US 301 Waldorf: A Strategic Approach to Environmental Stewardship

Green Infrastructure Network Design & Optimization

The Conservation Fund
Will Allen, Director of Strategic Conservation
wallen@conservationfund.org
919-967-2223 ext 124
http://www.conservationfund.org/strategic_conservation

August 2010

The Strategic Approach

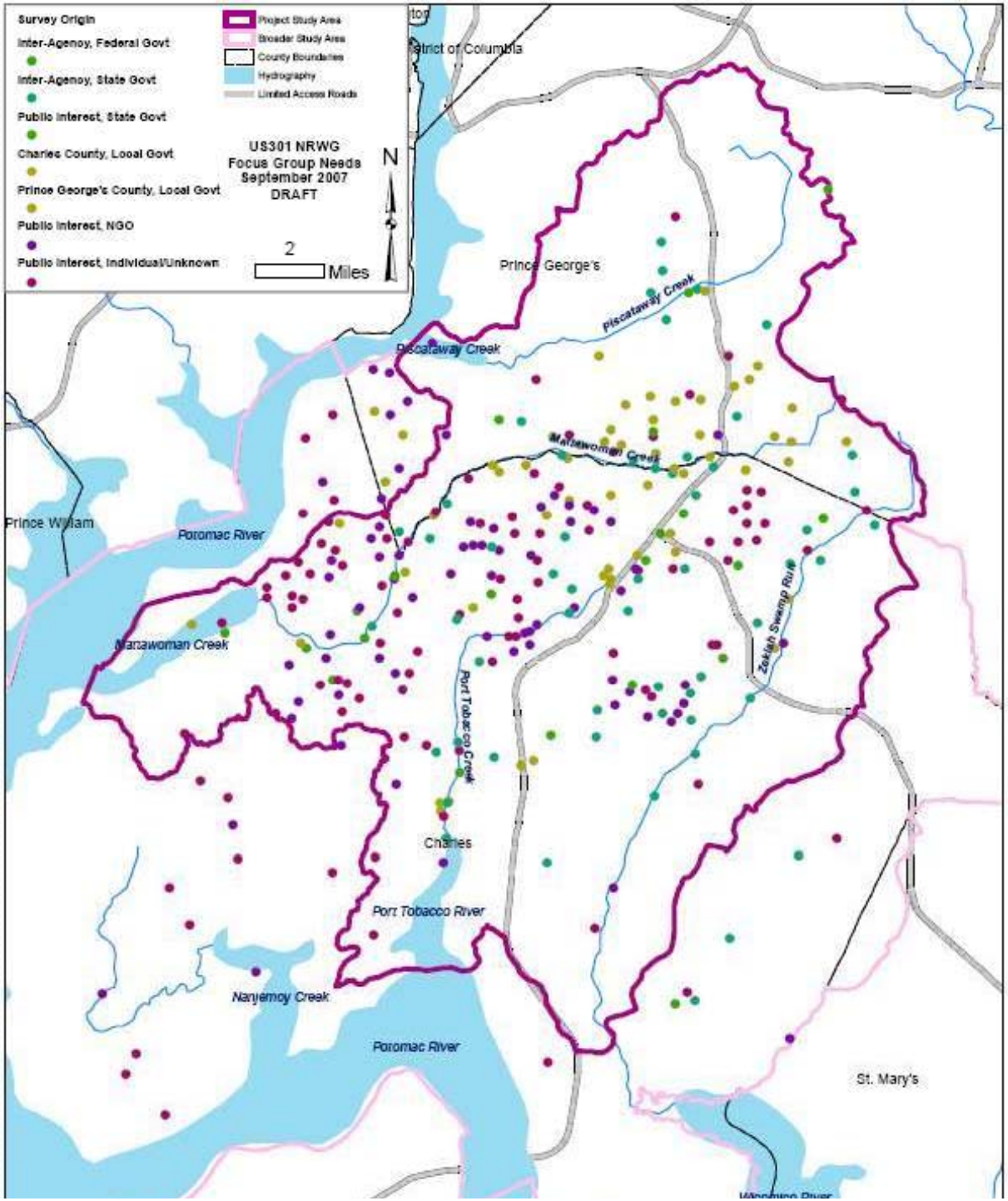
- Framework for Environmental Stewardship
  - The Conservation Fund, Maryland DNR, and US Fish and Wildlife Service partnered with Maryland SHA to design a framework for identifying environmental stewardship opportunities for a proposed Transportation Improvement project near Waldorf, MD.
- Green Infrastructure Network Design
  - The Conservation Fund served as the lead designer of an interconnected network of land and water resources that serve as a framework for evaluating and prioritizing conservation and restoration opportunities within the project area.
- Integrating the Green and the Gray
  - The US 301 project serves as a model for integrating transportation and environmental planning used public involvement, the best available conservation science, and decision support tools.
- Optimization Tool for Project Selection
  - The Conservation Fund and the University of Delaware developed an Excel-based decision support tool to select environmental stewardship projects that maximize benefits at a given budget level.

