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St Lucia Coastal Habitat Mapping Project

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Utilizing Coastal Habitat Maps and Database

Jeffrey Euwema

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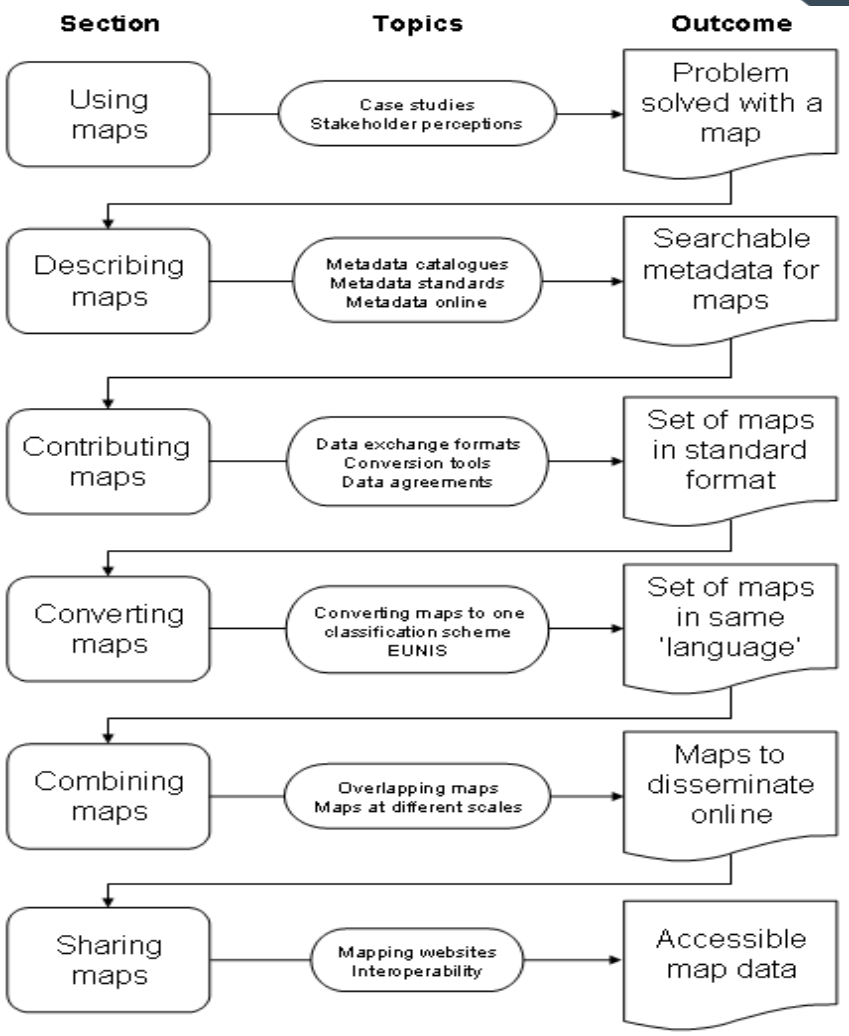
Session Purpose

- This session addresses key issues for the utilization of habitat maps:
  - the purpose for which the maps were intended to be used, and
  - how maps can be used beyond their original purpose.

Map Uses [1]

- For many people, maps are pieces of art to be admired, but to others, they form an essential part of a toolset to solve complex problems in the natural environment.
- Habitat distribution maps are becoming invaluable in providing information for the sustainable management



