

Integrated Coastal Management Tool

Spatial Decision Support Systems

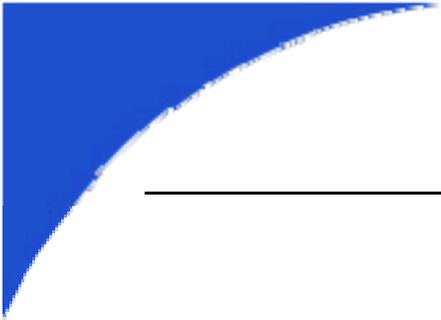
Coastal Services Center's Goal for Decision Support Tool Usage

-To help coastal managers develop greater **strategic awareness** when approaching natural resource decision making by **intelligent application of appropriate spatial decision support systems / tools.**

-Development of a sustainable process for learning about, building, and using new tools.

Contact: Robert McGuinn (robert.mcguinn@noaa.gov)



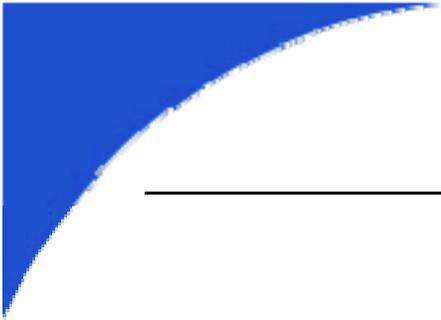


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Current and future conditions

Decision support software leverages the power of computers to remember and quickly analyze large amounts of data for targeted resource decisions.

- Deliver analysis of the the **current state** of the ecosystem or other subsystem of the landscape.
- Allow prediction of multiple **future conditions** given chosen management options.



Integrated Coastal Management Tool

Tool Concept – Overview

- Current State Calculations
 - Terrestrial
 - Connectivity
 - Quality
 - Impervious surfaces
 - Aquatic
 - Quality and health
 - Physical characteristics
- Queries and Overlays
 - Query results
 - Overlay additional data with results
- Scenario Testing
 - Land cover changes
 - Land use impacts
- Output Options
 - Reports
 - Map files
 - Databases
 - Tables

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Functionality

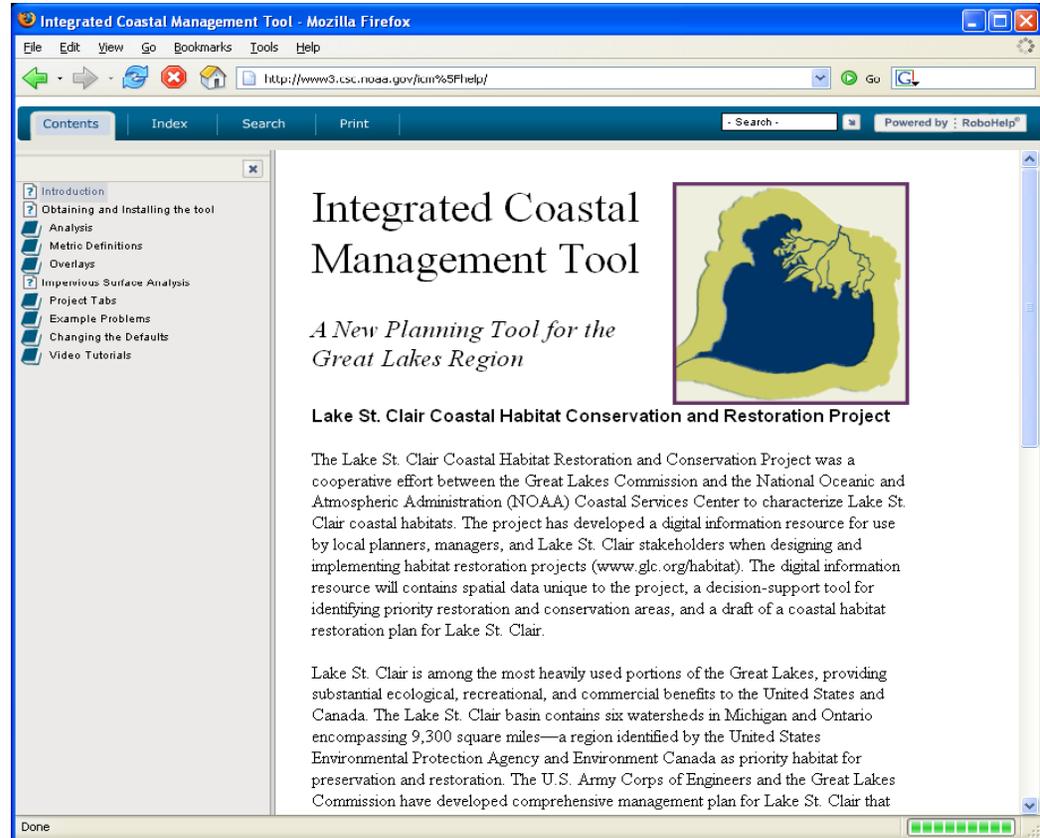
- Flexible Data Inputs
 - Raster land cover (required)
 - All others optional and can be point, line, or polygon
- Flexible Location
 - Any polygon
 - User-drawn polygon
 - Any geographical boundary
 - Watershed
 - County, township
- Flexible Classification
 - User chooses what is habitat
 - Simple
 - Unique
 - Grouped
- Flexible Scoring
 - User determines values
 - User determines scores
- Optional Features
 - Queries
 - Overlays
 - Scenario testing
- Multiple Outputs
 - GIS Shapefiles
 - Map images
 - Reports
 - Tables



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RoboHelp

- Flash-Based Help Files
 - Web browser
 - Flash (free-ware)
- Interactive
 - Overall users' manual
 - Context-sensitive help
 - Movie demonstrations
 - Index and search options
 - Print ready
- www3.csc.noaa.gov/icm_help



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Why Use It?



- **Does it do anything that ArcView with Spatial Analyst cannot do?**

- No. Relies completely on ArcView infrastructures

- **What are the advantages?**

- Automated Analysis
 - Multiple calculations per patch
 - Some landscapes can have 8,000+ patches
- Transparent
 - Metadata for each analysis
 - Well documented, well tested
 - Metrics from current landscape ecology science

- Repeatable
 - Work with existing outputs
 - Default parameter sets
- Consistent
 - Parameters are flexible
 - Code is fixed
- Portable
 - Not fixed to a geography
- Ease of Use
 - Time saver for GIS professional
 - GIS skills not required so it can be used by anybody

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Defining the Analysis Question

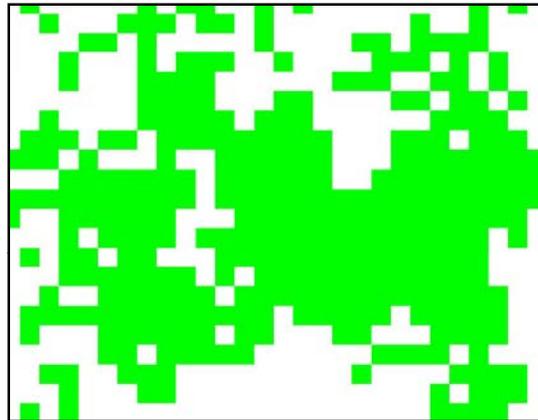


- What do we want the tool to do?
- What data do we have?
- What kind of output do we want?

