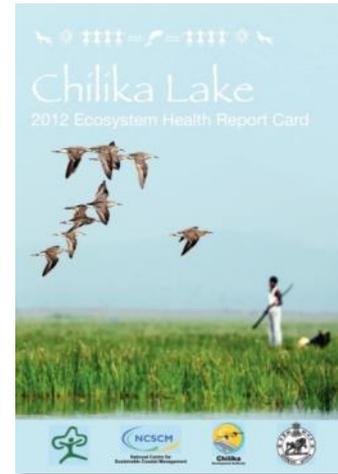
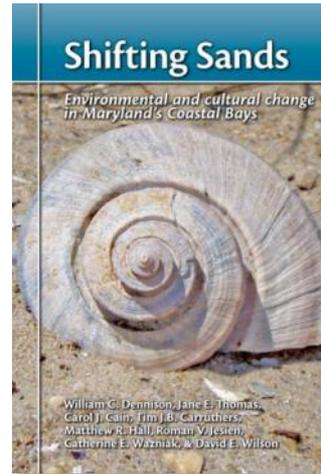
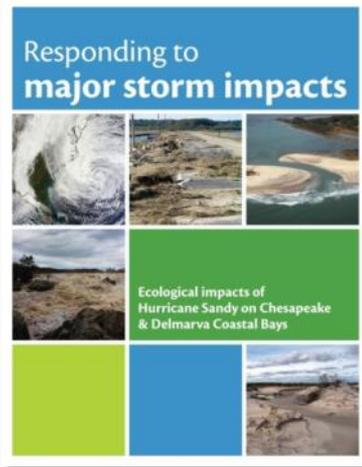
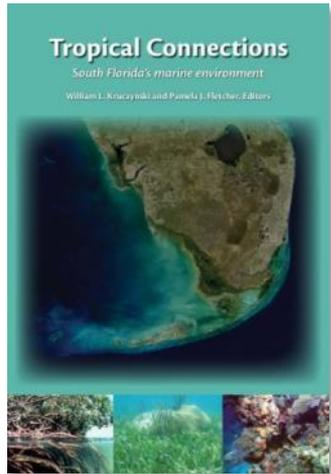
Image and Symbol Library Users





COMMUNICATING SCIENCE EFFECTIVELY

Creating innovative ways to
visually present science



395

communication products



COMMUNICATING SCIENCE EFFECTIVELY

Creating innovative ways to visually present science

May 1, 2015

Fifteen students, Ten minutes: One humbling education



Rebecca Peters, Aimee Hoover, Emily Russ The birds are chirping, the grass is green, the tourists are out walking the streets, and students are indoors on a Saturday signaling the coming end of another eventful school year: Spring is in the air in Annapolis. On Saturday April 25, 2015 graduate students in the Science for [...]

[Continue Reading »](#)

April 28, 2015

A report card to tell your mom about: Environmental report cards provide transparent assessments of our aquatic ecosystems



Melanie Jackson, Chih-Hsien (Michelle) Lin, Detbra Rosales Students in grammar school and all the way to college have anxiety about receiving report cards, and often times devise plans for the best time to tell their parents about their not so stellar grades. Explaining poor grades to parents can involve tactics such as blaming the teacher [...]

[Continue Reading »](#)

April 23, 2015

Willamette River Report Card – I can see the light at the end of the tunnel



Developing a new report card is not a trivial business and can take a lot of time and effort on everyone's behalf. The Willamette River Report Card has been no exception with over eight months since start date and upwards of 20 indicators initially proposed by stakeholders from 25 organizations at four workshops. Despite information [...]

Search for:

Categories

- Environmental Literacy
- Environmental Report Cards
- Science Communication
- Applying Science
- Learning Science
- Case studies
 - Australian cities and waterways
 - Queensland Floods
 - Uncategorized

Tags

- Australia
- Brisbane
- Chesapeake Bay
- climate change
- conceptual diagrams
- conference
- dancing with dugongs
- dennison-sabbatical
- dugong rock
- ecosystem health
- education
- effectively-communicating-science
- environment
- Environmental Report Cards
- flood
- Great Barrier Reef
- Management
- monitoring

