Ecosystem Services in Land Management Decision Making: Development and Application of EcoAIM™ at Aberdeen Proving Ground

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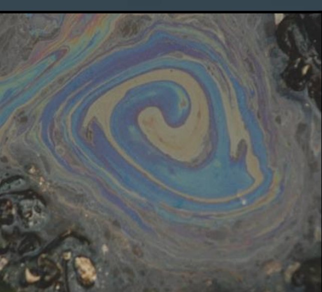
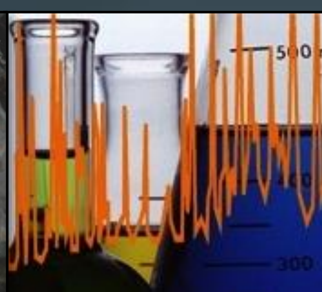




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What We Will Cover Today

- What EcoAIM™ is
- A little background on APG and the project
- Geospatial models applied at APG
  - Visual/landscape aesthetics
  - Nitrogen sequestration
  - Recreation
  - Habitat provisioning for biodiversity
- Illustrative scenario and results

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Project Background

- Dept. of Defense owns/manages >30 million acres
- Spends $4 billion/year on management to meet regulatory and mission requirements
- Missions affect ecosystem services (ES)
- Quality of ecosystem services have effect on missions
- Objective was to adequately account for ES tradeoffs to ensure sustainability of DoD mission at installations

Aberdeen Proving Ground

- Located in Maryland, on Chesapeake Bay
- 72,000 acres
- Active proving ground for testing weapons and technology
- BRAC-gaining installation
- Hosts 66 tenants (e.g., Chemical and Biological Center, Army R&D, etc)

What EcoAIM™ Is

A decision support framework and geospatial tool for managing ecological assets

- Main objective is trade-off analysis via scenario building
- Scalable process and tool
  - Spatial—project, parcel, watershed, geopolitical/management unit
  - Data needs—should not require data collection
  - Modeling sophistication—determined by need
- Focus on non-monetary quantification
  - Beneficiary preferences weighting
  - Relative ranking and proportional change

The EcoAIM™ Decision Support Framework

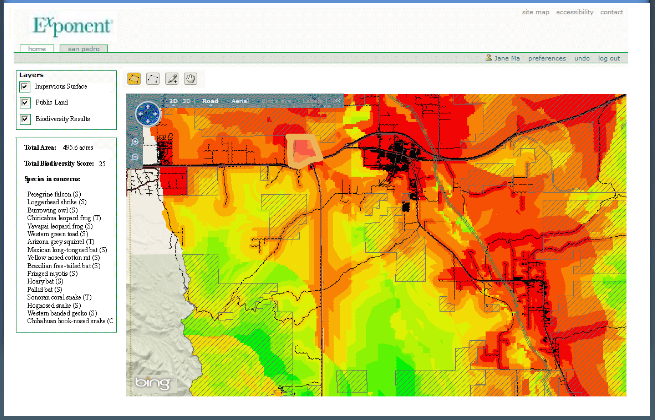
Problem formulation: Define decision space

- Objectives and priorities
- Ecosystem services of primary concern
- Define ecological production functions
- Identify endpoints stakeholders value