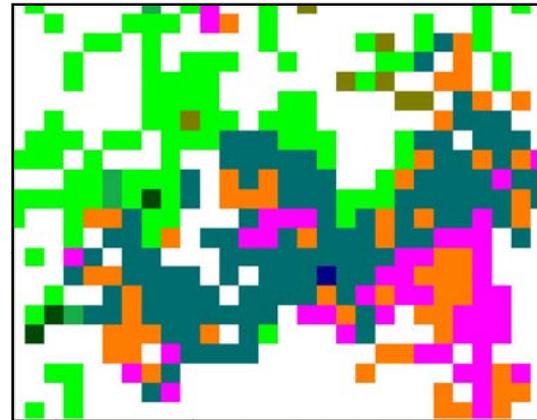
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Habitat Classification (Terrestrial Only)

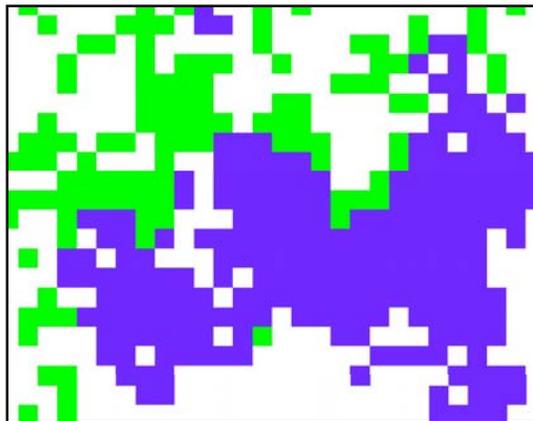
Simple:
all selected land
covers = habitat



Unique:
all selected land
covers types =
individual types
of habitats



Group:
class of habitat
where all
selected land
covers = habitat



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Lake St. Clair Pilot Study

- Analysis Setup
 - Default scores and values from similar analysis performed by the Michigan Natural Features Inventory
- Simple Habitat Classification, Including Forest and Wetland
 - Grassland was removed because of the potential for confusion with cultivated classes
- Analysis Was Conducted for Each Individual Political Unit
 - Results have not been merged at the boundaries



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Lake St. Clair Pilot Study



- Total Score is a Combination of Quality and Connectivity Potential
 - High quality means
 - Large size greater than 240 acres
 - Large core area greater than 240 acres
 - Less than 400 meters from a stream
 - Absence of a hardened shoreline or stream
 - Presence of element occurrence
 - Absence of invasive species
 - High connectivity potential means
 - A nearest like neighbor within 400 meters
 - More than 4 like neighbors within 100 meters

Development Pressure on Habitat Map for Coastal Lake St Clair, Habitat Map combined with SEMCOG 2030 Growth Forecast



Legend

- Townships
- project boundary

Economic Pressure 0 - 31+

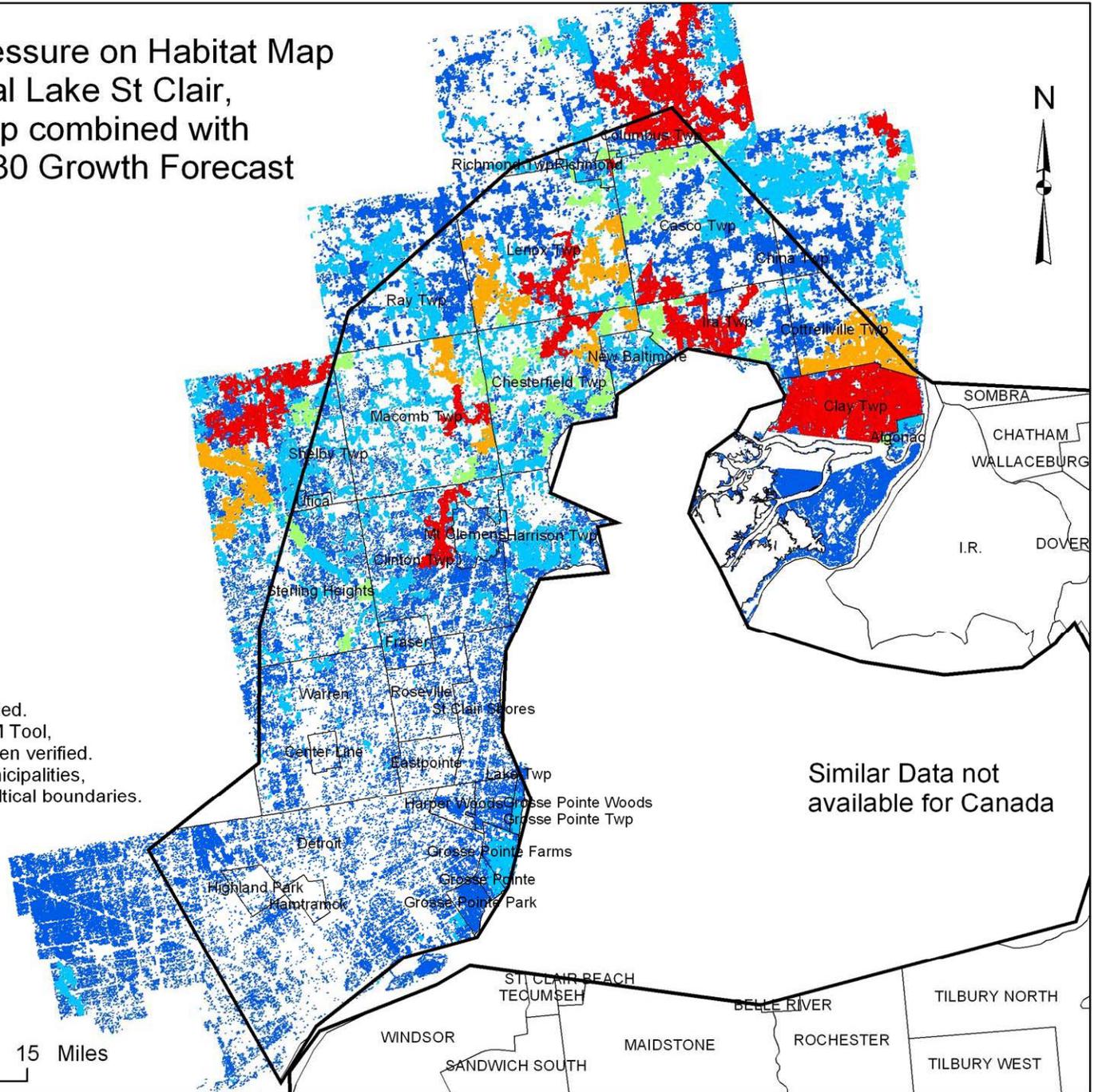
Economic

- 0
- 1 - 10
- 11 - 20
- 21 - 30
- 31 - 40
- 41 - 50

No warranty is given or implied.
Output developed with the ICM Tool,
input data, and scores have not been verified.
Runs were done for individual municipalities,
results have not been merged across political boundaries.

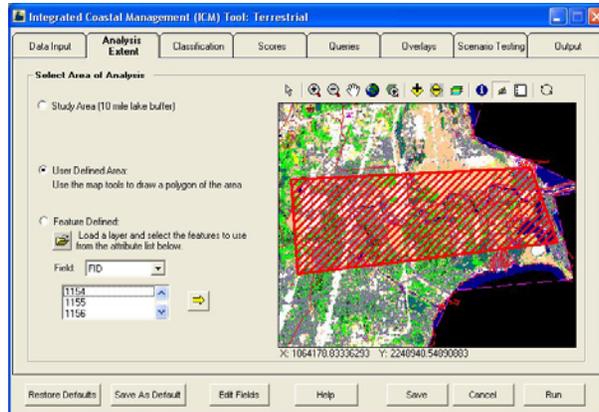
Similar Data not
available for Canada

0 3.75 7.5 15 Miles

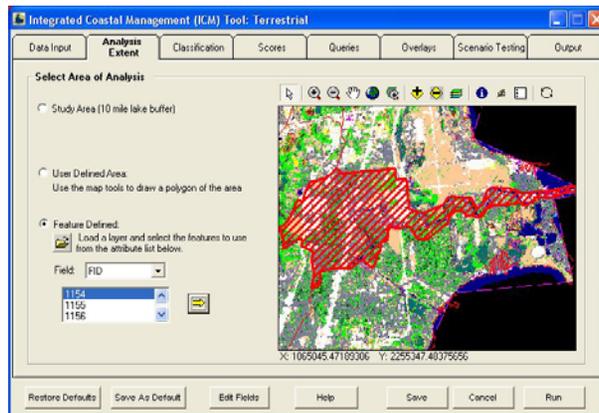


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Analysis Area



- Pre-Set Polygon
 - Currently Lake St. Clair Study Area
 - Changed in .ini file
- User Defined
 - Use map tools to draw area(s)
 - May be multiple and unconnected