477
blog posts

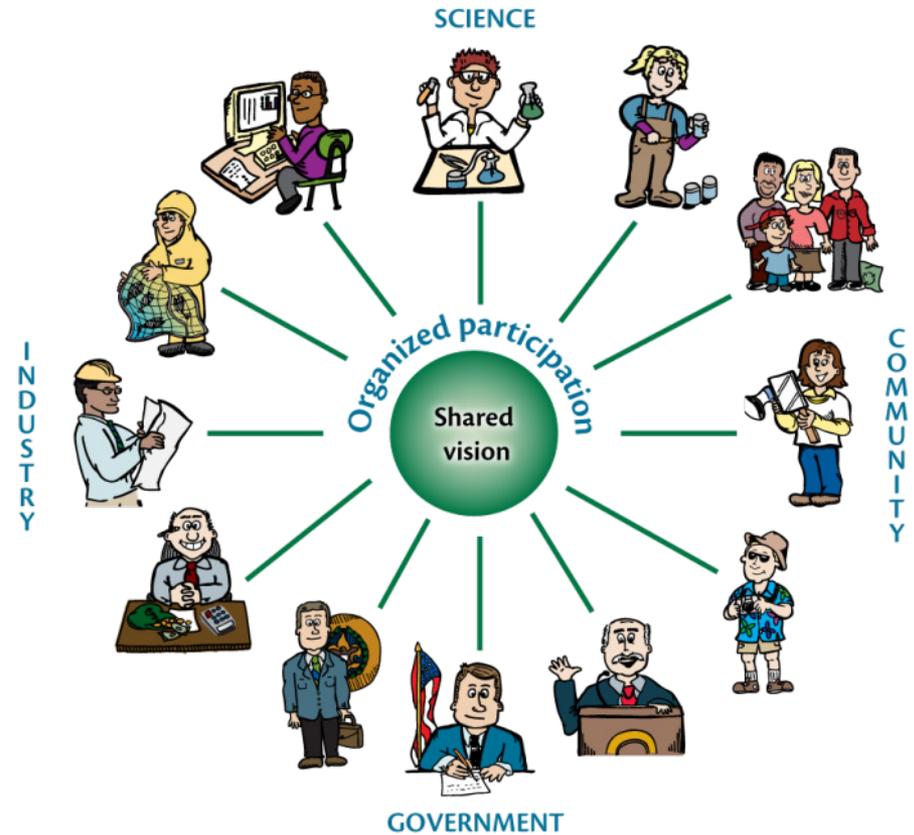
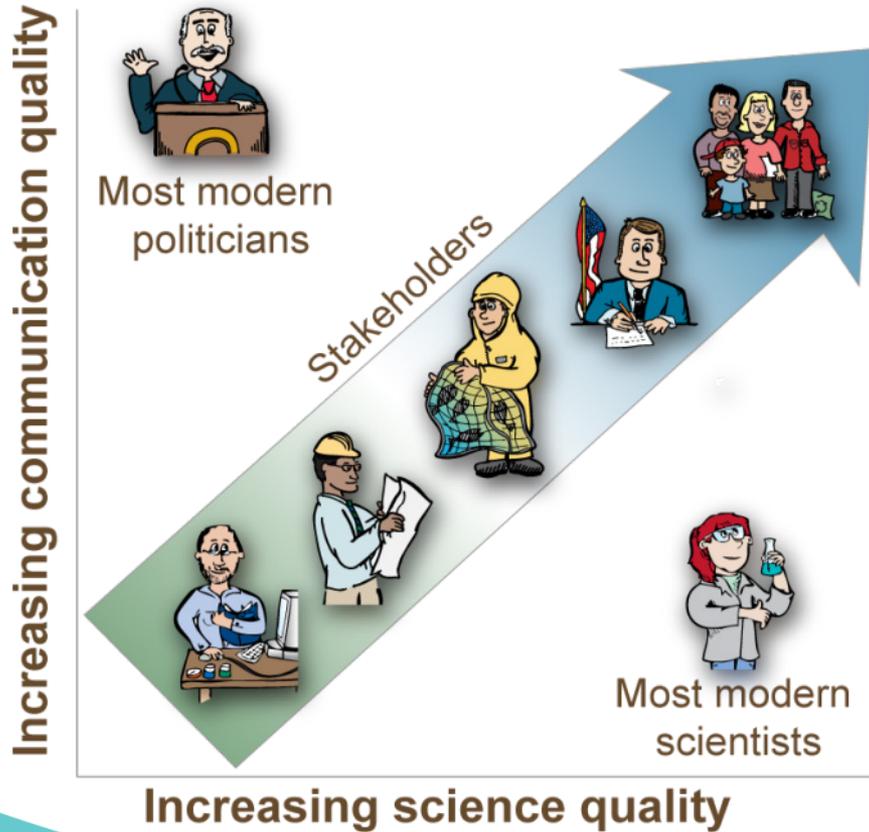
426 
likes

WHAT IS SCIENCE COMMUNICATION?

- Successful dissemination of knowledge to a wide range of audiences (science and non-science)
- You are not doing anything if nobody knows about it



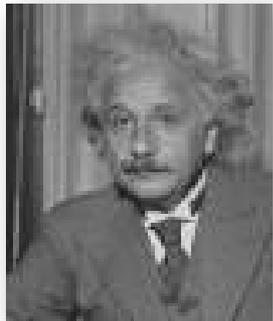
SCIENCE COMMUNICATION IS A BALANCE OF QUALITY SCIENCE AND COMMUNICATION



THE GREAT SCIENTISTS ARE/WERE ALSO GREAT COMMUNICATORS

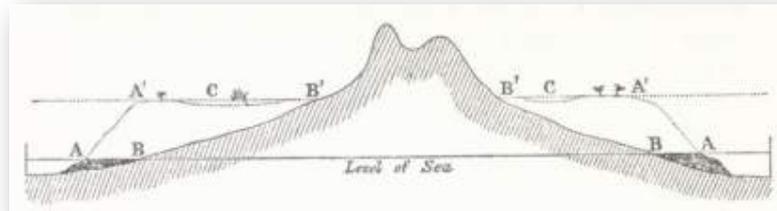


*Charles Darwin:
119 published books & papers*



*Albert Einstein:
248 published books & papers*

“Finally when ... barrier-reefs ... atolls... and fringing-reefs ... are laid down on a map, they offer a grand and harmonious picture of the movements which the crust of the earth has undergone within a late period. We there see vast areas rising, with volcanic outbursts; and we may feel sure that the movement has been so slow as to have allowed the corals to grow up to the surface...”