Develop and refine modeling parameters

Stakeholder Engagement

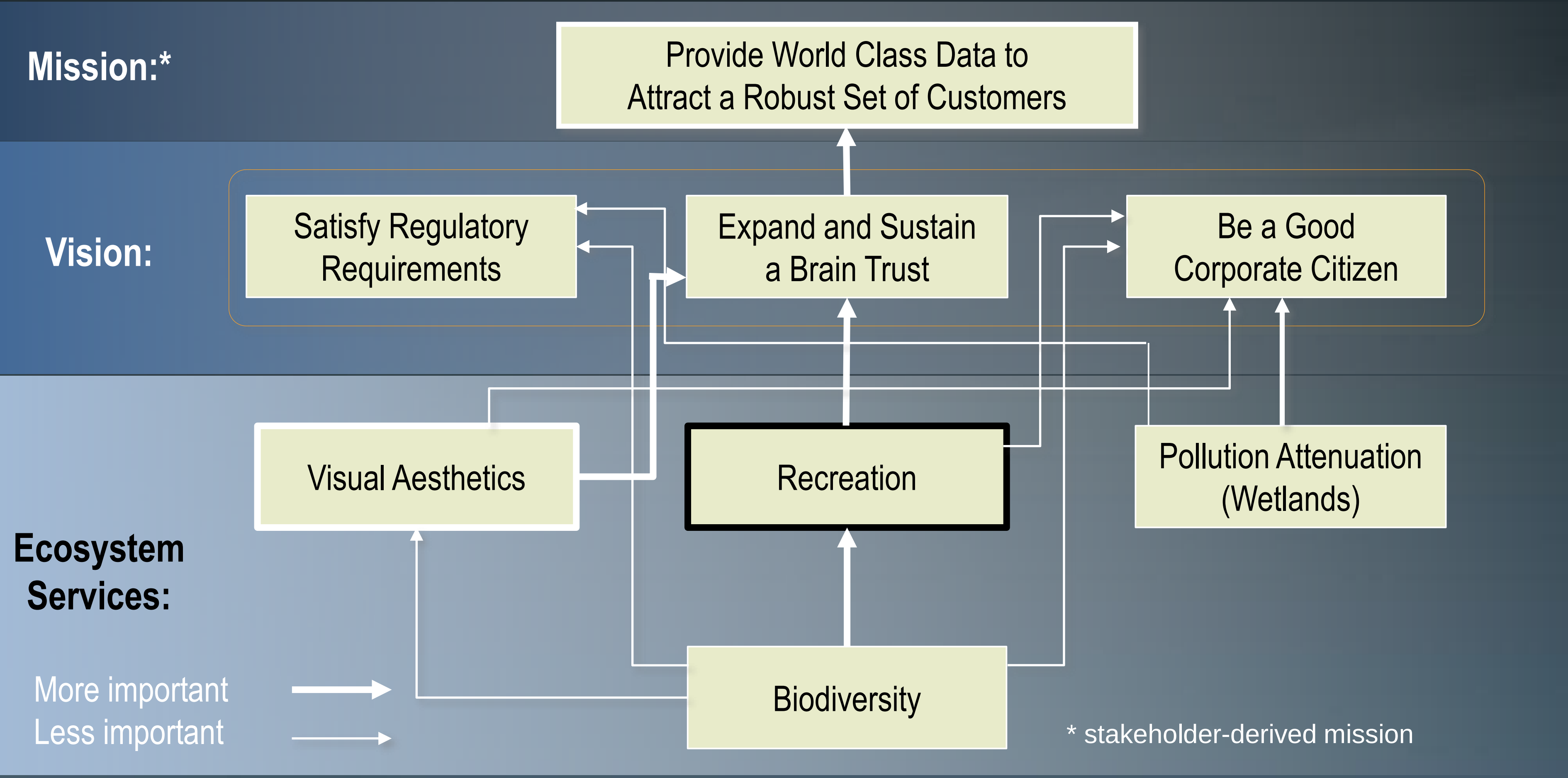
EcoAIM™ Spatial Analysis Tool



Stakeholder Engagement Objectives

- Clarify installation’s organizational structure
- Understand the natural resource management decision making process
- Describe how information flows within the organization
- Identify stakeholders’ and beneficiaries’ roles in decision making