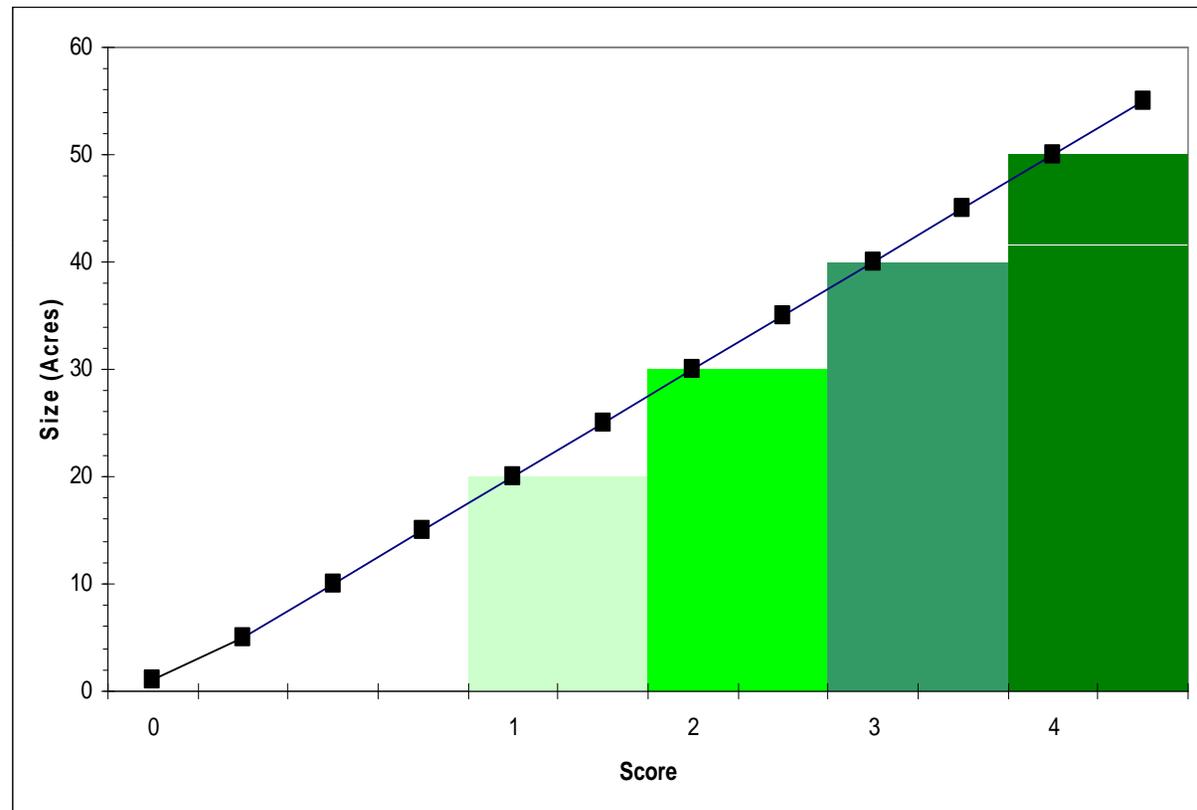


- Feature Defined
 - Select polygons from a GIS Shapefile
 - For example:
 - Watersheds
 - Townships
 - City boundaries
 - Quarter-Quarter sections

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Scoring System

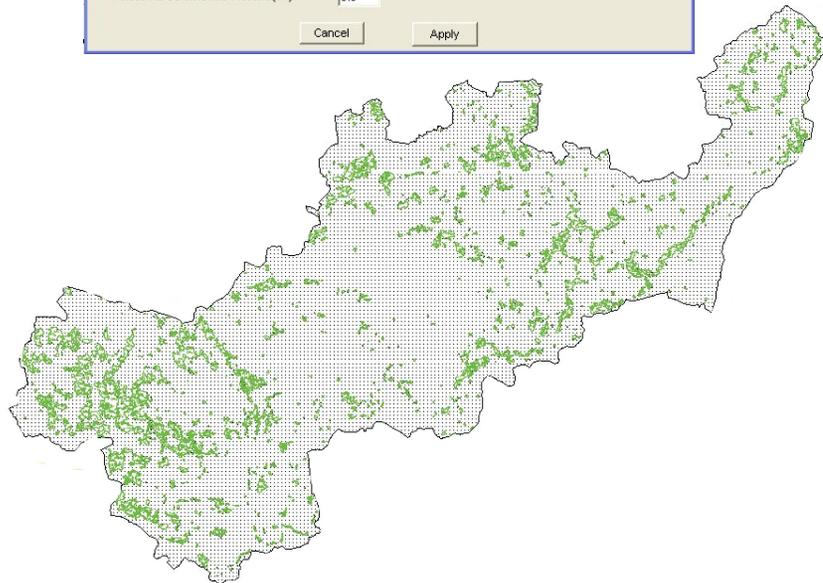
- Flexible Scoring System
 - User determines range
 - User determines scores
- Linear System
 - User determines high/low values, scores, and number of divisions
- Example for Size Metric
 - High Value 50
 - Low Value 20
 - High Score 4
 - Low Score 0
 - Bins/Divisions 5



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Impervious Surface (IS) Analysis

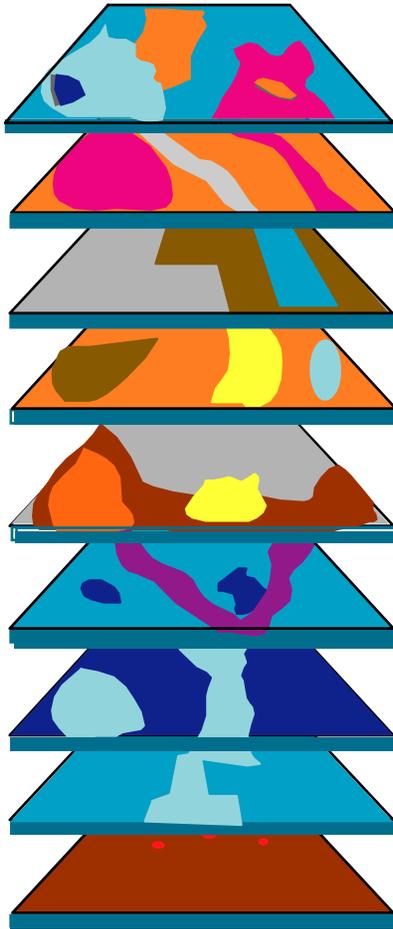
Class Name:	Value:	Class Name:	Value:
Background(0)	0	Palustrine Emergent Wetland(12)	0
Unclassified(1)	0	Estuarine Forested Wetland(13)	1
High Intensity Developed(2)	60	Estuarine Scrub/Shrub Wetland(14)	18.6
Low Intensity Developed(3)	50	Estuarine Emergent Wetland(15)	0
Cultivated Land(4)	14.7	Unconsolidated Shore(16)	1
Grassland(5)	9.9	Bare Land(17)	18.6
Deciduous Forest(6)	4.9	Water(18)	0
Evergreen Forest(7)	4.9	Palustrine Aquatic Bed(19)	0
Mixed Forest(8)	3.9	Estuarine Aquatic Bed(20)	0
Scrub/Shrub(9)	4.9	Tundra(21)	0
Palustrine Forested Wetland(10)	3.5	Snow/Ice(22)	0
Palustrine Scrub/Shrub Wetland(11)	3.5		



- Multiple IS Percentages Calculated
 - Overall IS
 - Non-habitat IS
 - Habitat IS
- Coefficients
 - User defined
 - Flexible inputs, with default file
 - Current defaults from work in New England
 - Class names from Coastal Change Analysis Program (C-CAP)
 - Also flexible

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Ancillary Data (Overlays)

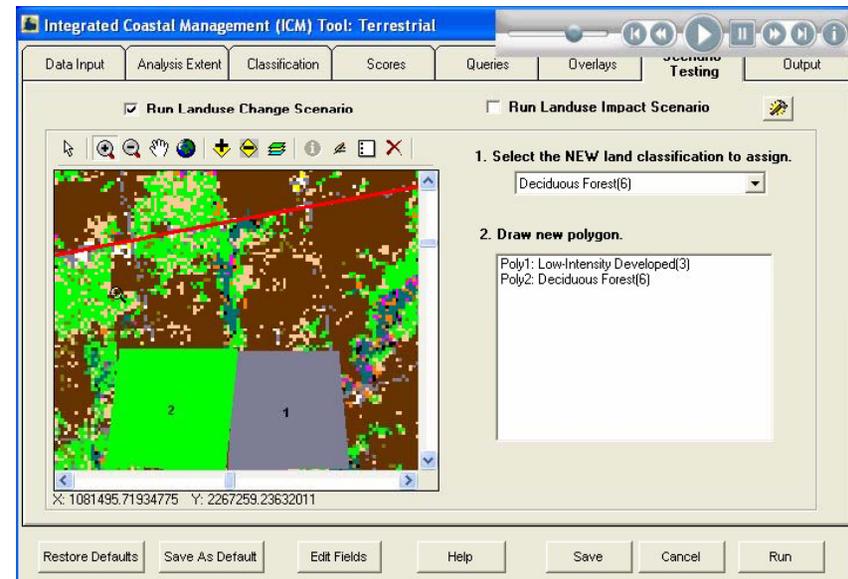


- Ancillary / Overlays = Data Stacking
 - Does not contribute to scores
 - Provides additional information, for example
 - Land ownership
 - Soils
 - Historical cover
- Flexible Naming
 - Change the name of the overlays
 - Change name, not algorithm
- Examples
 - Determine soil types present in every habitat patch
 - Count projected future development areas within each patch
 - Determine all patches within a floodplain or historic lake-water levels