*The Structure and Distribution of Coral Reefs
Charles Darwin, 1874 2nd Edition,
revised 1842 1st Edition*

*"Make everything as simple as possible,
but not simpler." A. Einstein*

EMPLOYING DIFFERENT COMMUNICATION TECHNIQUES

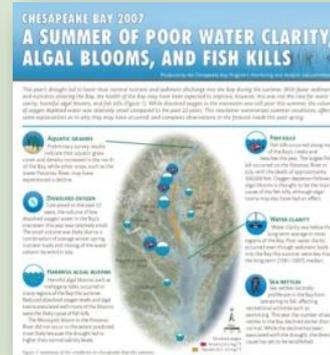
Scientific writing



- Providing scientific context (references)
- Text > graphics
- Authorship exclusive
- Focus on results & interpretation



Science communication



- Providing societal context (examples)
- Text ≈ graphics
- Authorship inclusive
- Focus on conclusions & recommendations



GOOD SCIENCE COMMUNICATION CAN MAKE YOU A BETTER SCIENTIST

Completeness

Envisioning the 'story' can lead to comprehensive research program

Context

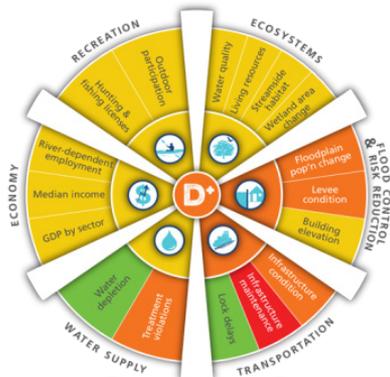
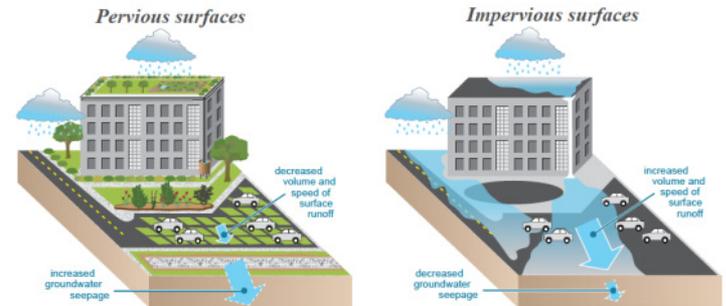
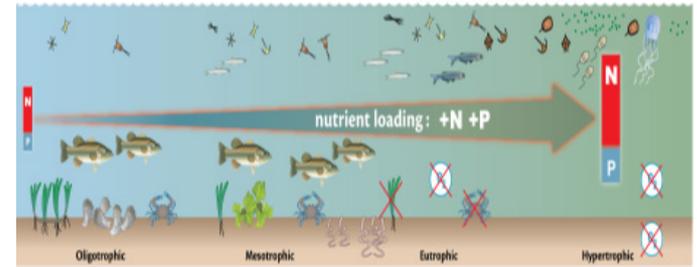
Identifying the linkages and developing comparisons can provide important insights

Visualizations

Combining visual elements can lead to new insights

Synthesis

Combining and comparing different data sets or approaches can lead to insights



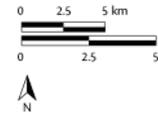
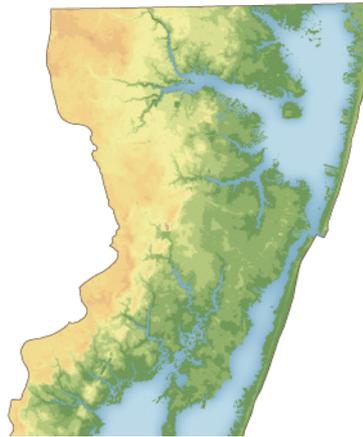
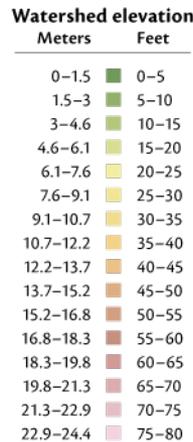
SYNTHESIZING INFORMATION FOR LESS TECHNICAL AUDIENCES