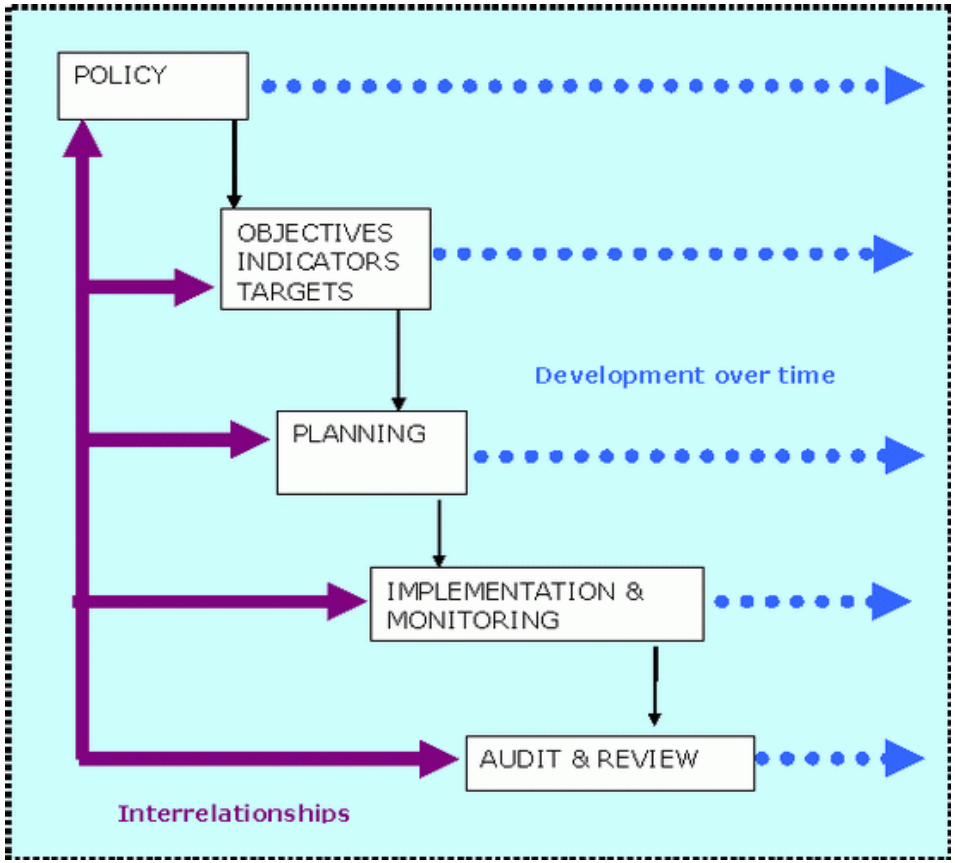
Map Uses [2]

- The following are some of the foremost uses of marine habitat maps:
  - To assist in making environmental assessments and hence decision-making regarding new developments or infrastructure projects
  - To facilitate strategic and spatial planning through knowledge of the distribution, extent and importance of habitats
  - To inform on-going management of marine activities, such as fisheries, leisure activities
  - To assess nature conservation value, including the assessment of habitat rarity in local, regional and international contexts and identification of important biodiversity areas
  - To map the sensitivity of areas to various human impacts, such as dredging or catastrophic events such as oil spills

Map Uses [3]

- To help surveillance programmes in the assessment of the state of the seas, such as regional or international initiatives
- To enable monitoring programmes to better target at a range of ecological features and potentially reduce monitoring effort through selection of sites based on better information
- To identify marine protected areas (MPAs) at both a site specific or national level, including selection of representative sites and management of sites after designation
- To increase our understanding of marine ecosystems, for example through study of relationships between seabed habitats, hydrodynamic conditions and fish communities

Key Elements of Environmental Management



- Policy → improved scientific understanding
- Objectives → ecological quality objectives
- Planning → resource identification stakeholder participation
- Implementation→ resource management conflict resolution
- Monitoring → change in extent and quality of seabed habitats
- Audit → sampling design extraction and disposal sites
- Review → effects of policy

Describing Data [1]

- Maps are produced to convey information to people.
- Details should be provided to describe the map and to help map users interpret the information.
- Metadata is used to capture basic characteristics of a data or information resource. It represents the “who, what, when, where, why and how” of the resource.
- The major uses of metadata are:
  - organize and maintain an organization's internal investment in spatial data,
  - provide information about an organization's data holdings to data catalogues, clearinghouses, and brokerages, and
  - provide information to process and interpret data received through a transfer from an external source.

Describing Data [2]: Metadata

- U.S Federal Geographic Data Committee (FGDC) has been actively involved with the International Organization for Standardization Technical Committee 211 in the development of an International Metadata Standard -- ISO 19115 Metadata Standard (2003).
- A geospatial metadata record includes:
  - Core library catalog elements such as: Title, Abstract, and Publication Data;
  - Data Quality Information − assessment of the quality of the data set.
  - Spatial Data Organization Information − the mechanism used to represent spatial information in the data set.
  - Spatial Reference Information − description of the reference frame for, and means of encoding, coordinates in the data set.
  - Entity and Attribute Information − information about the content of the data set, including the entity types and their attributes and the domains from which attribute values may be assigned.
  - Distribution Information − information about obtaining the data set.

Contributing to Data [1]

- Wherever possible, habitat maps should be made available to the wider scientific and marine management community to avoid an unnecessary duplication of effort to collect data in the same area.
- There are a number of issues to consider when transferring data between organizations, they are:
  - data exchange formats to facilitate the process of transferring maps,
  - data conversion to standard formats, and
  - the benefits of data agreements

Contributing to Data [2]: Data Exchange Formats

- Data Exchange Formats (DEFs) define the characteristics of data to be exchanged between parties. DEFs facilitate the exchange of data between individuals, projects or organisations in an efficient manner.
- In the context of habitat mapping data, a DEF should state the file formats expected for example:
  - CSV (comma separated values) is a common text file format,
  - an ESRI™ shapefile for GIS vector data, or
  - JPEG or TIFF for raster or image data;

Also remember to stipulate a coordinate system and define require attribute(s).