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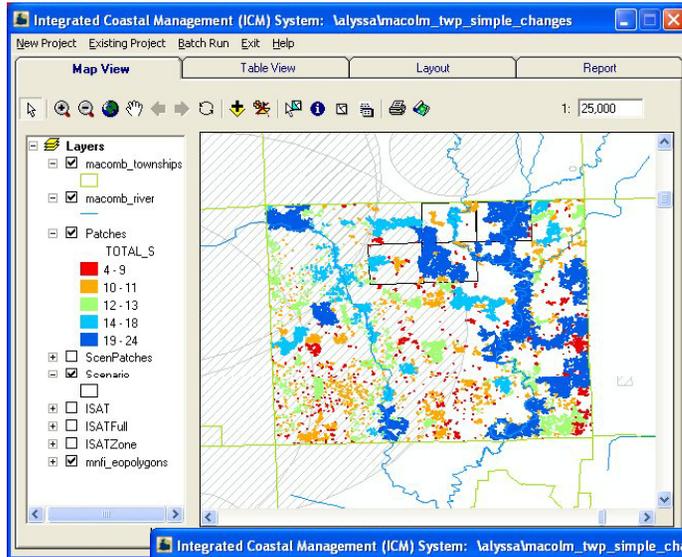
Scenario Testing

- “What if” Games
 - Calculate current values
 - Change land cover types
 - Recalculate values
- Develop Deciduous Forest
 - Calculate current scores
 - Habitat values
 - Impervious surface
 - Artificially change the land cover type
 - No permanent change to original data
 - Recalculate changed values
 - Habitat values
 - Impervious surface
 - Determine forest lost, impervious surface increase

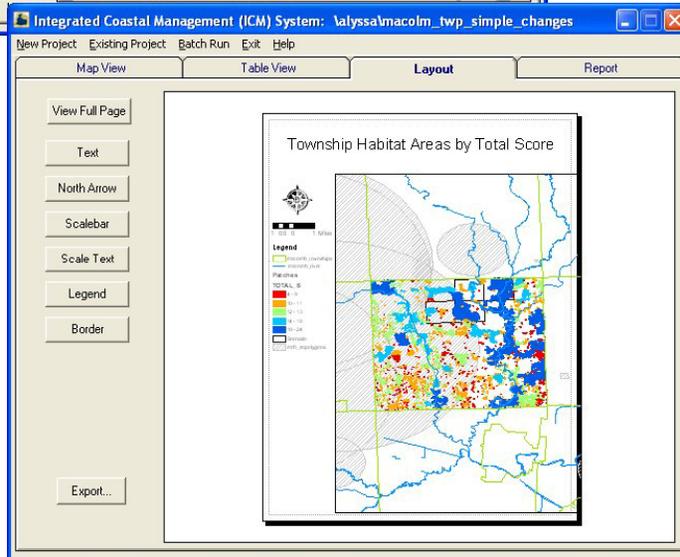


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Output Formats



PatchID	VALUE	DESC	EDGE	NN	NN_S	Prox	Prox_S	Size	Size_S	Core	Core_S	ElemOcc	ElemOcc_S
1	1	Habitat	1	30	3	1	1	2700	0	722	0	0	0
2	1	Habitat	1	30	3	2	2	7200	0	2308	0	0	0
3	1	Habitat	1	85	3	2	2	11700	0	5629	0	0	0
4	1	Habitat	1	30	3	1	1	900	0	100	0	0	0
5	1	Habitat	1	30	3	2	2	9900	0	3165	0	0	0
6	1	Habitat	1	30	3	7	4	138600	1	81912	0	0	0
7	1	Habitat	0	30	3	2	2	4500	0	1365	0	0	0
8	1	Habitat	1	30	3	2	2	900	0	100	0	0	0
9	1	Habitat	1	30	3	3	3	80100	0	39361	0	0	0
10	1	Habitat	1	30	3	18	4	2151900	4	555046	4	1	1
11	1	Habitat	0	30	3	3	3	7200	0	3200	0	0	0
12	1	Habitat	1	30	3	1	1	1800	0	400	0	0	0
13	1	Habitat	0	30	3	2	2	2700	0	500	0	0	0
14	1	Habitat	0	30	3	1	1	3600	0	1022	0	0	0
15	1	Habitat	0	30	3	1	1	3600	0	800	0	0	0
16	1	Habitat	0	30	3	2	2	2700	0	700	0	0	0
17	1	Habitat	1	60	3	1	1	94500	0	55189	0	0	0
18	1	Habitat	0	30	3	2	2	900	0	100	0	0	0
19	1	Habitat	0	30	3	6	4	37800	0	12873	0	0	0
20													



Input Parameters:

Input Parameters File	ICMSettings.ini	Total Number of Habitat	1366
Classification Scheme	Simple	Total Possible Score	24
		Data Units	Meters

Analysis Extent: FeatureDefined: IN **Impervious Surface Percentage:**

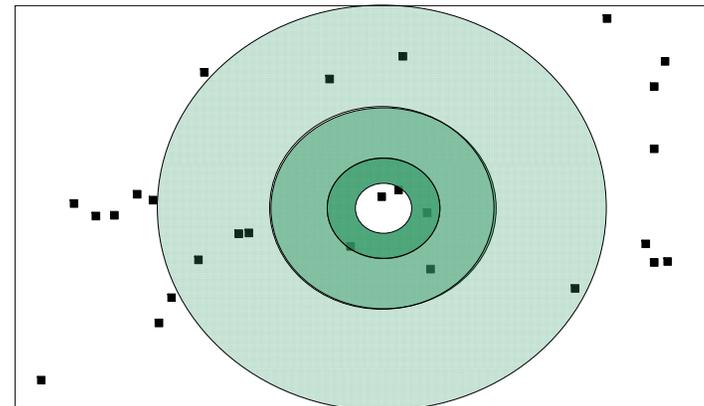
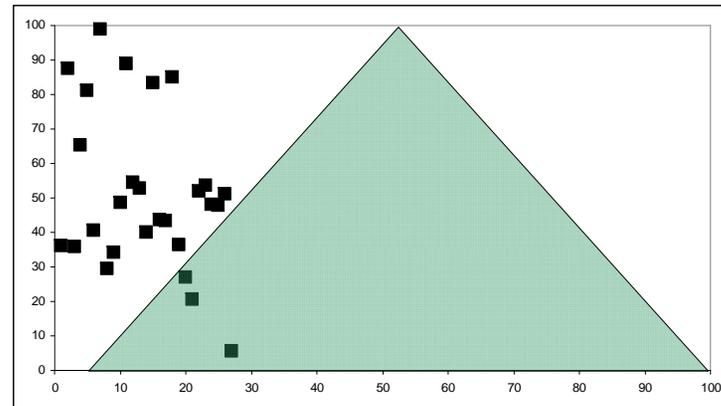
Analysis Statistics:

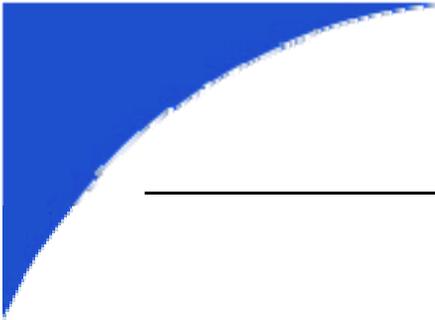
Habitat Type	Total Area	Number of Patches	Average Patch Size	Minimum Patch Size	Maximum Patch Size	Landscape Percentage
1 Habitat	19,175,400	1366	14,038	900	2,179,800	20.26%

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Decision Point Assistance Through Batch Running

- Key Decision/Uncertainty Areas
 - What scoring system do I use?
 - What buffer distances are appropriate?
 - What habitat classification scheme and land covers should be included?
 - What are the impacts of alternative landscape changes?
- Automated batch running
 - Test multiple scoring schemes
 - Test multiple buffer distances
 - Evaluate different classification schemes
 - Test development scenario A versus development scenario B