Synthesis



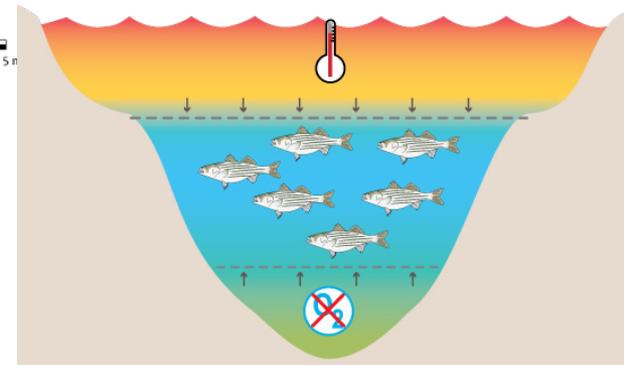
Interpreted & synthesized data

Visualization



Sense of place: who, what, where, when, how & so that you can tell them why

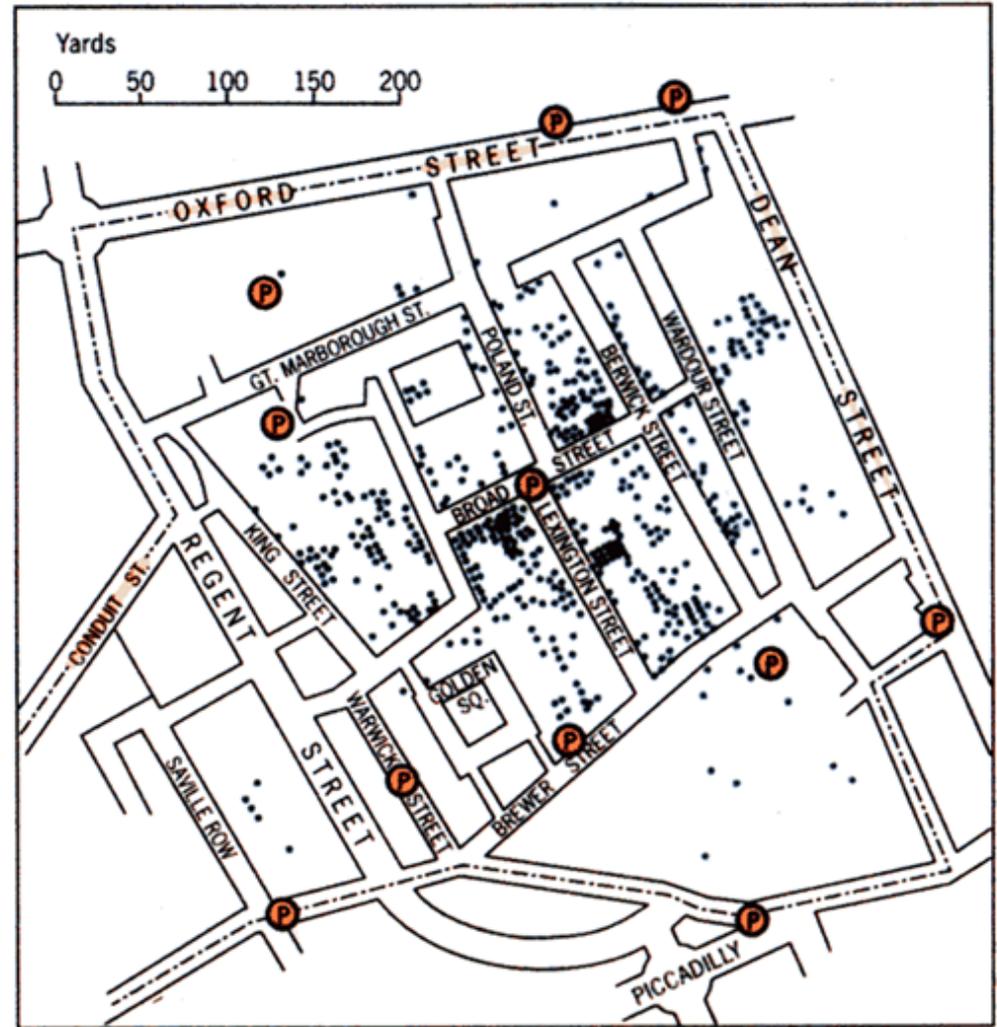
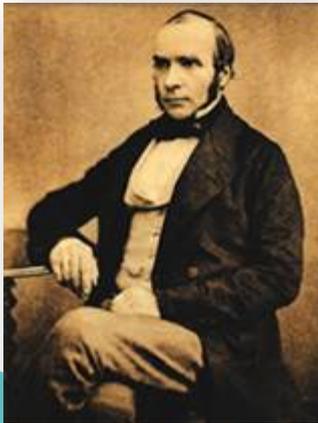
Context



So what?

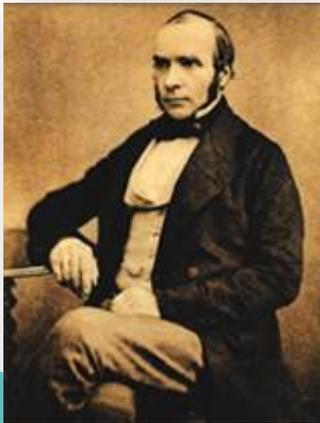
JOHN SNOW'S 1854 CHOLERA MAP

- Cholera outbreak in London
- John Snow mapped cholera cases
- Linked cholera cases to pump locations
- Pump handle removed; cholera subsided



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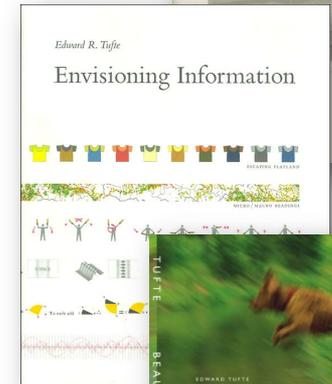
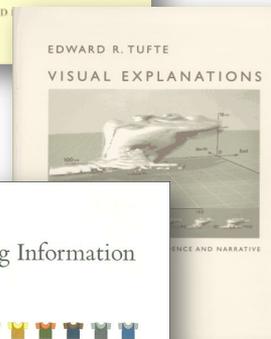
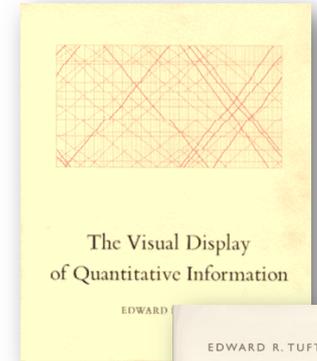
WHAT IS DATA VISUALIZATION?

