Tools for effective science communication

Our coastlines are becoming increasingly developed as more and more people live and recreate in coastal areas.

Many fish and shellfish species have been declining for the last few decades. Careful management can sustain populations of important commercial and recreational fisheries.

Seagrass abundance is declining globally. Physical disturbance and poor water quality threaten this valuable ecosystem.

In our estuaries and coastal waters, increased nutrient and sediment loads are resulting in areas with little or no oxygen (dead zones) which cannot support life.

Bill Dennison and Tim Carruthers

ian.umces.edu
Outline

• Overview of science communication

• Description of conceptual diagrams

• Exploration of how diagrams and symbols are used

• Introduction to online tools
Integration and Application Network

- A collection of scientists interested in solving, not just studying environmental problems
- Partner with other academic institutions, resource management agencies and non-governmental organizations
- Part of the University of Maryland Center for Environmental Science
Science communication has a social context

**Scientific writing**

- Provide scientific context (references)
- Text > graphics
- Focus on results & interpretation

**Science communication**

- Provide societal context (examples)
- Text ≈ graphics
- Authorship inclusive
- Focus on conclusions
Balancing quality science and quality communication

- Provide synthesis, visualization & context
- Simplify terms but not content
- Assemble self-contained visual elements
- Define all terms
- Minimize AU (Acronym Use)
- Prepare for and invite questions

Adapted from Thomas et al. 2006
Synthesizing information for less technical audiences

Synthesis

Report Card for the Mesoamerican Reef

Visualisation

Watershed elevation

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<td>22.9–24.4</td>
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Interpreted and synthesised data

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

Context

So what?
What is a conceptual diagram?

**Concept** — something conceived in the mind (Webster’s 3rd Dictionary, 1986)

**Diagram** — a drawing that shows relations (Webster’s 3rd Dictionary, 1986)

**Conceptual diagram** — A diagram using symbols that depicts the essential attributes of a system or process.
Conceptual diagrams synthesize and present information

Plate tectonics
Why are conceptual diagrams effective?

- Helps to clarify thinking (words can be ambiguous; an image commits to the message being portrayed)
- Communication (one-way and two-way – idea presentation and idea development)
- Identify gaps / priorities / essential elements
- Develop syntheses (or present synthesis)
Conceptual diagrams provide an interface

Science

Current understanding

Credibility & support

Community

Priorities & environmental values

Commitment & resources

Shared vision

Healthy Chesapeake Waterways
Conceptual diagrams use symbols to depict unequivocal messages

- Cave drawing
- Storyboard
- Darwin’s diagram
- Modern photograph
Symbols (icons) are a key element of conceptual diagrams

• Something that stands for or suggests something tangible

• A visible thing that stands for something invisible or intangible

• Symbols used in mathematics (e.g. $\pi$), chemistry (e.g. $^{210}\text{Pb}$), music (e.g. $\frac{4}{4}$) weather (e.g. $\text{cloud}$), religion (e.g. $\text{cross}$), corporations (e.g. $\text{Nike}$), and organizations (e.g. $\text{Plus}$)

• Symbols can be universal; language independent

• Symbols are scalable; size of symbol can represent relative importance (e.g. $\downarrow$ vs. $\Rightarrow$)

• Symbols can be information-rich: size, shape, color and position of symbols can convey information
In conceptual diagrams, as in maps, symbols need to be explained in a legend.

Map legend:
- Hiking trail
- Steep trail; arrows point uphill
- Overlook
- Horse trail
- Unpaved road
- Parking
- Ranger station
- Picnic area
- Wheelchair accessible
- Public campground
- Private campground

Conceptual diagram legend:
- Biological processes:
  - 7 excessive Ulva
  - 8 Zostera seed bank
  - 9 Halophila seeds
  - 10 urchin grazing
  - 11 dugong grazing
  - 12 green sea turtle grazing
  - 13 epiphytic grazers abundant
  - 14 fisheries
  - 15 fin fisheries
  - 16 Parrotfish grazing
  - 17 seabird guano
- Biological cycles:
  - 18 low seagrass production
  - 19 high seagrass production
  - 20 seagrass leaf recycling
  - 21 organic carbon release
  - 22 respiration
  - 23 nitrogen fixation
  - 24 ammonification
- Biological environment:
  - 25 stable seagrass
  - 26 seagrass detritus
  - 27 Avicennia
  - 28 Rhizophora
  - 29 branching coral
  - 30 boulder coral
  - 31 giant clam
  - 32 sea cucumber
  - 33 Angel fish
  - 34 duck
  - 35 wader
- Physical environment:
  - 36 seasonal turbidity runoff
  - 37 cyclone
  - 38 nutrient and sediment input
  - 39 environmental variability
  - 40 limestone
  - 41 carbonate sand
  - 42 terrigenous sand and mud
- Threats:
  - 43 canal development
  - 44 port development, marinas
  - 45 beef / dairy farming
  - 46 treated sewage outflow
  - 47 sugar cane
  - 48 boating
Developing a global symbol language

>51,000 people from 236 countries registered

1500+ symbols
How can conceptual diagrams be used?