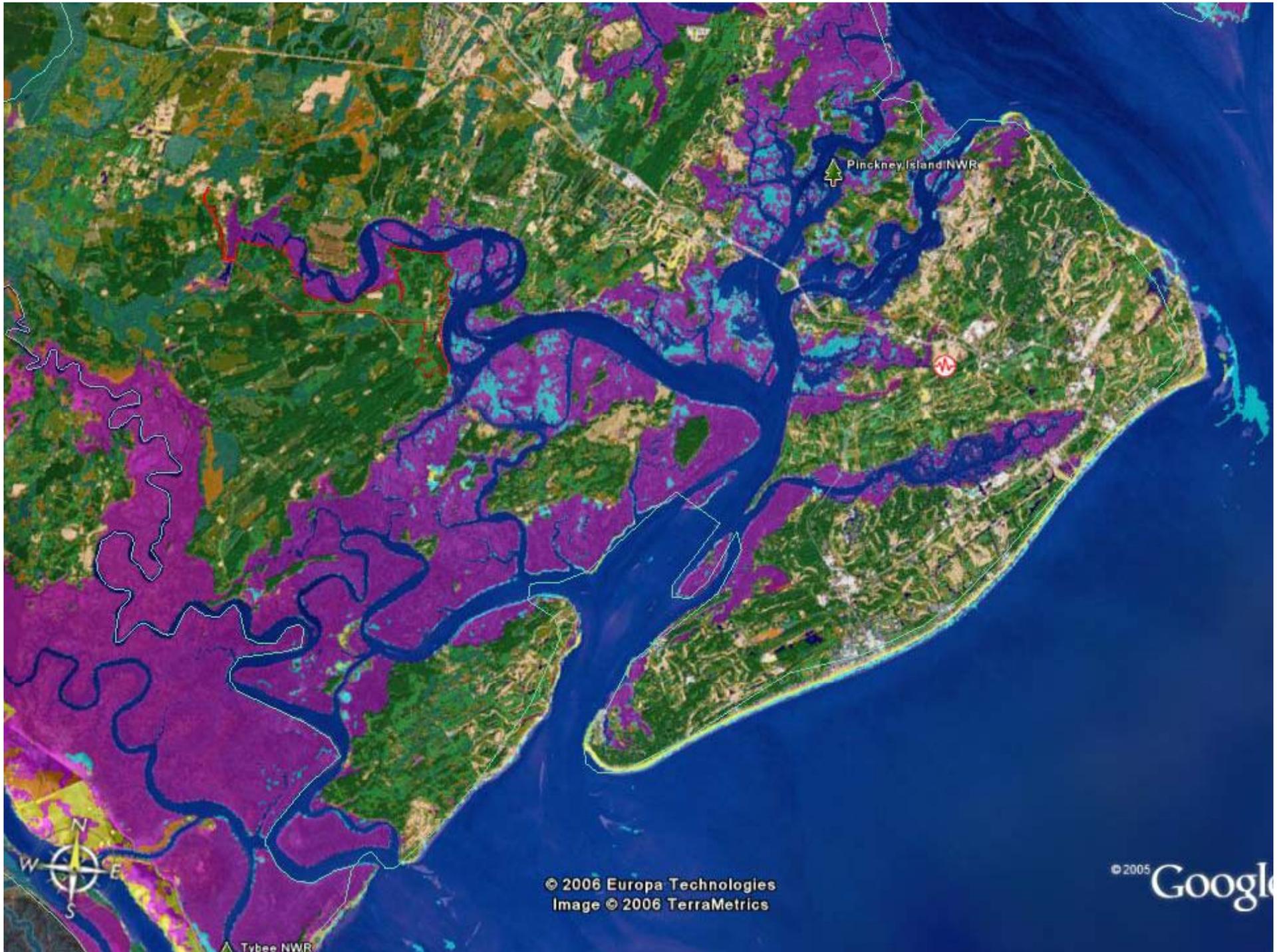
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Advantages of Using the Tool

- **What Are the Advantages?**

- Automated Analysis
 - Multiple calculations per patch
- Transparent
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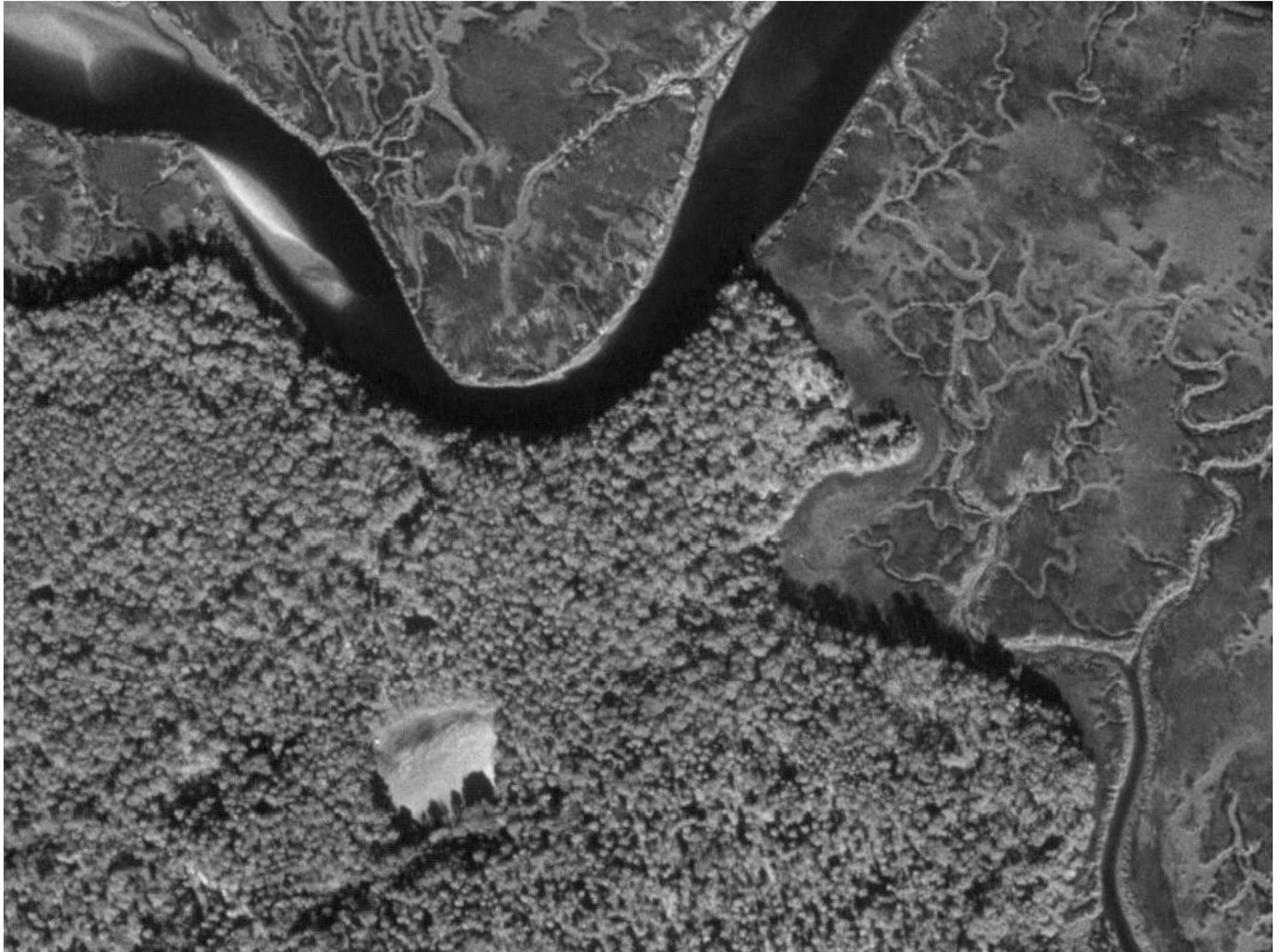