- The goal is to communicate information clearly and efficiently via statistical graphics, plots, information graphics, tables, and charts
- Effective visualization helps uncover trends, realize insights, explore sources, and tell stories
- It makes complex data more accessible, understandable, and usable.

PRINCIPLES OF ANALYTICAL DESIGN: EDWARD TUFTE

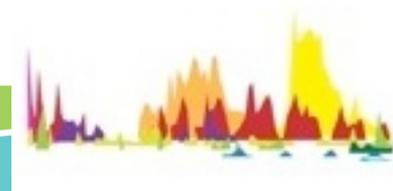
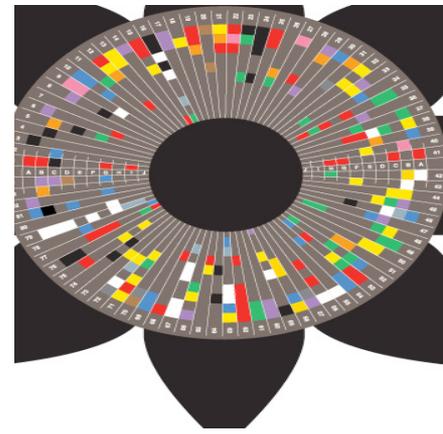
- Integrate word, image, numbers
- Content-driven
- Presentation enables thinking
- Use small multiples (maximize content variation; minimize style variation)
- Know your content and audience
- Use humor and hyperbole

Bad science communication can be tragic
(Challenger disaster)



INFORMATION IS BEAUTIFUL: DAVID MCCANDLESS

1. **Have fun!** Remember to play.
2. **A hierarchy of information.** Don't forget to structure the visual hierarchy of your image.
3. **Less is more.** What can you take out?
4. **Grids are good.** Use a mathematical grid to harmonize your layout.
5. **Color, color, color.** Draw a color palette from your subject matter.
6. **Re-skin the wheel.** Don't throw out pie, line, and bar charts. Just design them better.
7. **Make text work harder.** Text is a graphical element of your visual too.



WHAT IS DATA VISUALIZATION?

Function

&

Form

Choose the visualization type that best conveys the characteristics of the data

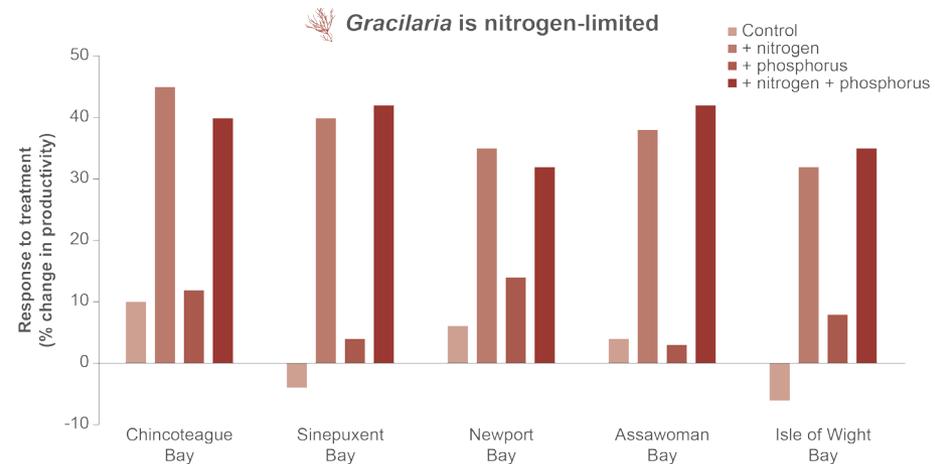
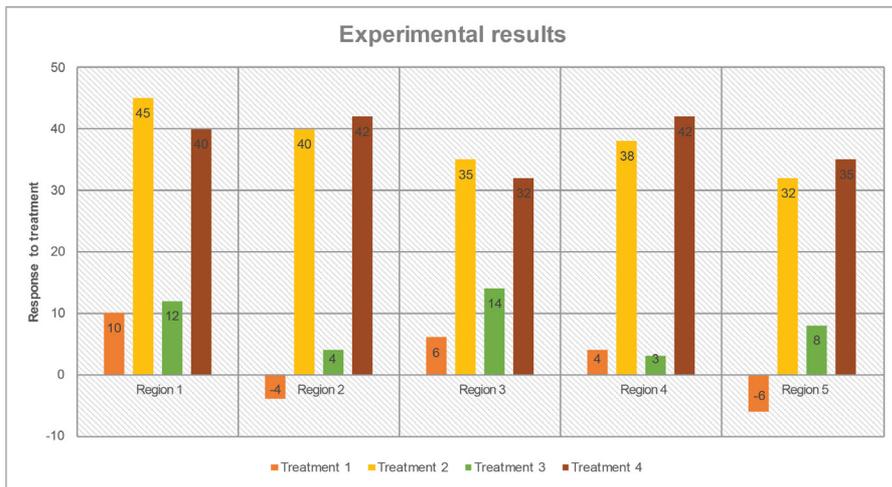
Apply color, size, fonts, and other design elements to guide the user

WHAT IS DATA VISUALIZATION?