Example Outcome: Mindmap of APG and Ecosystem Services



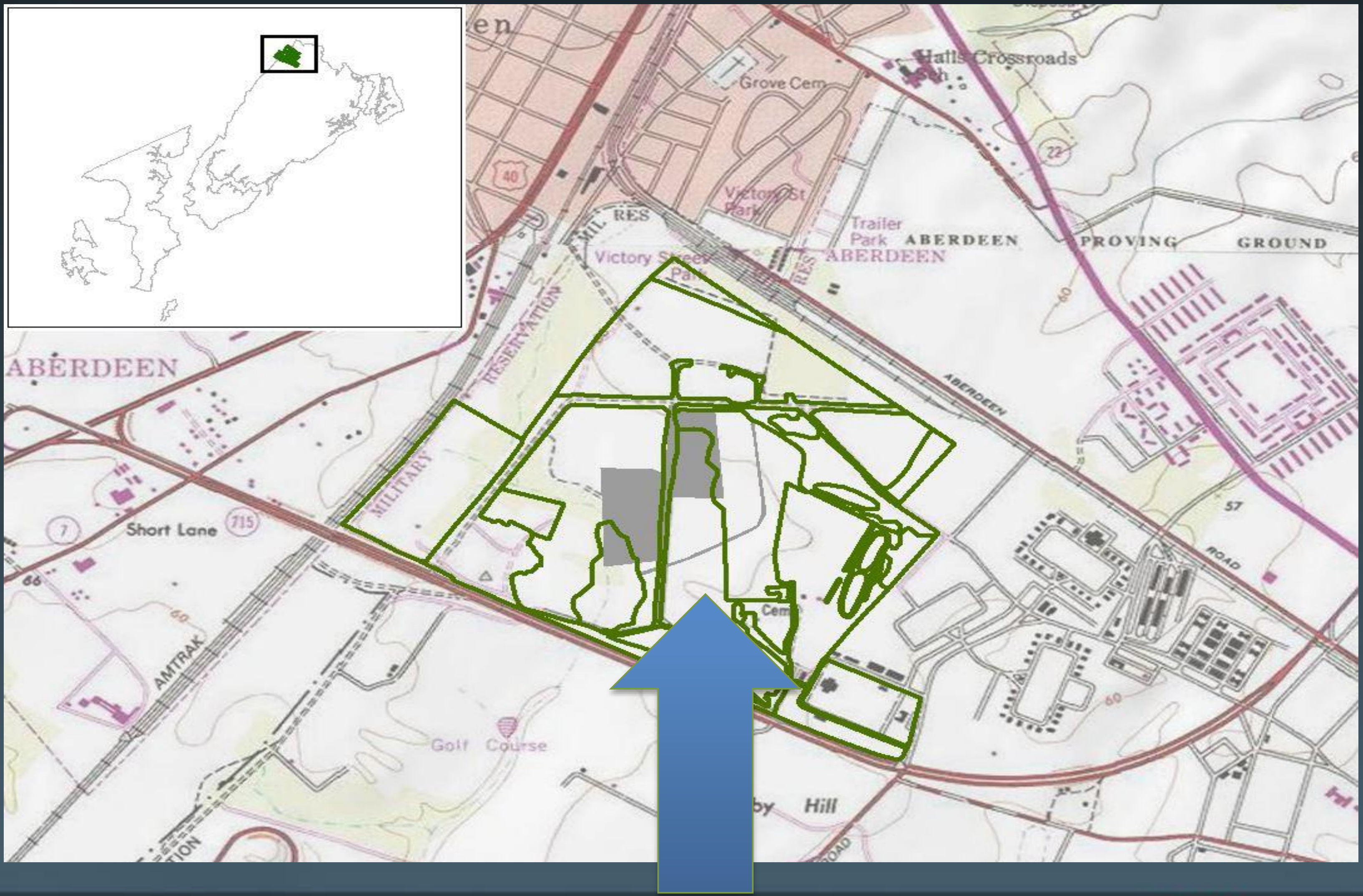
Models Selected to Reflect the ES of Greatest Importance to APG

- Aesthetics
  - Vista
  - Landscape
- Habitat provisioning for biodiversity
- Recreation
- Nutrient sequestration

Scenario Building and Analysis

- User can create polygons and see changes in ES scores by comparing to each other and to baseline
- Drill down to parcels to determine drivers
- Understand trade-offs between different ES

Landuse Change Scenario



Calculating Relative Ranking of Ecosystem Services

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1. Landform contrast
2. Wetland-edge complexity
3. Associated water-body size
4. Associated water-body diversity
5. Surrounding land-use contrast
6. Surrounding land-use diversity
7. Wetland size
8. Vegetative/water interspersion

3

Overall wetland aesthetics scores

80
60
55
40
56
10
35
23
12
21
....

Natural break algorithm or re-scaling

4

Overall wetland aesthetics rank

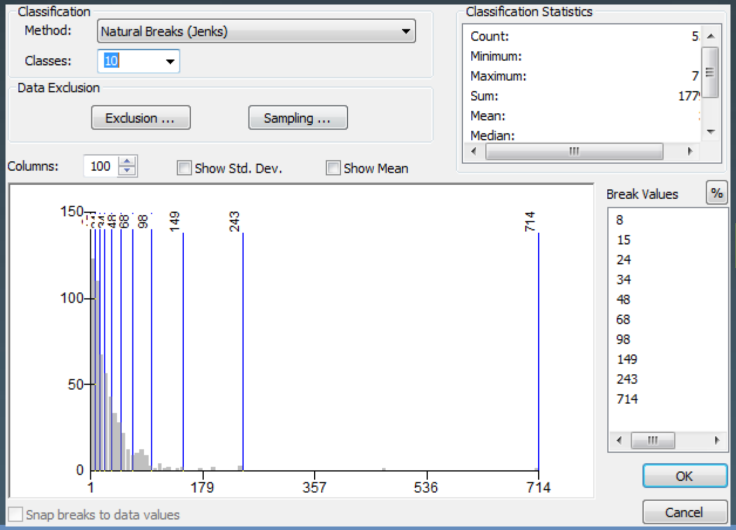
10
9
8
7
6
5
4
3
2
1

2

Example: Wetland size

AREA_SIZE	AREA_U_D
39	ACR
140	ACR
111	ACR
42	ACR
74	ACR
19	ACR
30	ACR
28	ACR
16	ACR
7	ACR
20	ACR
57	ACR
57	ACR
76	ACR
50	ACR
66	ACR