Stakeholder Priorities

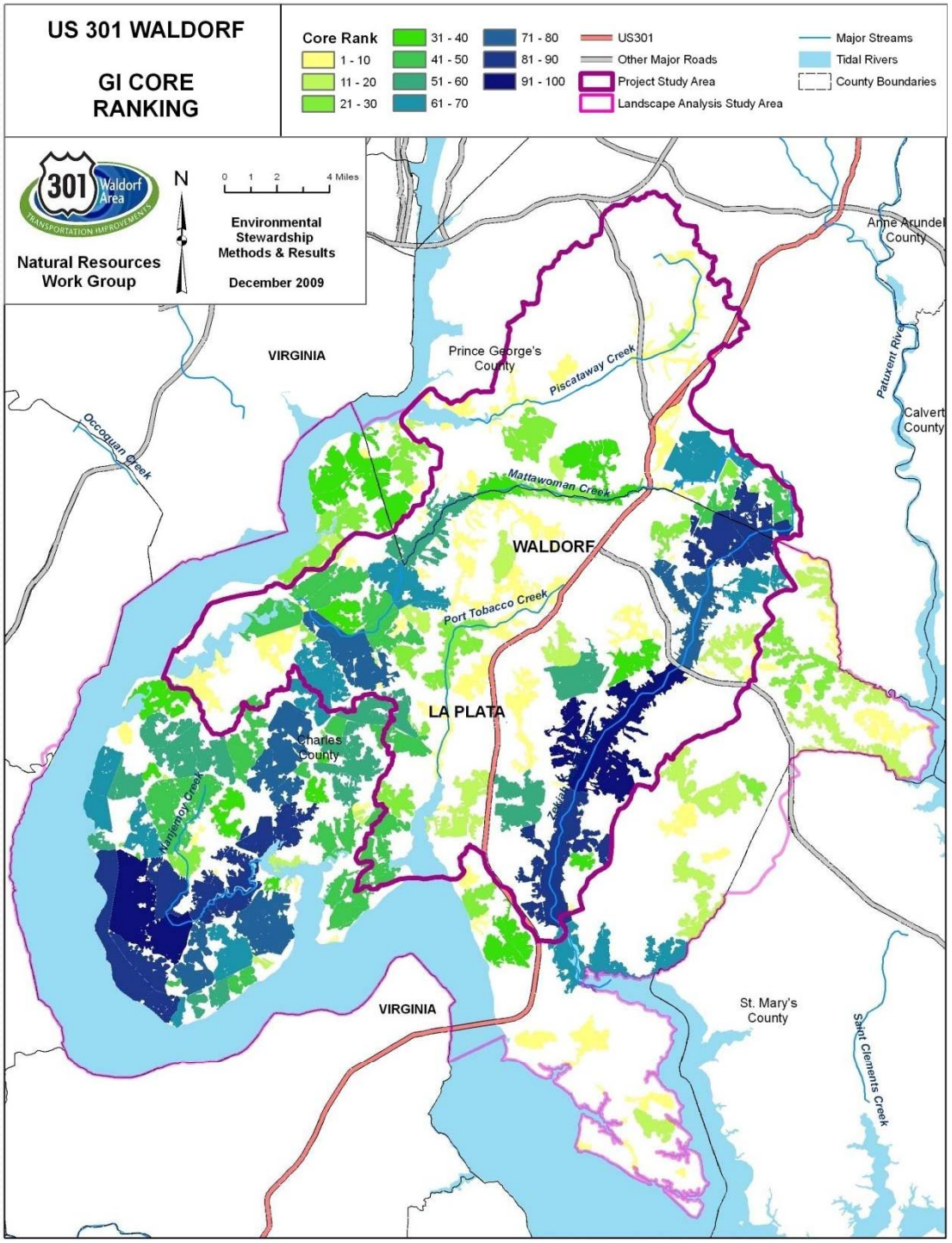
- Four focus group sessions
- 64 individuals