Function

&

Form

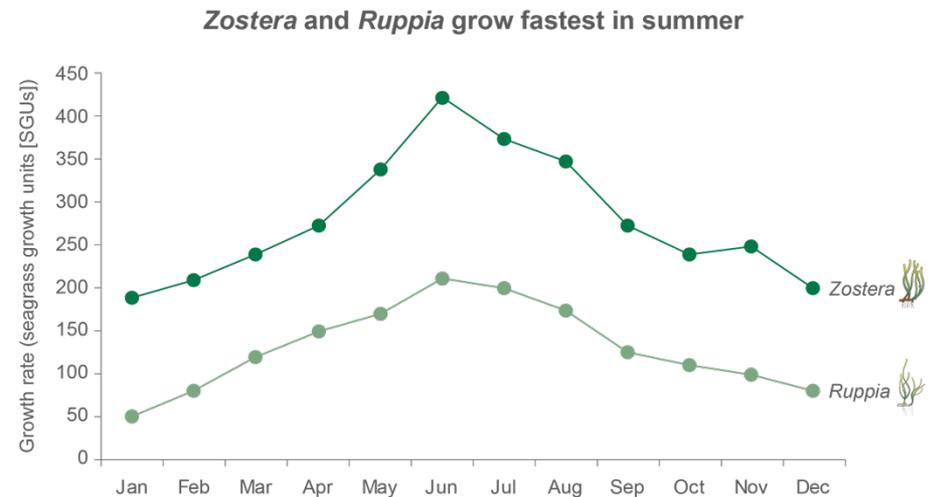
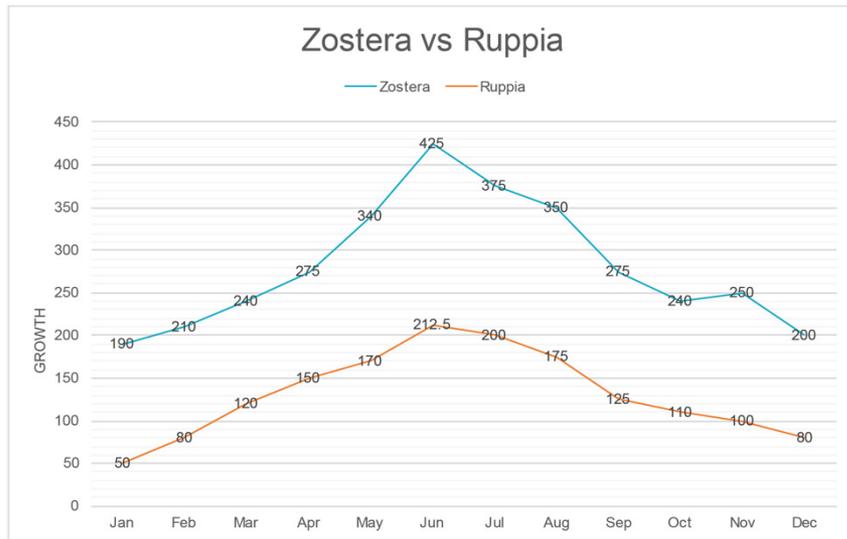


WHAT IS DATA VISUALIZATION?

Function

&

Form



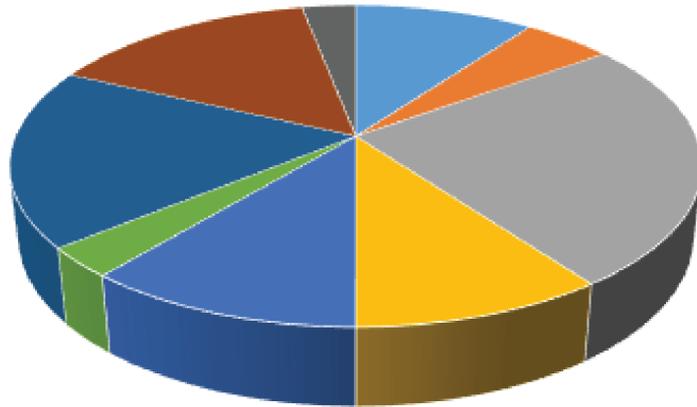
WHAT IS DATA VISUALIZATION?