Natural break algorithm or re-scaling



Scores

10
9
8
7
6
5
4
3
2
1

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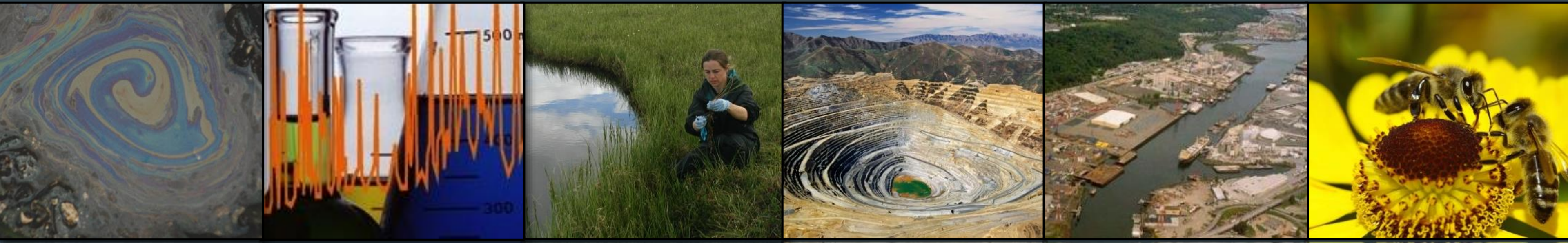
Vista Aesthetics



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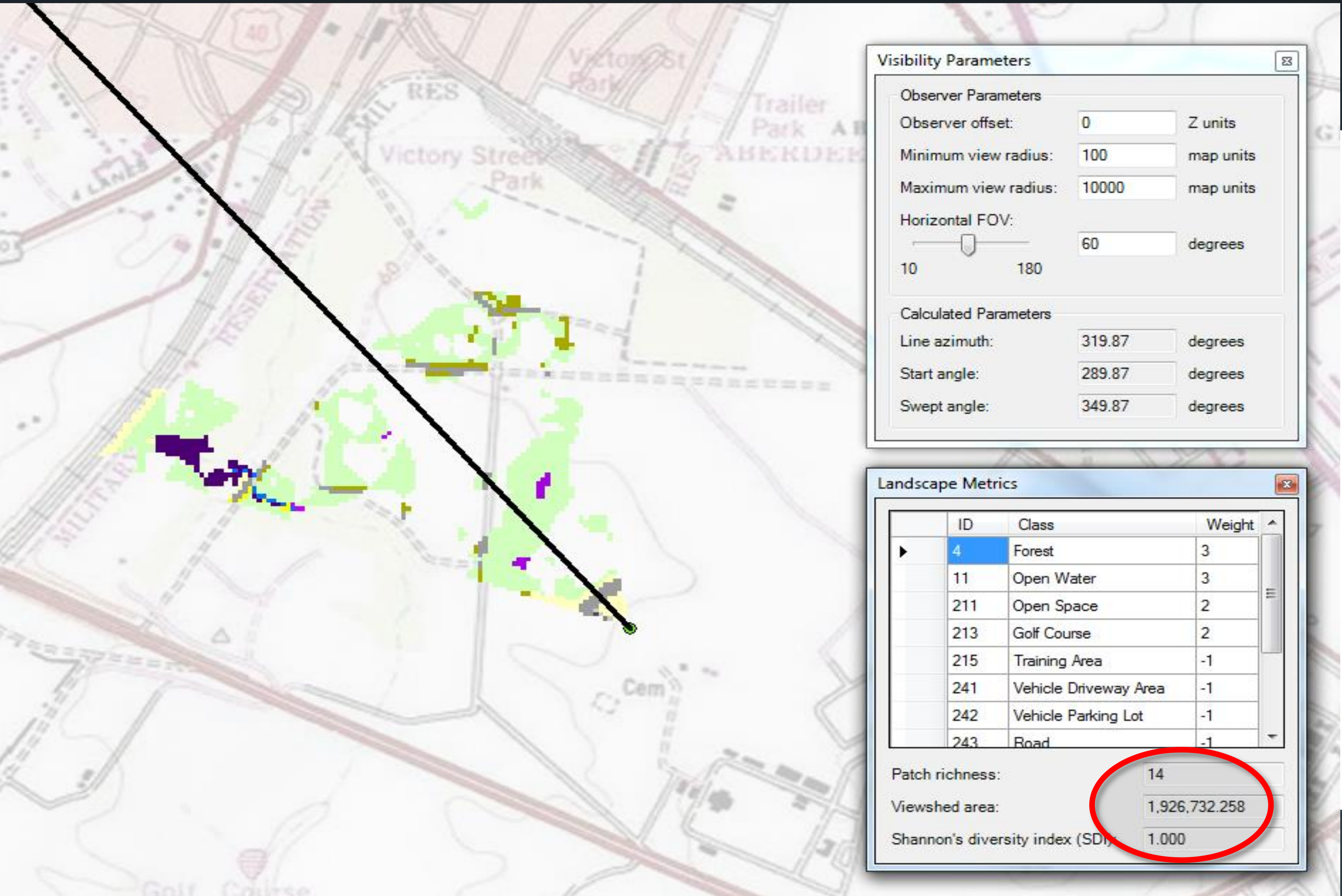
Vista Aesthetics Baseline