Contributing to Data [3]: Data Archiving

- Efficient archiving is a key part of improving access to information.
- Proper archiving facilitates efficient data distribution.
- Data that must be archived so that they can be accessed and used in the future.

Too many data resources languish in desk drawers or on out dated hardware because of a lack of clear planning in projects about what will happen to the data beyond the life of the project.

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Translating Maps

- Translating maps ***not*** Converting maps
- Translation refers to a process of integrating data into the national classification schema that has been developed under this consultancy.
- Need not be restricted to habitat maps

Scale of mapping	Purpose of mapping study	Example classification scheme
Site Specific	Environmental impact assessment e.g. habitat map produced as part of port development	Habitat classes used within a single local mapping study
Local	Strategic Environmental Assessment	Habitat classes used for a suite of habitat maps across local area or bay
National	National mapping study	National Marine Habitat Classification for St. Lucia

Combining Maps & Analysis [1]

- Related to the slide above, combining maps and data is not a problem. The user; however, must be aware of several factors such as:
  - map scale,
  - map purpose and
  - method of compilation.

- The process of combining maps or asking questions of map in a computer system is known as spatial analysis.

Combining Maps & Analysis [2]

- Spatial Data Analysis - collection of methods, techniques and approaches to extract meaningful information from sets of spatial and/or attributive data, represented in geospatial form in modern GIS packages
- The role of analysis in GIS is to turn data into information and create new data by manipulating collected data.
- Spatial analysis has several levels of sophistication:
  - manipulation
  - transformation
  - queries
  - geo-statistics
  - modeling

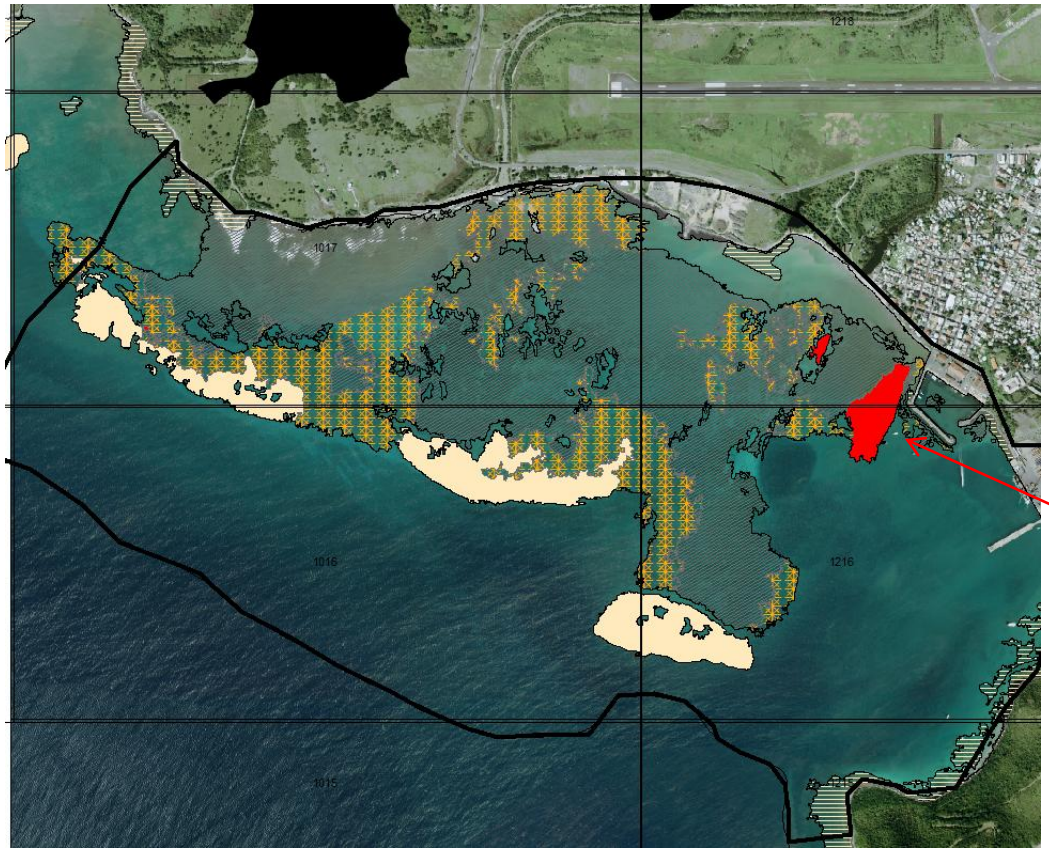
Combining Maps & Analysis [3]

- There are two main division of spatial analysis can be defined by data type:
  - Vector analysis - uses spatial data that is stored in a GIS as a series of lines, points, and polygons.
  - Raster analysis - on the other hand, makes no such assumption, and represents areas as a series of pixels within a grid.