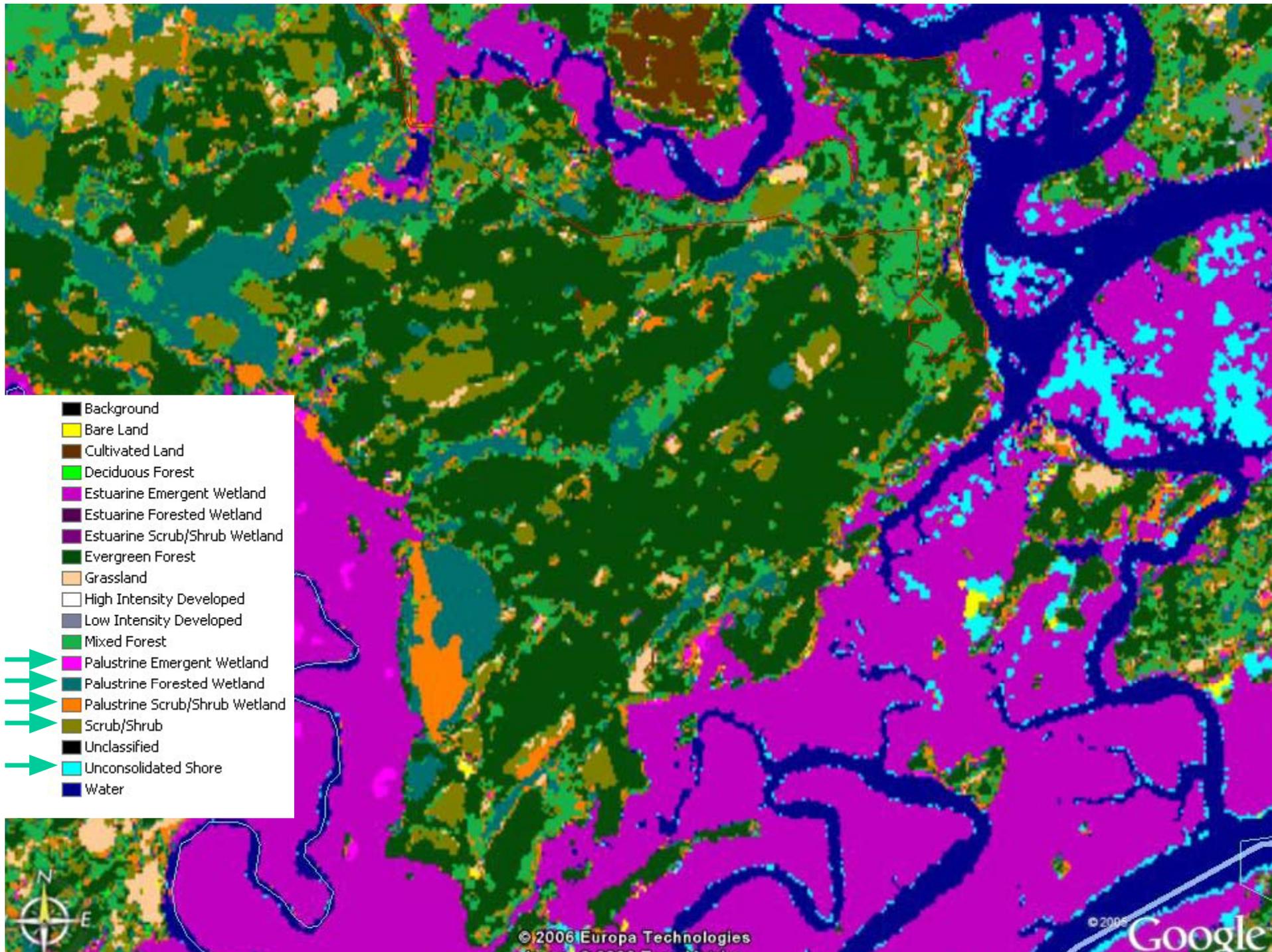


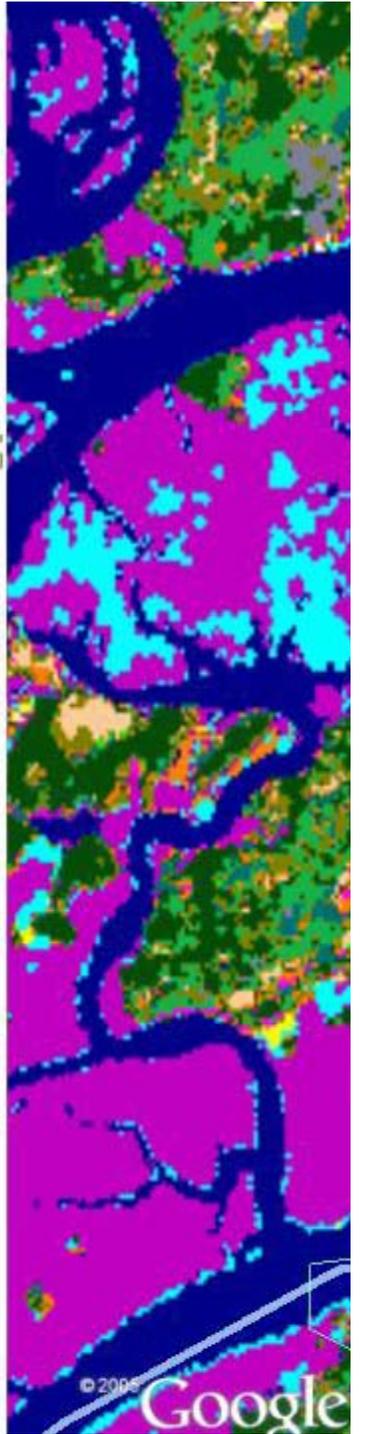
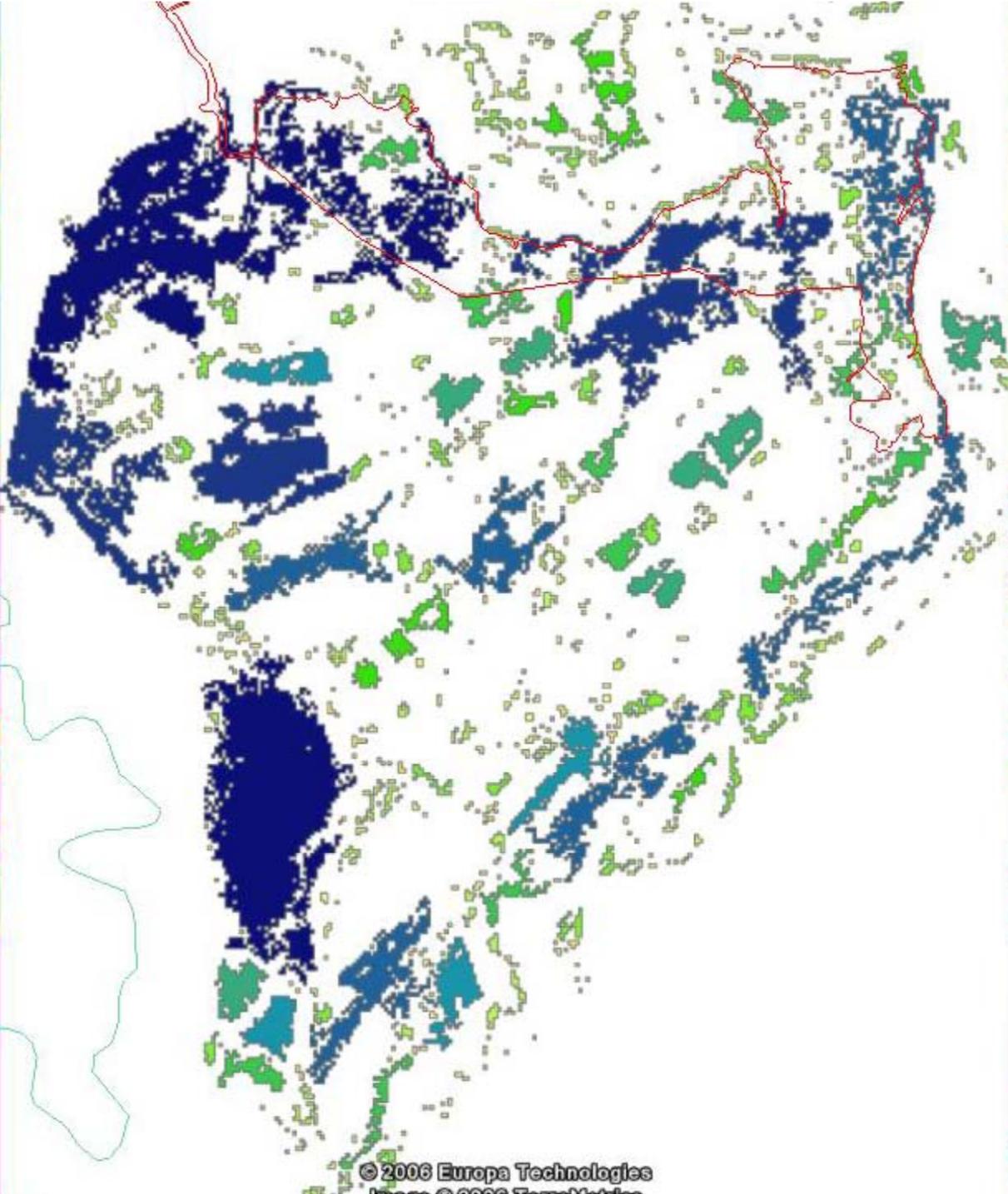
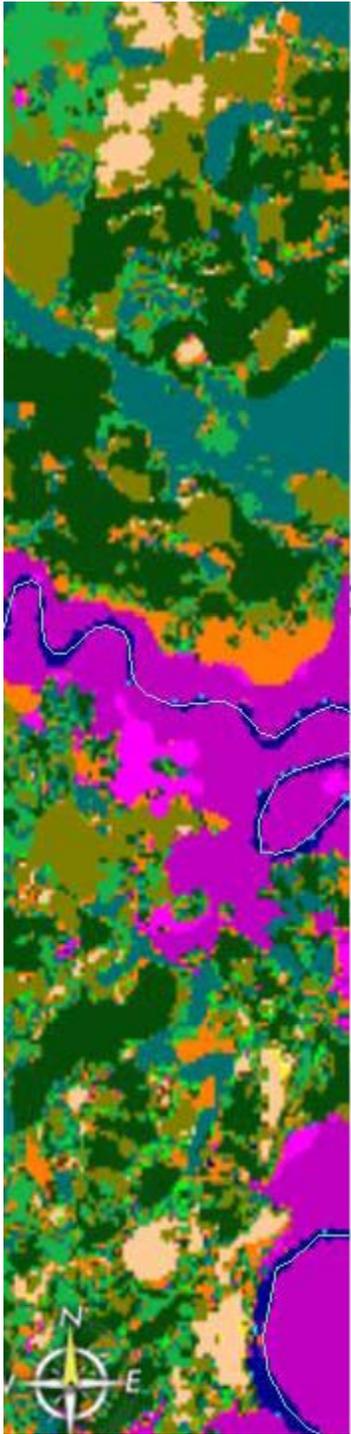