Landscape Aesthetics

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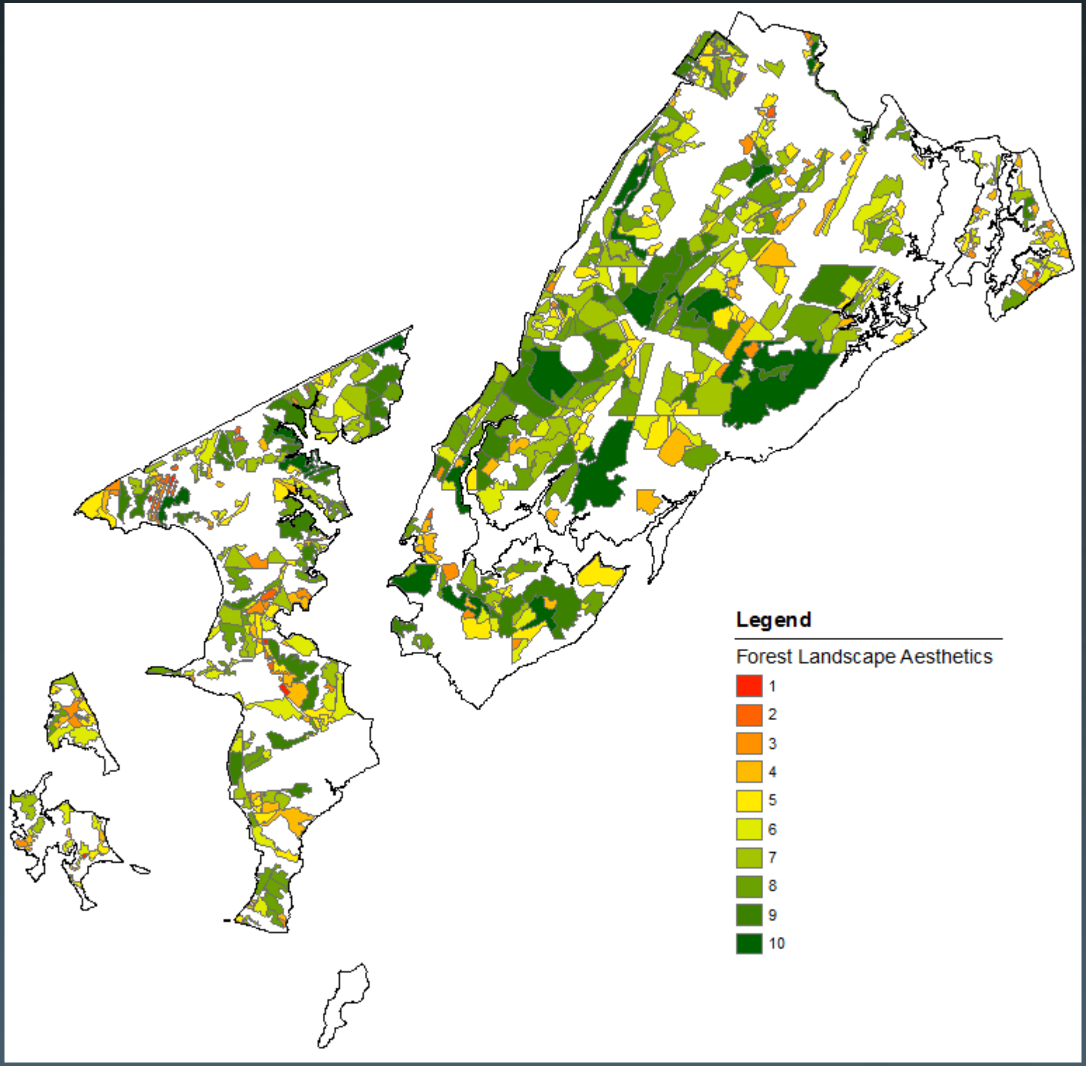
Forest Landscape Aesthetics