Function

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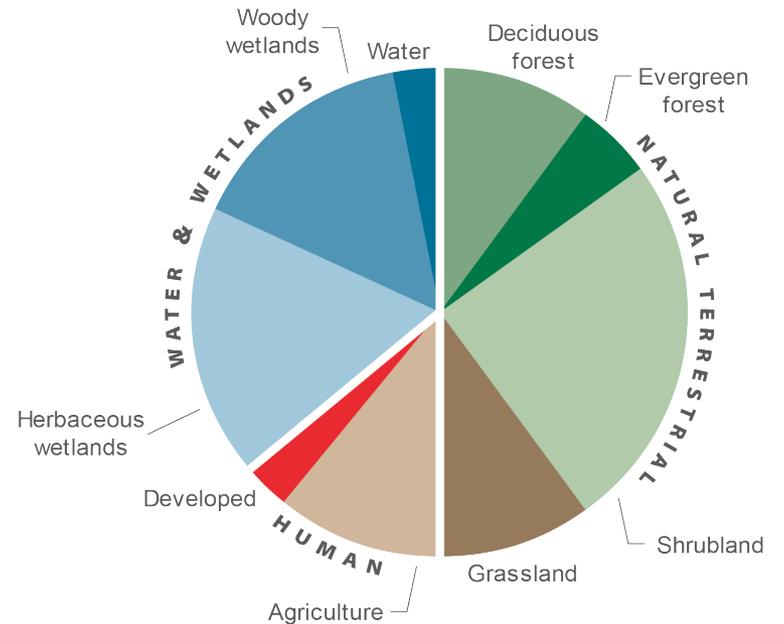
Form

Land use



Deciduous forest Evergreen forest Shrubland Grassland Agriculture
Developed Woody wetlands Herbaceous wetlands Water

Land use by area



DEVELOPING A VARIETY OF SCIENCE COMMUNICATION PRODUCTS

Newsletters

Science Journals

Posters

INCORPORATING HABITAT INTO ECOSYSTEM-BASED FISHERIES MANAGEMENT: HABITAT MATTERS!

Habitat consists of the physical, chemical, and biological components that are necessary for the survival and growth of organisms in an ecosystem and an entity. Habitat provides food and shelter for invertebrates, fish, and plants. Habitat is an integral part of an ecosystem and having habitat is important for determining ecosystem health. This newsletter describes the steps for determining aquatic habitat conditions, discusses the practical study of measuring habitat in complex ecosystems, and presents an example of a habitat suitability model.

WHY FOCUS ON HABITAT?

Ecosystem-based fisheries management (EBFM) includes not only the stock assessment and prey items of a single species, but also addresses the relationship between habitat, food, and water quality and the effects on species. Most fish health models consider the link among ecosystem and habitat characteristics, integrative ecosystem assessments, and habitat restoration.

One key component of ecosystem-based fisheries management is habitat restoration. Habitat restoration is a major focus area in the Chesapeake Bay. The goal of restoration in the past 20 years' habitat may be defined in a variety of ways, but usually includes the physical, chemical, and biological structure that living organisms require to survive and grow (Figure 1). The habitat that is being managed is often based on the type of ecosystem (e.g., estuarine versus ocean) and on ecosystem processes, habitat restoration is a wide range of factors such as salinity, dissolved oxygen, sediment type, and prey availability and distribution. To manage these ecosystems, habitat also needs to include other aspects of EBFM, such as living resources' use of habitat or habitat characteristics.

Restoration of habitat and food web structure is a key component of ecosystem-based fisheries management. The Chesapeake Bay has a long history of habitat restoration. The Chesapeake Bay has a long history of habitat restoration. The Chesapeake Bay has a long history of habitat restoration.

Environmental problem solving in coastal ecosystems: A paradigm shift to sustainability

William C. Dennison

University of Maryland Center for Environmental and Estuarine Science, P.O. Box 38, College Park, MD 20742, USA

Received 18 June 2006; accepted 1 September 2007
Available online 10 October 2007

Abstract

The marine ecological response to human activities in coastal ecosystems is becoming more complex and more difficult to understand. This is particularly apparent in coastal ecosystems where the problem is not only the direct effects of human activities but also the indirect effects of human activities on the ecosystem. The complexity of the problem is increasing and the need for a paradigm shift to sustainability is becoming more apparent. This paradigm shift involves a move from a focus on the physical and chemical characteristics of the ecosystem to a focus on the biological and ecological processes of the ecosystem. This paradigm shift is necessary to understand the complexity of the problem and to develop effective management strategies. This paradigm shift is necessary to understand the complexity of the problem and to develop effective management strategies.

1. Introduction

It is becoming increasingly apparent that the human ecological impact on coastal ecosystems is becoming more complex and more difficult to understand. This is particularly apparent in coastal ecosystems where the problem is not only the direct effects of human activities but also the indirect effects of human activities on the ecosystem. The complexity of the problem is increasing and the need for a paradigm shift to sustainability is becoming more apparent. This paradigm shift involves a move from a focus on the physical and chemical characteristics of the ecosystem to a focus on the biological and ecological processes of the ecosystem. This paradigm shift is necessary to understand the complexity of the problem and to develop effective management strategies.

Coastal Ecosystems: A Paradigm Shift to Sustainability

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The diagram illustrates the components of coastal ecosystems and their interactions. It shows the flow of energy and matter between different parts of the system, including the atmosphere, land, and water. Key components include phytoplankton, zooplankton, and higher trophic levels. The diagram also highlights the impact of human activities on these ecosystems and the need for sustainable management practices.