Environmental Stewardship Activities	
Conservation / Preservation	**60%**
Restoration / Creation	18%
Management Actions	11%
Recreation / Public Access to Open Space	11%

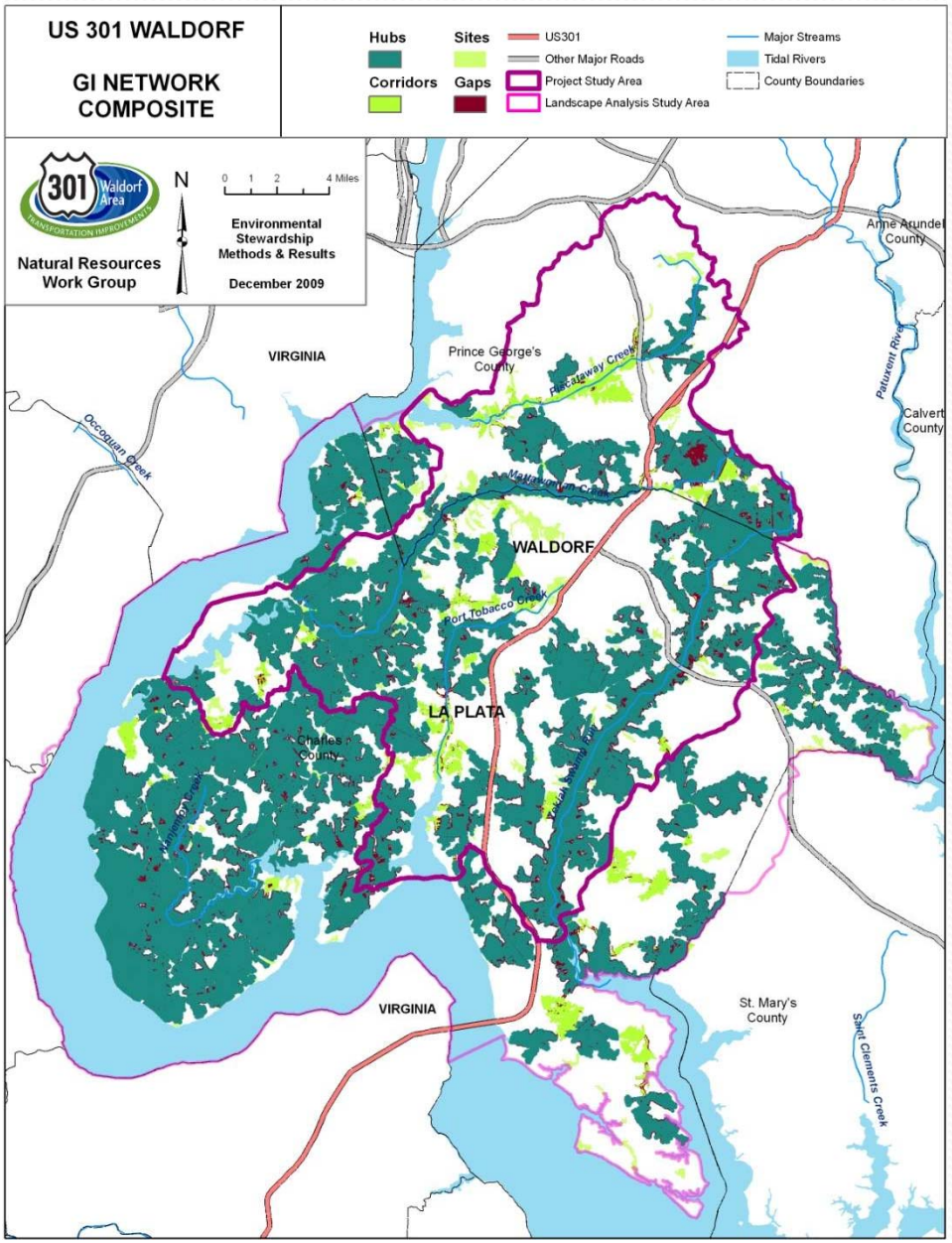
Priority Natural Resources	
Forests	**22%**
Streams and Aquatic Resources	19%
Wetlands	17%
Marine Fisheries	10%
Species Habitat	11%
Passive Recreation Areas	5%
Historic/Archeological	6%
Agriculture	9%