Combining Maps & Analysis [4]

- The fundamental assumption behind vector analysis is that the area defined by a point, a segment of line, or a polygon is uniform throughout.
  - Vector analysis is used when
    - precision is important, or
    - multiple attributes are required for polygon. Raster analysis is designed to model continuous data, in which values constantly change from point to point.
  - Raster analysis is used when
    - speed is more important than precision, or
    - very large amounts of analysis needs to be performed.

Data Utilization: Key Indicators



Testing/Sampling Area

- Key Indicators:
  - Water Temperature (26-32º)
  - Salinity (35000 -40000 ppm)
  - Nitrates (7.5 -19 m/per litre)

st_lucia_marine_habitats
- <all other values>
- CLASS
- Artificial
- Continuous SRV
- Coral Reef
- Hardbottom
- Mixed Substrate
- Patchy SRV
- Unconsolidated Sediments - Algae
- Unconsolidated Sediments - Mud
- Unconsolidated Sediments - Sand

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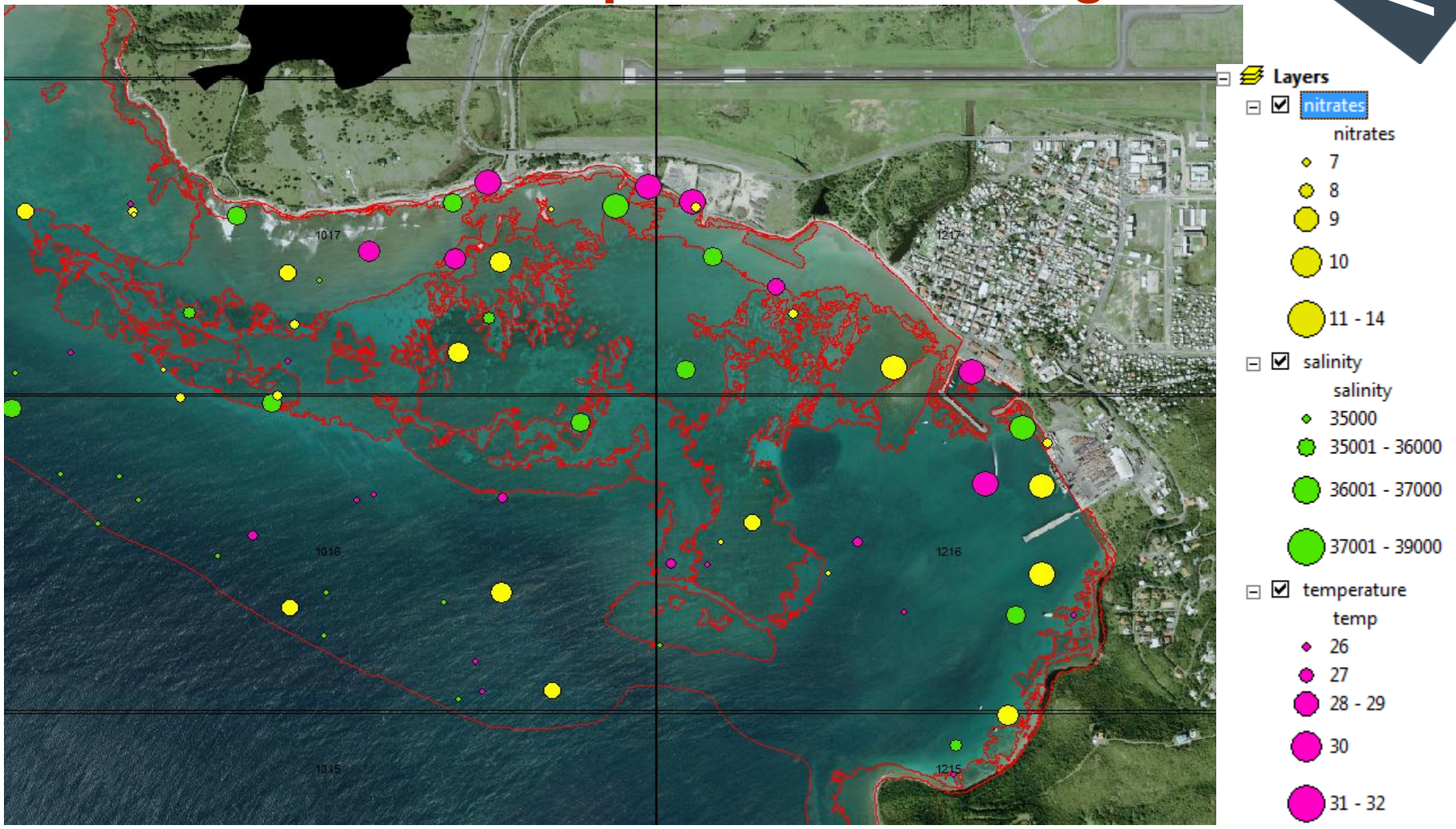
Data Utilization: Sample Points & Ranges