- Landform Contrast
- Edge Complexity
- Surrounding Landuse Contrast
- Surrounding Landuse Diversity
- Forest Size
- Vegetation Interspersion
- Forest Density
- Forest Age



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Nutrient Sequestration

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Nutrient Sequestration Model

Land use/Stormwater Sewers (Acres)

	Sewered	Unsewered
Commercial	.75	23.3
Industrial	6.04	5.62
Institutional	0	0
Transportation	1.09	79.98
Multi-Family	0	0
Residential	1.35	114.45
Agriculture	0	46.7
Vacant	0	47.07
Open Space	2.35	84.19
Total Contributing Area		412.88

Calculate the areas of various LULCs in the drainage basin

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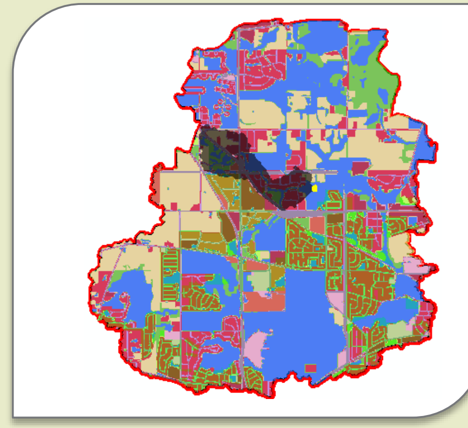
Delineates the drainage basin for each wetland



Calculate the nutrient and NPS contaminants loadings to the wetland

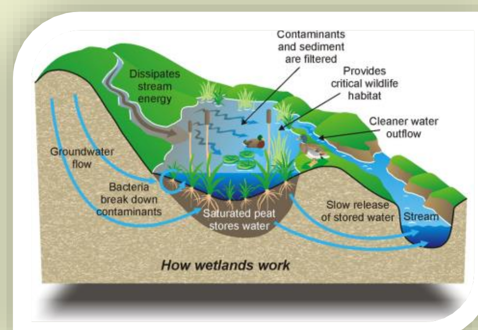
	Pre-wetland NPS loading (lbs/yr)	Loading reduction (lbs/yr)	Post-wetland NPS loading (lbs/yr)
TDS	440679.14	U	U
TN	1734.86	173.49	1561.37
TKN	1404.8	U	U
DP	56.39	U	U
TP	206.52	51.63	154.89
CADMIUM	1.57	.79	.79

Riparian Analysis Toolbox

Determine the effectiveness (percent) of the wetland regarding nutrient and NPS contaminant reduction, based on buffer width, average slope, vegetation strip width, etc.