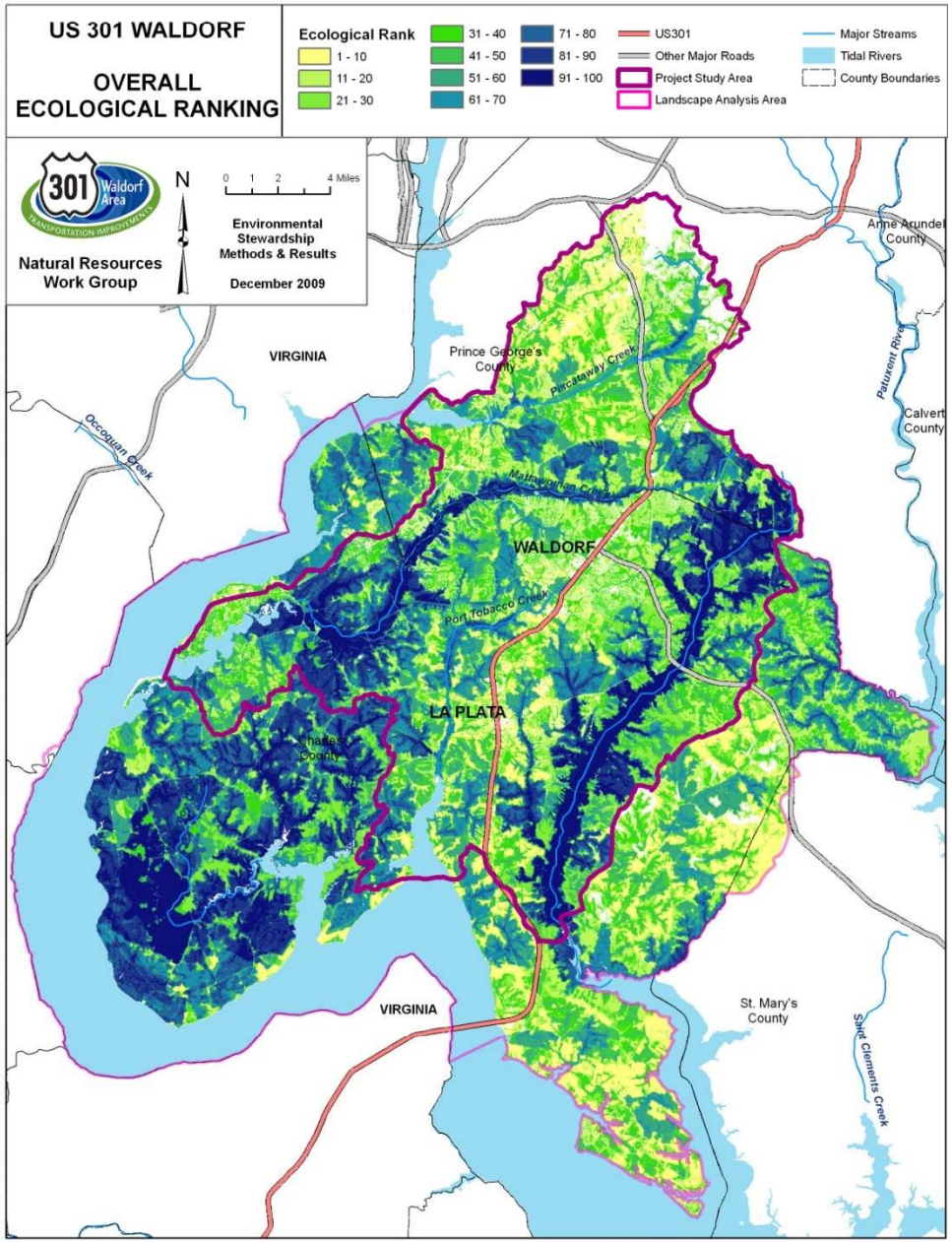


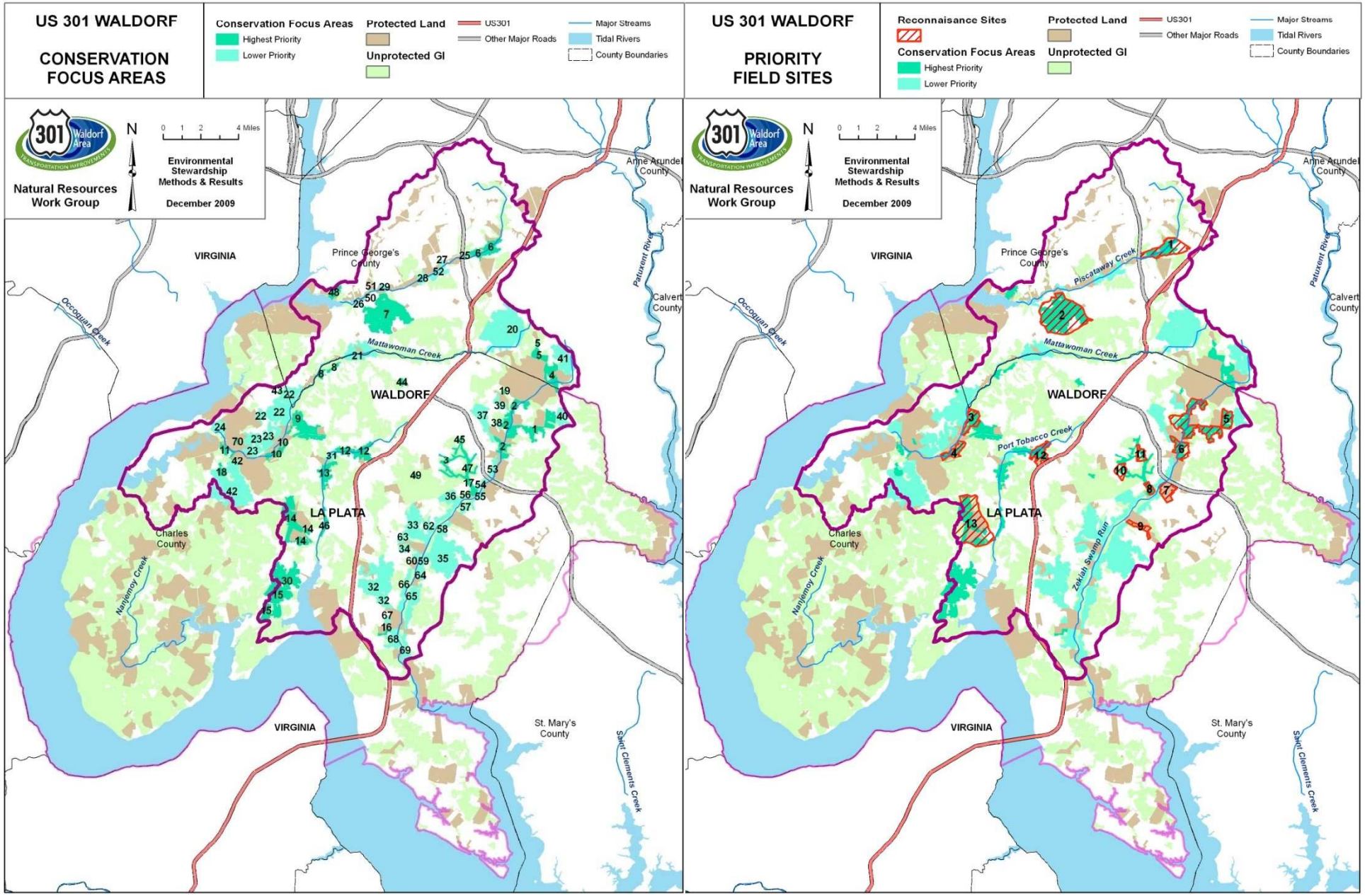
US 301 Core Areas



Environmental Stewardship - Ecological Ranking






US 301 WALDORF
CONSERVATION FOCUS AREAS
Conservation Focus Areas
Highest Priority
Lower Priority
Protected Land
Unprotected GI
US301
Other Major Roads
Major Streams
Tidal Rivers
County Boundaries
Natural Resources Work Group
Environmental Stewardship Methods & Results
December 2009
N
0 1 2 4 Miles
US 301 WALDORF
PRIORITY FIELD SITES
Reconnaisance Sites
Conservation Focus Areas
Highest Priority
Lower Priority
Protected Land
Unprotected GI
US301
Other Major Roads
Major Streams
Tidal Rivers
County Boundaries
Natural Resources Work Group
Environmental Stewardship Methods & Results
December 2009
N
0 1 2 4 Miles
VIRGINIA
Prince George's County
Anne Arundel County
Calvert County
St. Mary's County
Charles County
WALDORF
LA PLATA
Mattawoman Creek
Piscataway Creek
Port Tobacco Creek
Zekiah Swamp Run
Occoquan Creek
Nanjemoy Creek
Patuxent River
Smith Clements Creek

Project selection methods

- Government agencies and NGOs typically use a rank-based approach to select projects for implementation.
- The rank-based approach focuses only on the benefits of a project without considering the project's cost, which can result in highly inefficient investments.
- It ignores potential "good buys" that offer high quality (environmental benefits) at a significantly lower cost.
- The use of optimization in project selection provides a means to extend the reach and effectiveness of environmental efforts.