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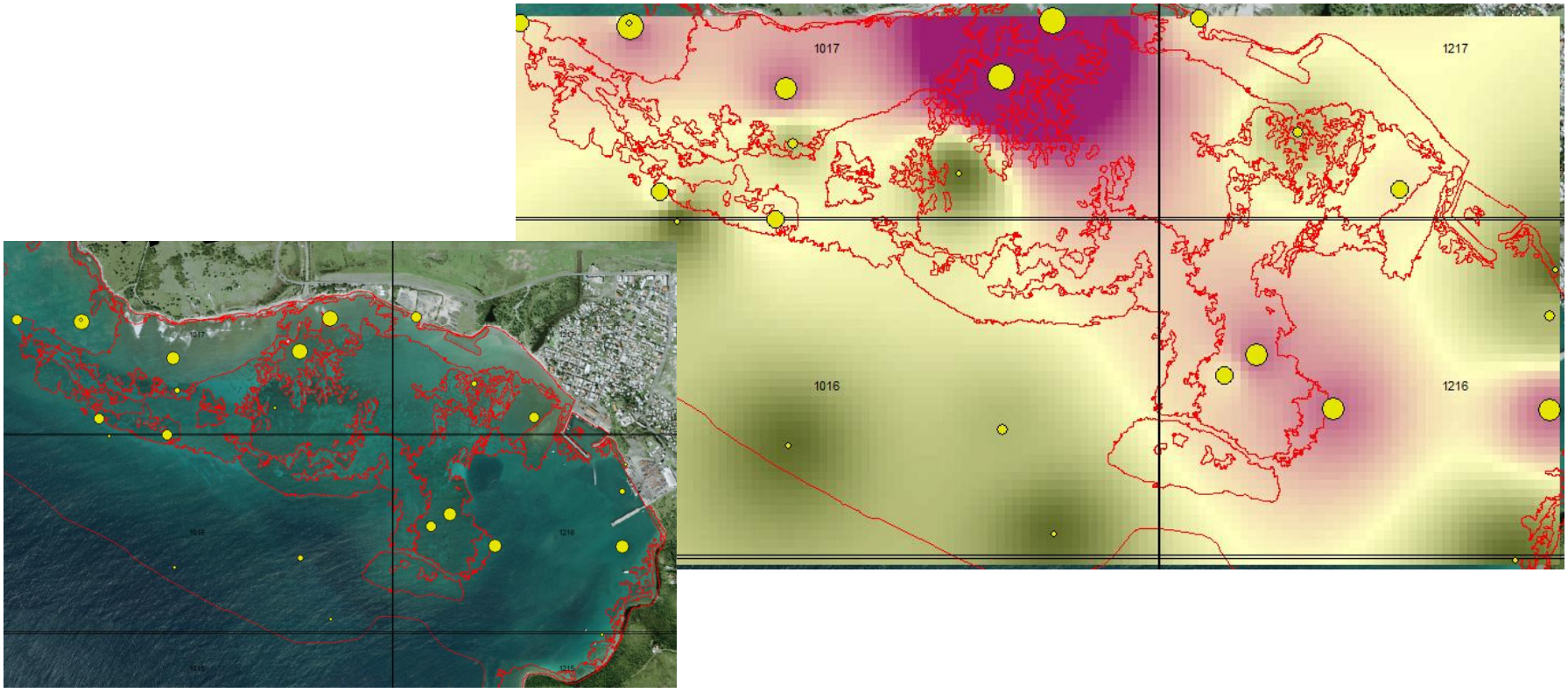
Data Utilization: Raster Conversion

In this example, ESRI ArcGIS Spatial Analyst extension was utilized to convert vector data (point samples) to raster GRID. Three factors were utilized, therefore, three separate GRID were developed: Nitrates, Salinity and Temperature