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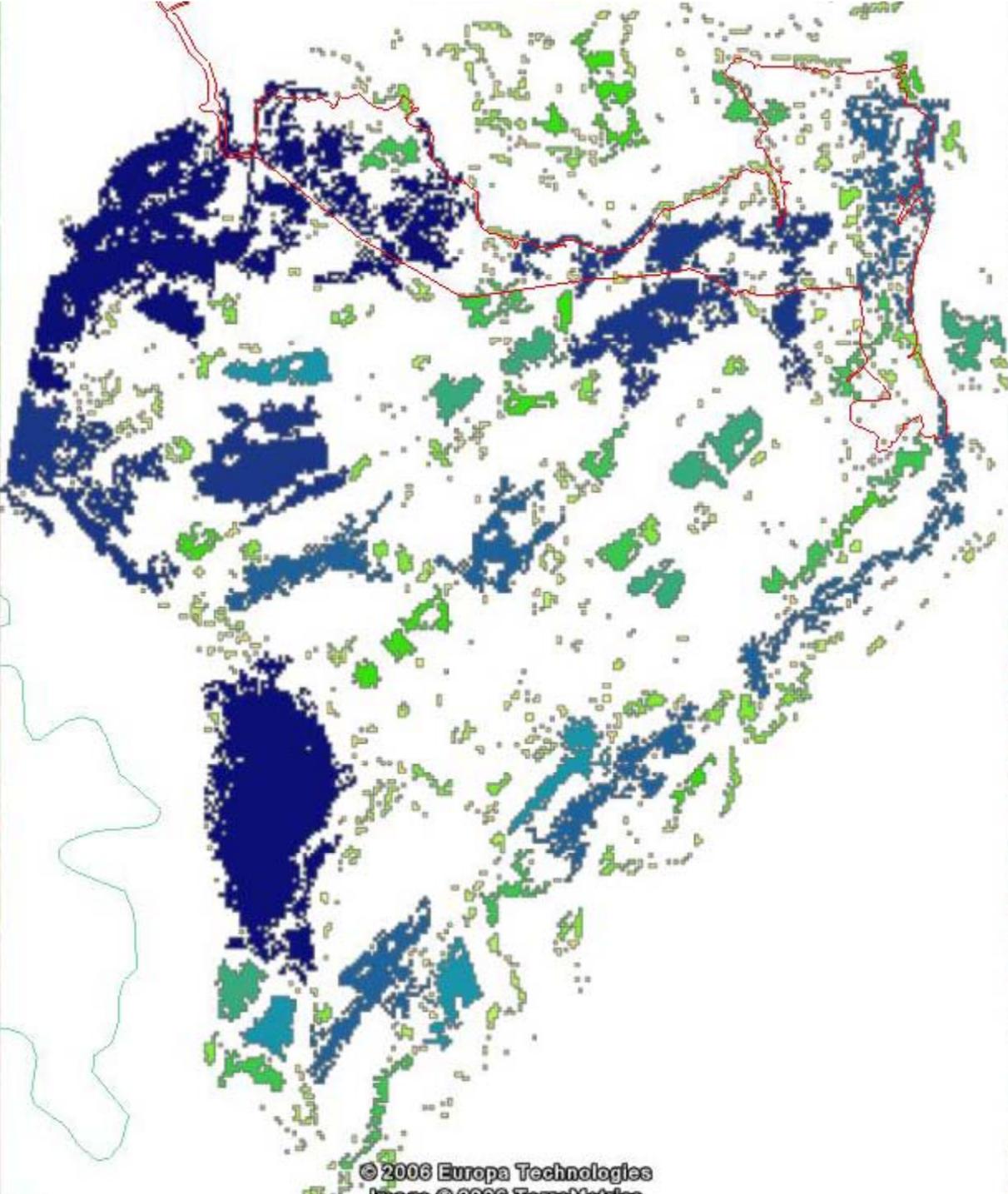
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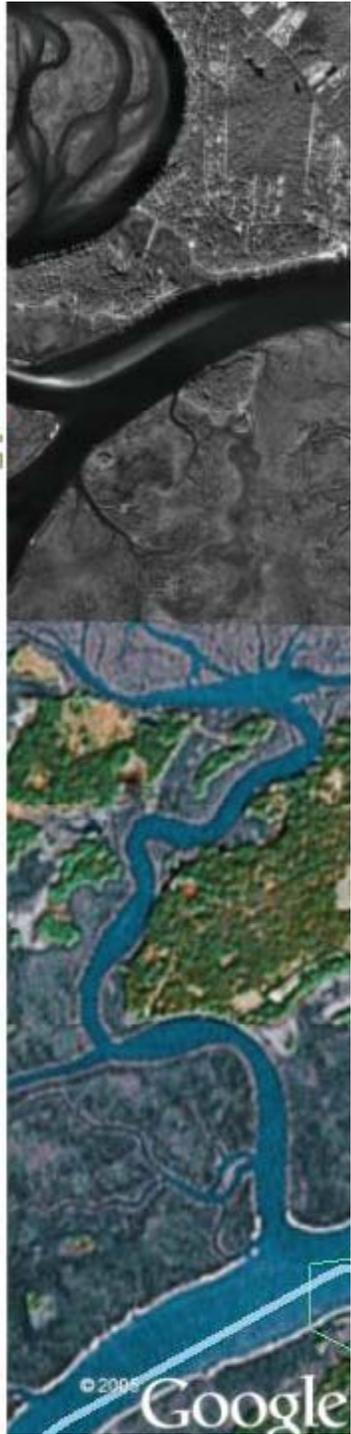