Courtesy of University of Delaware

Differences in selection models

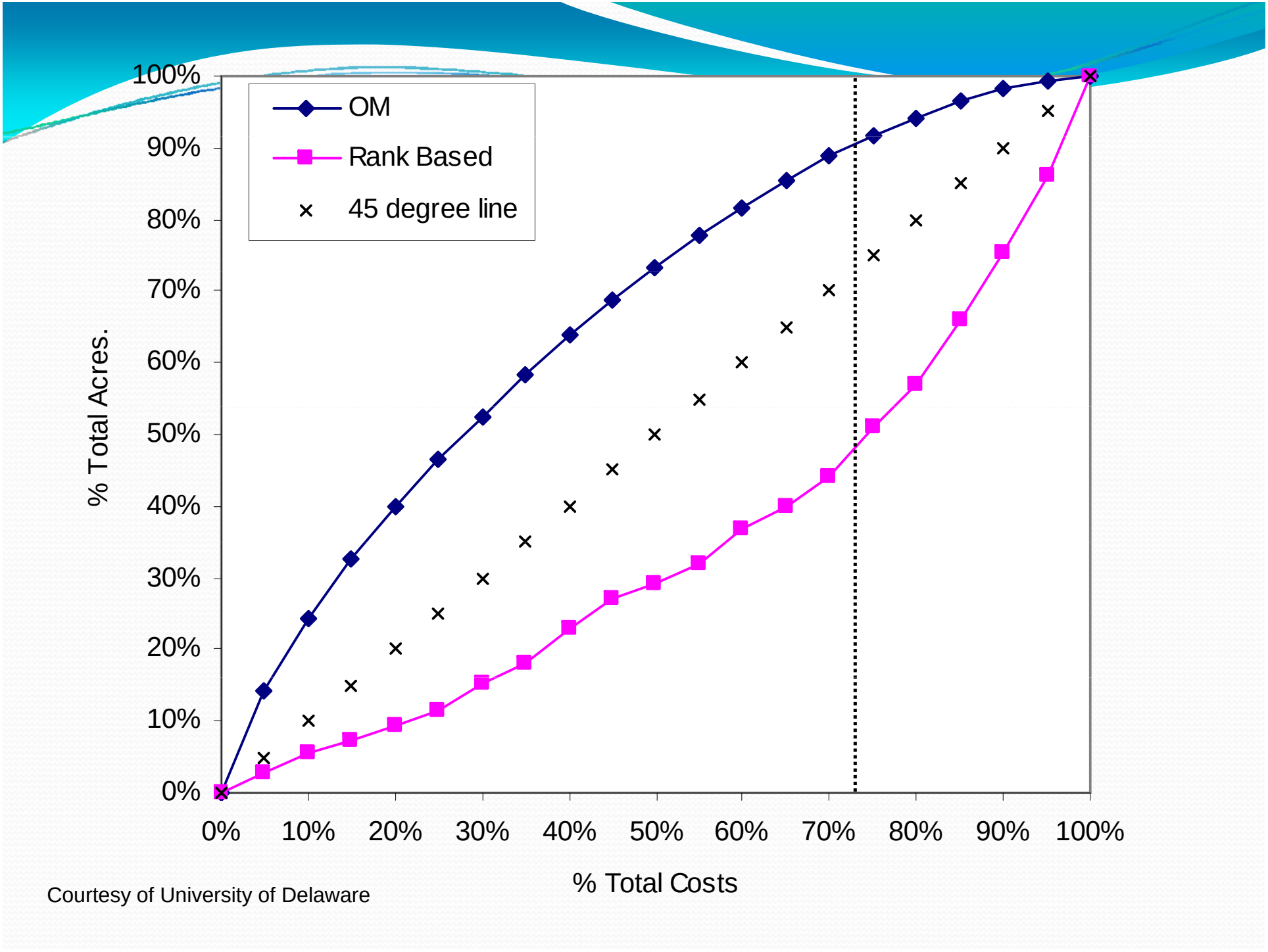
Rank-Based Models

- Rank-order projects from highest benefit to lowest.
- Invest in highest ranked projects until the budget is expended.
- Guarantees selection of the highest rated projects.
- Optimal, *only* if all costs are **equal.**

Optimization Models

- Seeks to maximize ***aggregate*** benefits.
- Subject to constraints (e.g. budget, project type, etc.)
- Model selects "Best Buys" by using optimization method (i.e. binary linear programming) or cost-effective analysis method