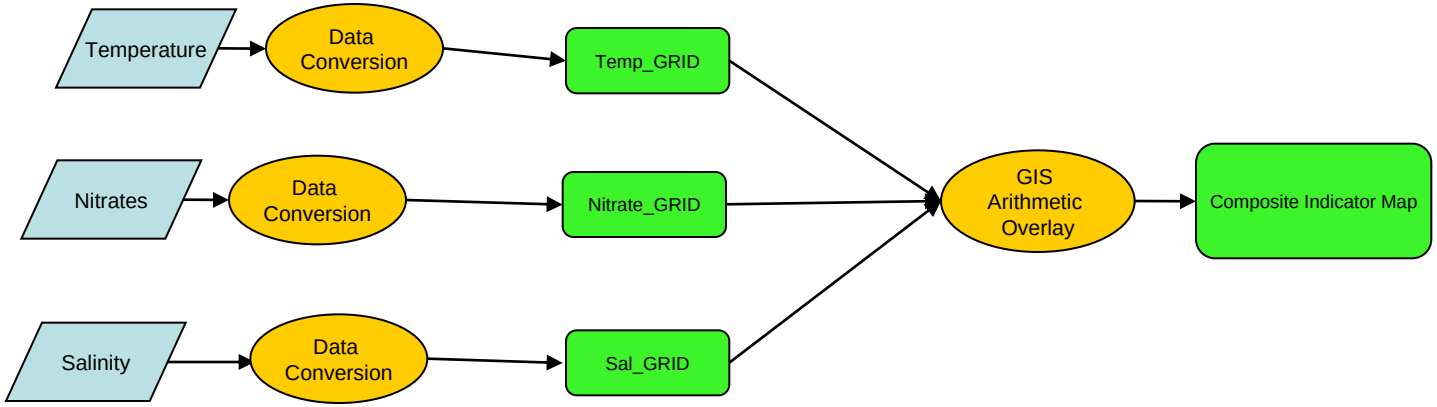


Composite Indicator Map

ArcGIS 9.3, with the Spatial Analyst Extension was used to process input data, construct the model, and present results.

Map Equation

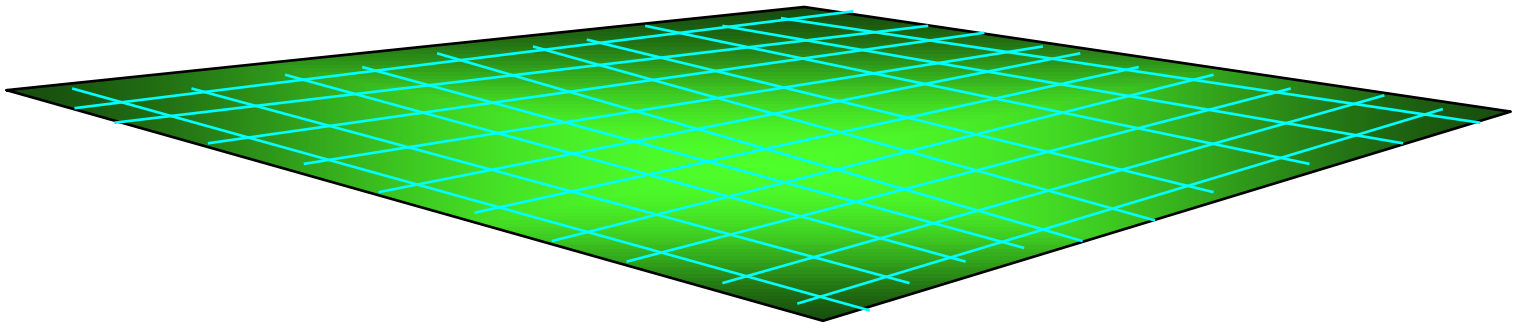
CIM = SA • TE • NI (sample)



Map Use

Maps can be classified to identify areas potential concern from very low to severe.

Maps can be used to understand spatial extent of an impact – i.e. how large an area is likely to affected, etc.