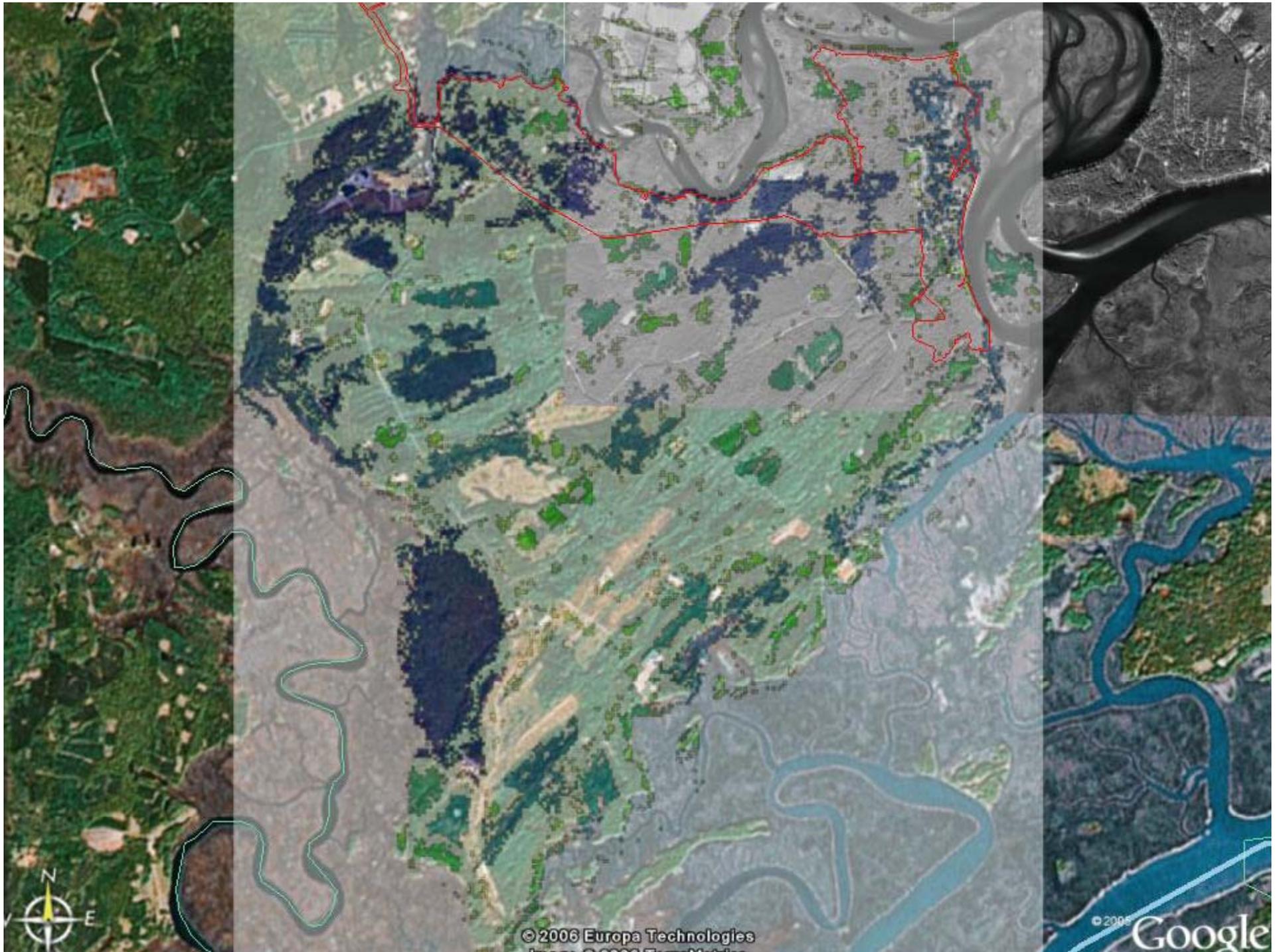






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Five Important Gradients in Available Tools

User level

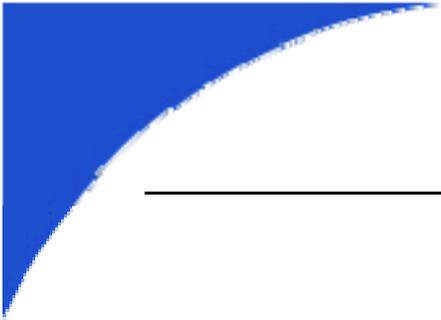
Focus

Geography

Analytical Complexity

Interoperability

Sustainability



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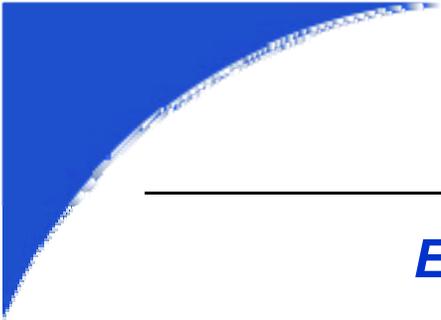
Select Prior Tool Reviews

Tools for Coastal-Marine Ecosystem Based Management: A Survey and Evaluation Of Utility, Sustainability, and Opportunities – NatureServe coordination and Packard Foundation funding ([LINK](#))

PlaceMatters ([LINK](#))

MidWest Spatial Decision Support System Partnership
([LINK](#))

National Commission on Science for Sustainable Forestry – NCSSF -
Decision Support Systems for Forest Biodiversity: Evaluation of Current
Systems and Future Needs ([LINK](#))



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Ecosystem Based Management (EBM) Tools Network

- **Develop and provide standards for data collection and management for the encouragement of ecosystem based management tools.**
- **Foster ecosystem-based management by providing a forum for the use and development of decision support tools.**
- **Contact: Patrick Crist or Sarah Carr of NatureServe.**

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Don't Create Custom Tools Unless It Is Required!!!

- **Building and maintaining** custom tools takes the long term dedication of high skill labor and significant IT infrastructure investment.
- Interoperable tools have **greater utility** than tools that “don't play well with others”

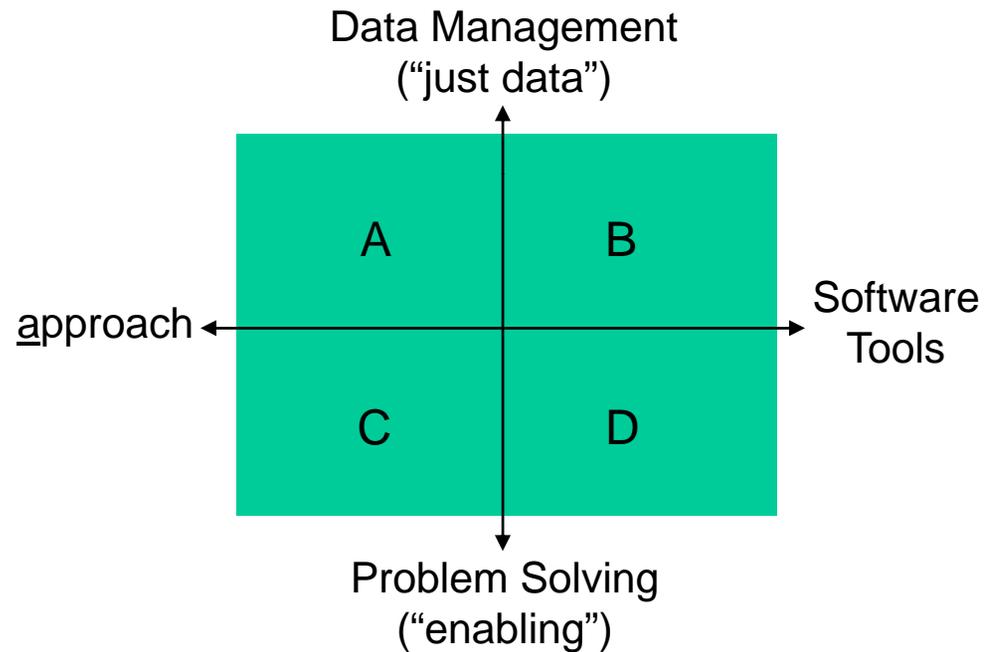


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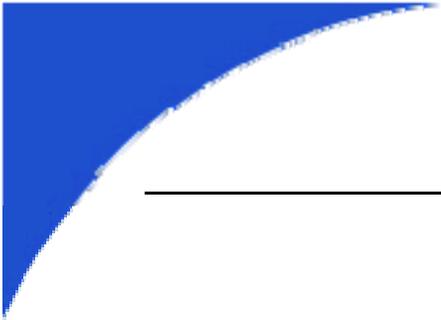
“Non-technical”

- Socio-economic context
- Attitudes
- Behavior changes
- etc.

“Technical”



Approach = Best Management Practice



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NASA DSS Definition

“Decision Support Tools (DST) refer to assessments and decision-support systems (DSS) that serve policy and management decisions. Generally, DSS are interactive, computer-involved systems that provide organizations with methods to retrieve information, analyze alternatives, and evaluate scenarios to gain insight into critical factors, sensitivities, and possible consequences of potential decisions. ..., DSS typically provide systematic mechanisms to incorporate data products and document the value derived from the inputs.”