Courtesy of University of Delaware

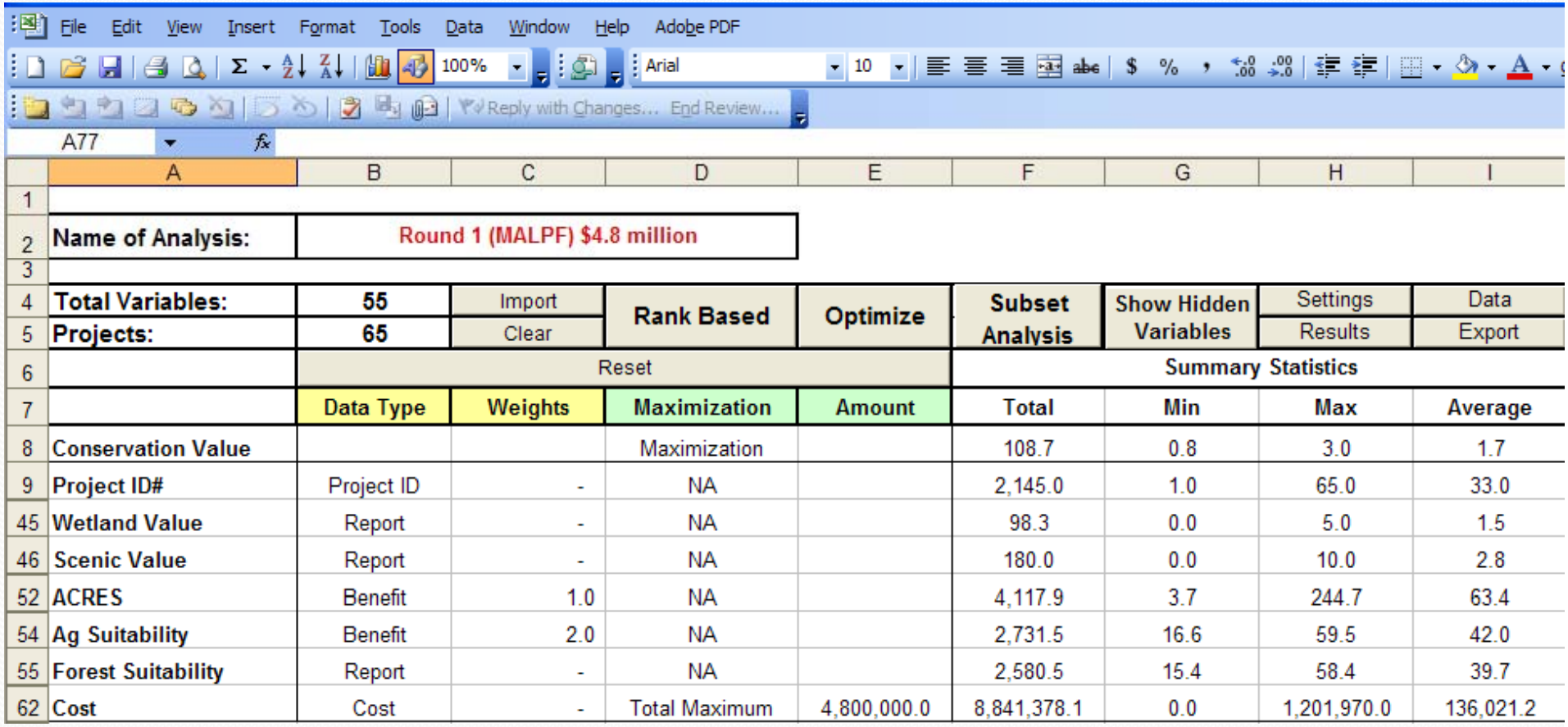


Courtesy of University of Delaware

Project selection using optimization

- Optimization Decision Support Tool requirements
  - **Opportunities** (Environmental stewardship projects)
  - **Benefits** (Project benefit scoring/ranking)
  - **Costs** (Financial investment required to achieve benefits)
  - **Constraints** (Budget scenario, other decision constraints)
- Tool benefits
  - Easy to use (Excel interface)
  - Flexible (answer multiple planning questions)
  - Ability to run multiple scenarios (sensitivity analysis)
  - Potential to extend limited funds for compensatory mitigation and environmental stewardship

Optimization Tool



File Edit View Insert Format Tools Data Window Help Adobe PDF

100% Arial 10

Reply with Changes... End Review...

A77

	A	B	C	D	E	F	G	H	I
1									
2	**Name of Analysis:**	**Round 1 (MALPF) $4.8 million**							
3									
4	**Total Variables:**	**55**	Import	**Rank Based**	**Optimize**	**Subset Analysis**	**Show Hidden Variables**	Settings	Data
5	**Projects:**	**65**	Clear					Results	Export
6		Reset				**Summary Statistics**			