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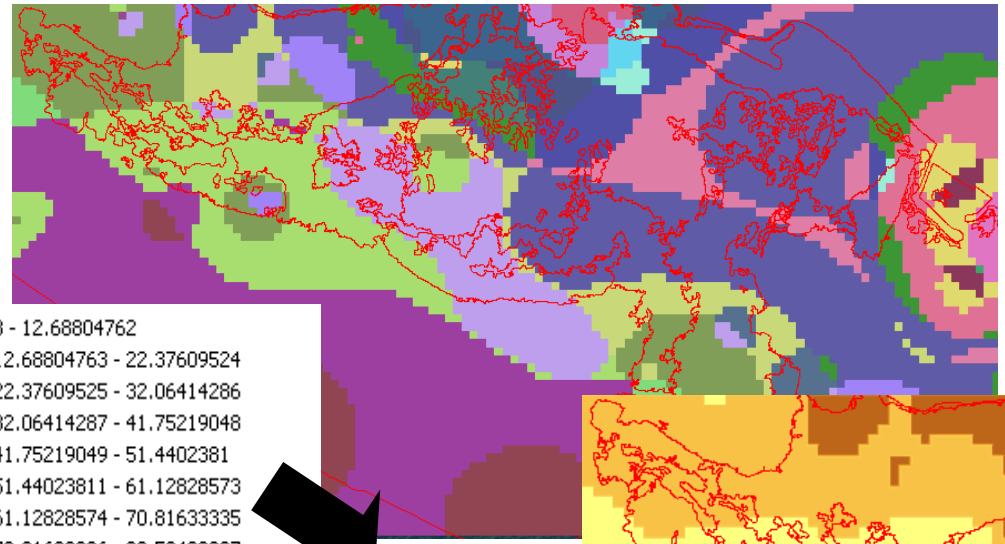
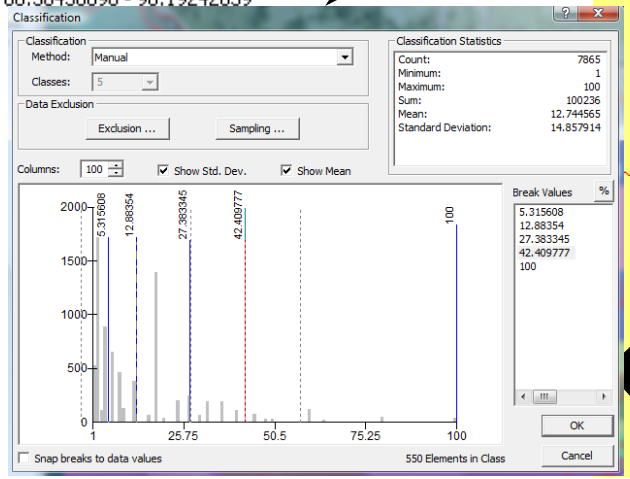
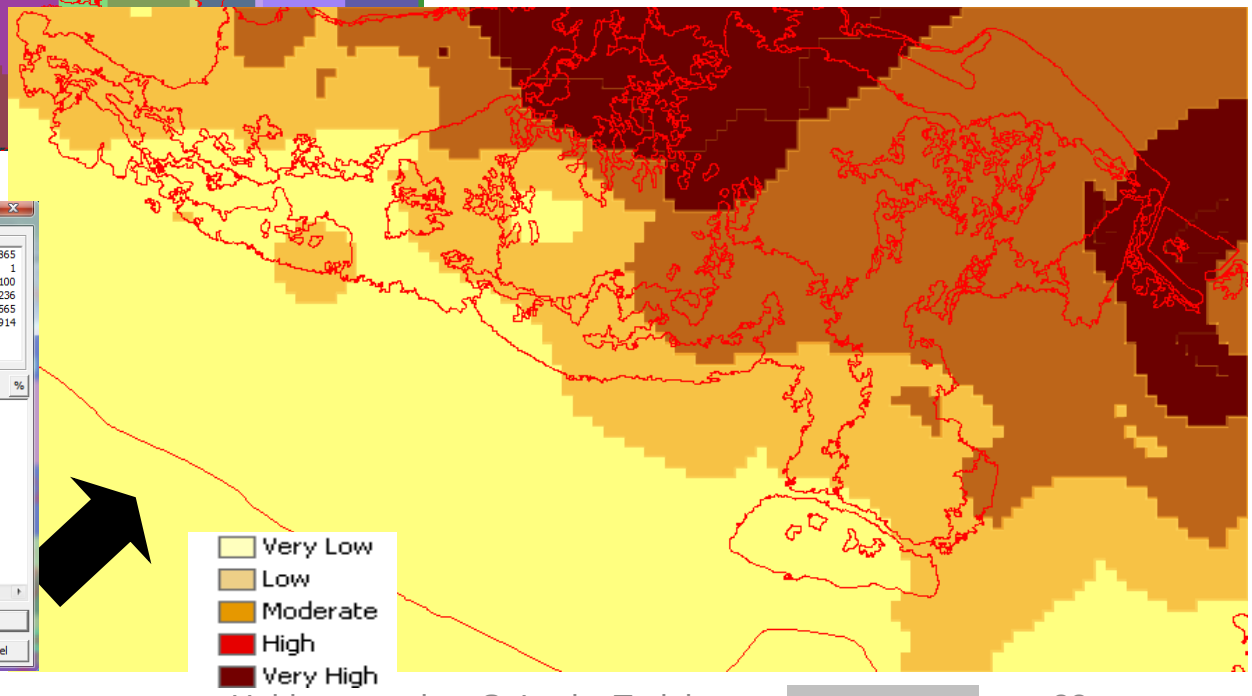
Map Reclassification