Reduction effectiveness

TN = 10%
TP = 25%



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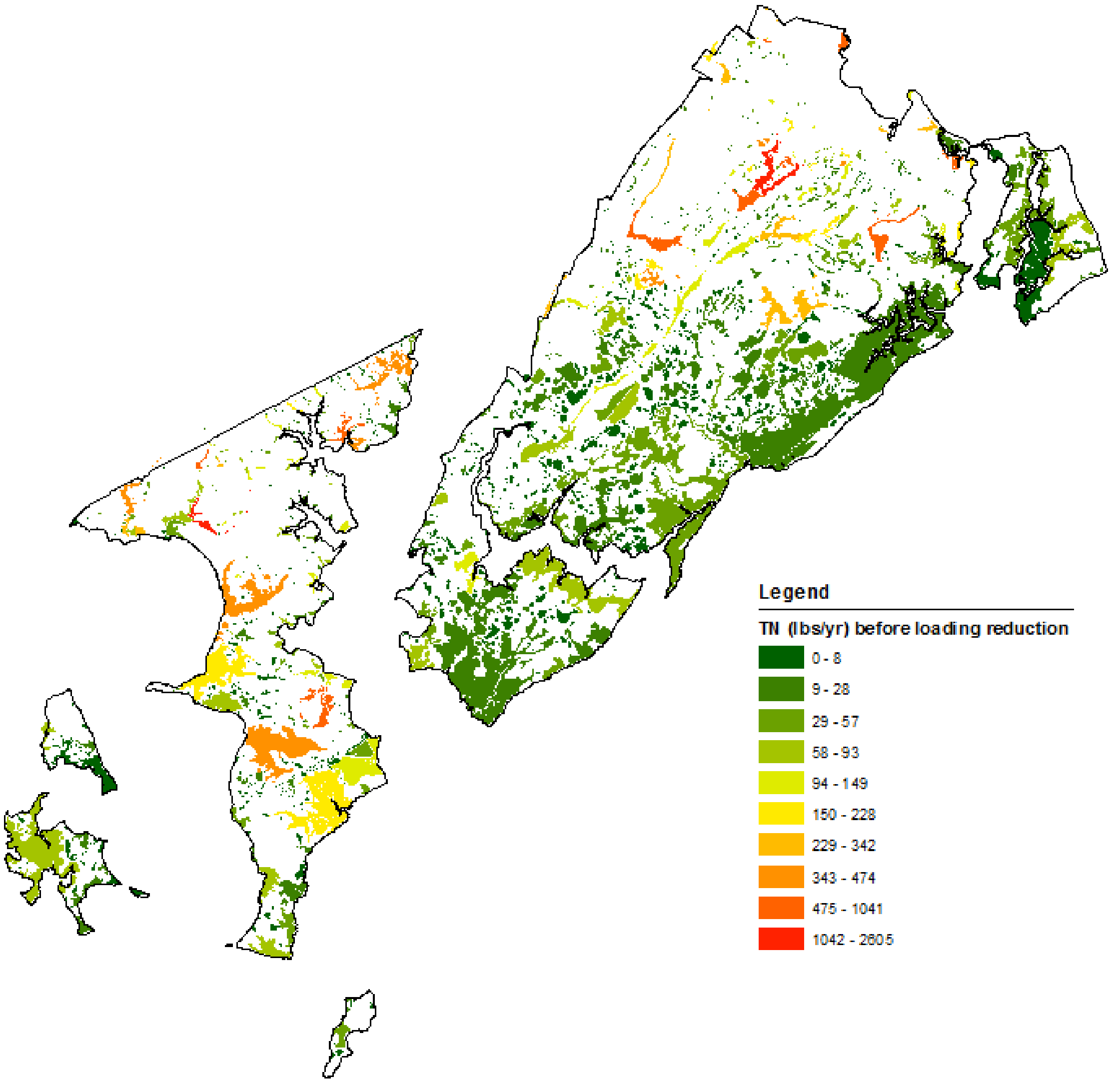
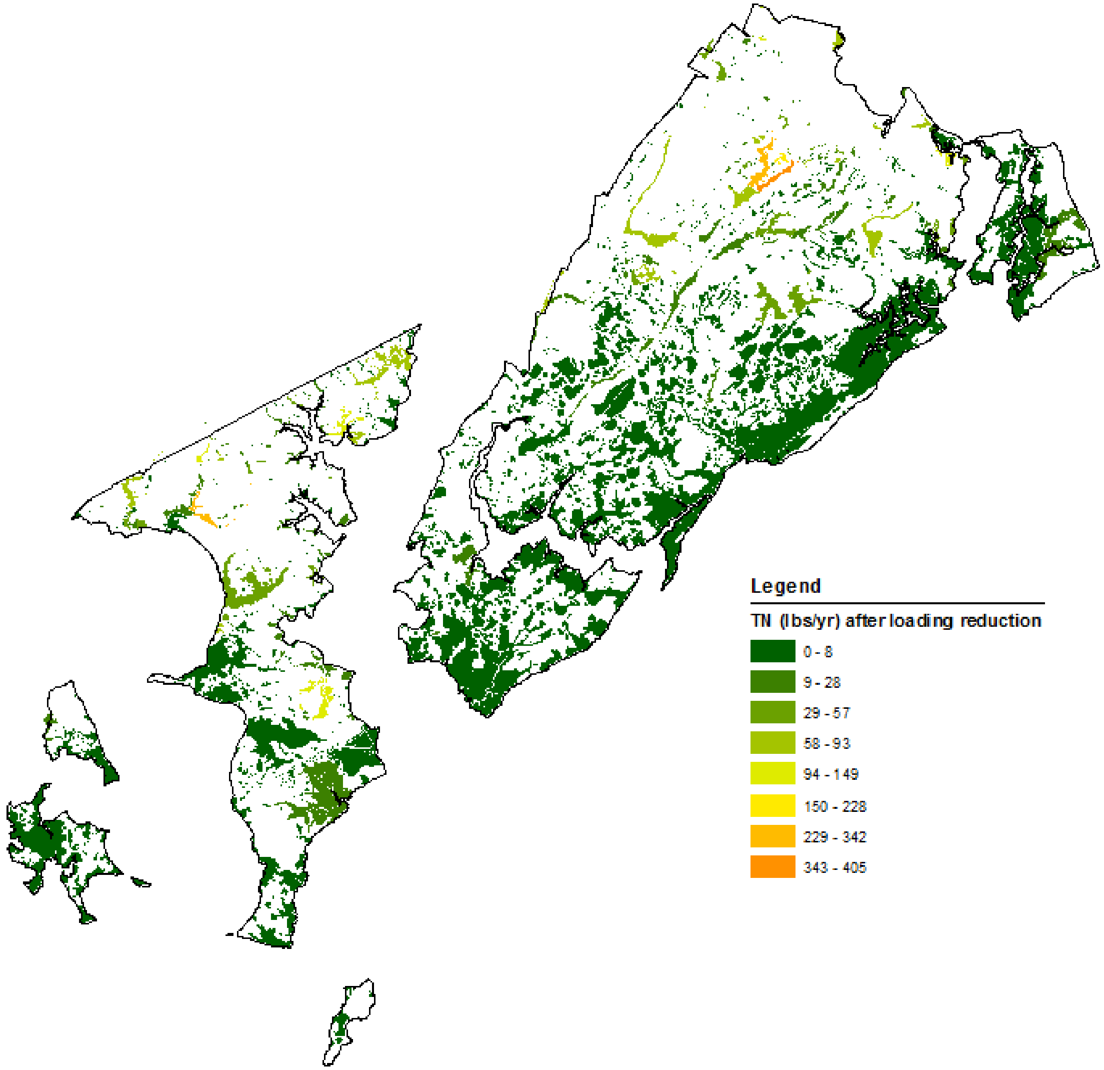
Total Nitrogen Loadings into Each Wetland