Research

Monitoring

Synthesis

Management
Conceptual diagrams can be incorporated into various publications:

- Newsletter
- Science journals
- Posters
- Reports
- Books
Capturing-interpreting-creating: (KAHO) the process of developing conceptual diagrams
Development of symbols unique to Hawaii:

- **konane**: board game
- **noni**: Indian mulberry
- **halau**: canoe hut
Symbols can be easily downloaded and used

ian.umces.edu
Symbols can be easily downloaded and used.

IAN Symbol Libraries

The IAN symbol libraries contain over 1500 custom made vector symbols designed specifically for enhancing science communication skills. The libraries are designed primarily for use with Adobe Illustrator (requires version 10 or better), however we also offer eps and svg versions for non-Illustrator users. The symbols allow diagrammatic representations of complex processes to be developed easily with minimal graphical skills.

Our aim is to make them a standard resource for scientists, resource managers, community groups and environmentalists worldwide. Currently downloaded by 51773 users in 236 countries and 50 U.S. states.

The libraries are provided completely **cost and royalty free**. Please acknowledge as: Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols/), University of Maryland Center for Environmental Science. **Please note:** This acknowledgement is not compulsory, but greatly appreciated!

Please visit our help forum for technical help and to discuss your conceptual diagrams.

**Overview | Download | Documentation | Resources | Contribute | Help | About**

The current version (5.1) of the IAN Symbol Libraries contains over 1500 vector symbols in 32 libraries (Illustrator symbol palettes).

Included in the FREE download are:

- 32 self-installing symbol libraries
- 1500+ science/ecology symbols
- 100+ custom swatches
- Ecosystem landscape diagrams
- Interactive multimedia tutorial
- PDF index of all symbols
- EPS & SVG versions for non-Illustrator users

Also available from the resources page:

- Symbol creation service
- Symbol contributions forum
High resolution images are available

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2925 files in 51 albums and 6 categories with 32 comments, 300331 views, and 10310 downloads.
Forums open for support and input

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<td>A forum for obtaining technical help in making conceptual diagrams and using the IAN Symbol Libraries with Adobe Illustrator</td>
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<td>Last post by AdrianJ on September 10, 2009, 09:18:39 am</td>
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<td><strong>Symbol Creation Service</strong></td>
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<td>Please use this board to make your requests for symbols</td>
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<td>Moderator: TraceyS</td>
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<td>Last post by jkerry in Request of Gulf of Mexico... on September 30, 2009, 10:12:04 am</td>
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<td><strong>Symbol Contributions</strong></td>
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<td>Last post by desco in New symbol - Long-Armed... on July 02, 2009, 02:56:04 pm</td>
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<td><strong>Conceptual Diagrams Posted for Review</strong></td>
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<td>Please post diagrams to this board for peer review</td>
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<td>Last post by carolyn in Re: Candidates for a Com... on September 28, 2009, 09:08:34 am</td>
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<td>This forum is for sharing information about effective dissemination of science to other scientists, resource managers, politicians and the public. You can also post links to your favorite online science communication resources</td>
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<td>Please contribute any software tips used in the production of science communication materials or ask and we'll see if we can help</td>
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<td>Last post by AdrianJ in Better image compression... on September 16, 2009, 09:19:04 am</td>
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<tr>
<td>Looking for information on Chesapeake Bay but don't know where to find it? OR Do you have a resource that you'd like the community to know about? Post a message here and let's start sharing the information!</td>
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<tr>
<td>Last post by AdrianJ in Re: Chesapeake Bay Image... on July 02, 2008, 11:07:30 am</td>
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Conceptionary

- **Purpose:** recognize how symbols and diagrams can easily convey complex information

- **Requirements:**
  - 4 to 60 people (in small groups)
  - 15 to 60 minutes
  - Provide drawing materials and concept cards

- **Audience:**
  - General (scientist, non-scientist)

- **Lesson learned:** visuals are a powerful tool for connecting with audiences
Title pursuit

- **Purpose:** practice creating active titles
- **Requirements:**
  - 4 to 60 people (in small groups)
  - 60 minutes
  - Provide visual elements and text
- **Audience:**
  - General (scientist, non-scientist)
- **Lesson learned:** well constructed titles can provide information for even the most casual reader and help to focus content
Trade-Off!

• **Purpose:** practice negotiating and making management decisions

• **Requirements:**
  - 4 to 6 people
  - 30 to 60 minutes
  - Game board & pieces

• **Audience:**
  - General
    (scientist, non-scientist)

• **Lesson learned:** effective management decisions require input from all stakeholders
Wrap up and review

• Science communication synthesizes information for less technical audiences

• Visuals are key to science communication

• Symbols and conceptual diagram provide context and information

• Tools for building synthesized communications are available