3 - 12.68804762
12.68804763 - 22.37609524
22.37609525 - 32.06414286
32.06414287 - 41.75219048
41.75219049 - 51.4402381
51.44023811 - 61.12828573
61.12828574 - 70.81633335
70.81633336 - 80.50438097
80.50438098 - 90.19242859





Very Low
Low
Moderate
High
Very High

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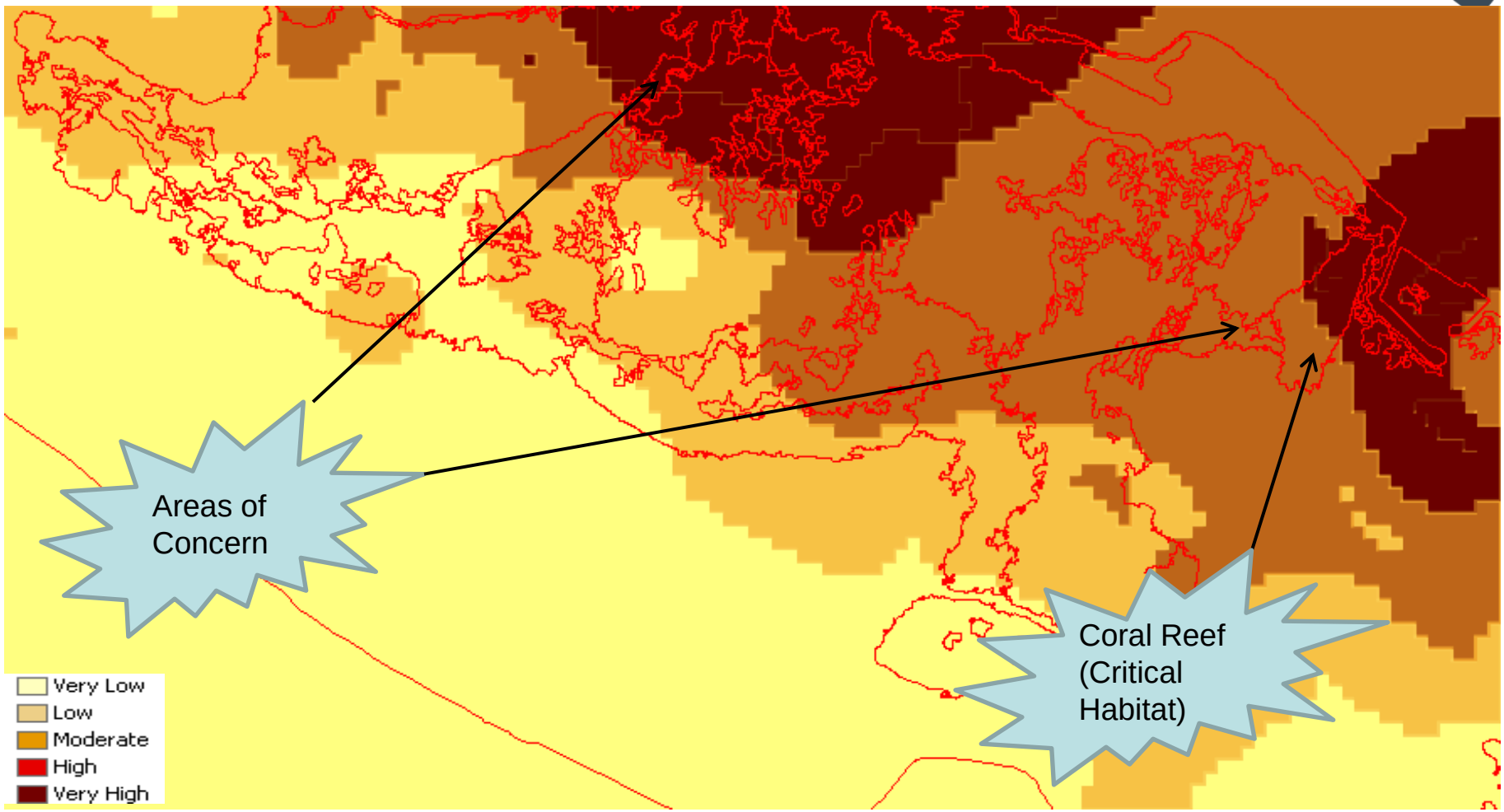
Combined Indicator Map and Identification of Critical Zones



Sharing Maps

- It is now possible to quickly search for information across multiple sources via the internet which provides several significant advantages, both for the organization that owns the maps, and users of the maps:
  - sharing information can save resources by raising awareness about where data are already available so that additional survey effort is not required;
  - data owners can get publicity for the data they hold;
  - maps can be accessed by staff while they are away from the office intranet or network.