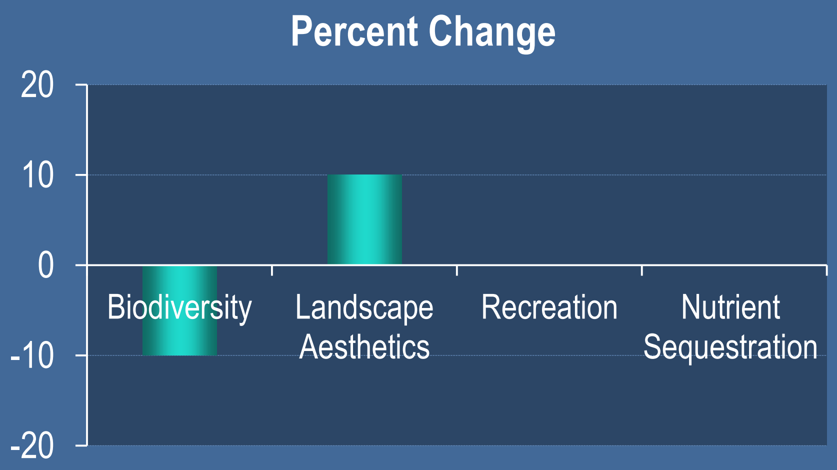


Total Nitrogen Outflow from Each Wetland



Final Results: ES Average Scores and Percent Change

ES	Baseline Case	Scenario 1
Biodiversity	3	2
Landscape Aesthetics	4	5
Recreation	9	9
Nutrient Sequestration	2	2
Vista Aesthetics	Patch Richness: 14	Patch Richness: 3
	Area (sq ft): >1.9 million	Area (sq ft): ~882,000
	SDI: 1.0	SDI: 0.96



Main Take Home Points

- Successful application of any ES quantification tool requires consideration of management context and decision space
  - Prioritizing modeling efforts
  - Interpreting and communicating results
- Flexible decision support framework allows for appropriate scaling of modeling and management application
- Flexible modeling approach allows for relative or absolute quantification of ES

THANK YOU!

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