An Eye Opening Approach to Integrated Environmental Assessments

William C. Dennison, Todd S. Conner, and David R. Turner

University of Maryland Center for Environmental and Estuarine Science, P.O. Box 38, College Park, MD 20742, USA

Received 18 June 2006; accepted 1 September 2007
Available online 10 October 2007

Abstract

The need for integrated environmental assessments (IEAs) is increasing as the complexity of environmental problems grows. IEAs provide a systematic and comprehensive approach to understanding the interactions between different components of the environment. This approach involves the integration of data from various sources, including scientific research, policy analysis, and stakeholder input. The goal of IEAs is to provide decision-makers with the information they need to make informed choices about environmental management.

The diagram shows an 'eye opening approach' to integrated environmental assessments. It features a central eye graphic surrounded by various environmental indicators and data sources. The approach involves a multi-step process: 1. Data Collection, 2. Data Integration, 3. Data Analysis, 4. Data Interpretation, and 5. Data Communication. Each step is illustrated with a corresponding diagram and text.

Reports

Books

A Conceptual Basis for Natural Resource Monitoring

William C. Dennison

University of Maryland Center for Environmental and Estuarine Science, P.O. Box 38, College Park, MD 20742, USA

Received 18 June 2006; accepted 1 September 2007
Available online 10 October 2007

Abstract

Natural resource monitoring is a critical component of ecosystem management. It involves the systematic collection and analysis of data on the state of natural resources over time. This process allows managers to identify trends, assess the effectiveness of management actions, and make informed decisions about future actions. The conceptual basis for natural resource monitoring involves a clear understanding of the objectives of the monitoring program and the selection of appropriate indicators and methods.

The diagram illustrates the conceptual basis for natural resource monitoring. It shows a flow from 'Conceptual Basis' to 'Monitoring Objectives', 'Indicator Selection', 'Data Collection', and 'Data Analysis'. Each step is supported by a list of key concepts and methods. The diagram also includes a list of 'Key Concepts' and 'Key Methods'.

Antietam National Battlefield

William C. Dennison

University of Maryland Center for Environmental and Estuarine Science, P.O. Box 38, College Park, MD 20742, USA

Received 18 June 2006; accepted 1 September 2007
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Abstract

The Antietam National Battlefield is a significant historical site in Maryland. It is a site of national importance and is home to a rich collection of historical artifacts and structures. The battlefield is a testament to the bravery and sacrifice of the soldiers who fought there in 1862. The site is a popular destination for tourists and history enthusiasts alike. The battlefield is a testament to the bravery and sacrifice of the soldiers who fought there in 1862.

The map shows the layout of the Antietam National Battlefield. It includes various landmarks such as the Antietam Battlefield, the Antietam National Cemetery, and the Antietam National Battlefield Visitor Center. The map also shows the surrounding landscape and the location of the battlefield relative to nearby towns and cities.

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The diagram illustrates the park management and land use at Antietam National Battlefield. It shows the layout of the park and the various areas that are managed and maintained. The diagram also shows the impact of land use changes on the park and the need for sustainable management practices.

Defending Our National Treasure: A Department of Defense Chesapeake Bay Restoration Partnership 1998-2004

William C. Dennison

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The Chesapeake Bay is a vital natural resource for the United States. It is a site of national importance and is home to a rich collection of historical artifacts and structures. The bay is a testament to the bravery and sacrifice of the soldiers who fought there in 1862. The site is a popular destination for tourists and history enthusiasts alike. The bay is a testament to the bravery and sacrifice of the soldiers who fought there in 1862.

The diagram illustrates the restoration partnership between the Department of Defense and the University of Maryland. It shows the various activities and projects that were undertaken as part of the partnership. The diagram also shows the impact of the partnership on the bay and the need for sustainable management practices.

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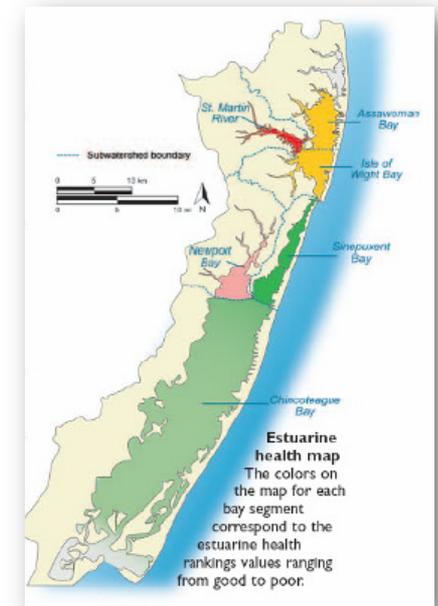
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INVEST IN SCIENCE COMMUNICATION

- Building a library of high quality visual elements is an investment that will pay dividends over time
- High quality visual elements can be recycled for various media
- Good science communication ...
 - Helps convey information
 - Helps make a good impression on your audience
 - Helps make a difference



ABOUT THIS TRAINING

- We want you to succeed and become better science communicators.
- Previous courses have created long-term collaborations and stimulated excellent science communication products.
- We like teaching this course and hope that you both learn a lot and have an enjoyable experience.

THANK YOU!

- Caroline Donovan
- cdonovan@umces.edu
- lan.umces.edu