7		**Data Type**	**Weights**	**Maximization**	**Amount**	**Total**	**Min**	**Max**	**Average**
8	**Conservation Value**			Maximization		108.7	0.8	3.0	1.7
9	**Project ID#**	Project ID	-	NA		2,145.0	1.0	65.0	33.0
45	**Wetland Value**	Report	-	NA		98.3	0.0	5.0	1.5
46	**Scenic Value**	Report	-	NA		180.0	0.0	10.0	2.8
52	**ACRES**	Benefit	1.0	NA		4,117.9	3.7	244.7	63.4
54	**Ag Suitability**	Benefit	2.0	NA		2,731.5	16.6	59.5	42.0
55	**Forest Suitability**	Report	-	NA		2,580.5	15.4	58.4	39.7
62	**Cost**	Cost	-	Total Maximum	4,800,000.0	8,841,378.1	0.0	1,201,970.0	136,021.2

Tool developed by the University of Delaware and The Conservation Fund

Optimization Example

	B	C	D	E	F	G	H	I	J	K
	ACCTID	NFMLNDVL	PROP_AC	GI_AC	CORE_RANK	HUB_RANK	CORR_RANK	ECO_SCORE	PROT_PROX	PER_AC
0	0902001071	17960	105	105	44	47	42	79	0	$ 171
1	0901007297	174910	189	147	41	47	0	55	0	$ 925
2	0901014854	70570	385	383	41	47	0	75	0	$ 183
3	0901013203	40670	272	236	44	47	42	63	0	$ 150
4	0901009427	139340	45	33	41	47	0	50	0	$ 3,096
5	0901013181	16860	87	43	41	47	0	59	0	$ 194
6	0902001691	443620	53	48	41	47	0	0	0	$ 8,370
7	0901057936	5940	23	6	23	47	0	39	0	$ 258
8	0901016369	384960	190	188	41	47	0	73	0	$ 2,026
9	0901054864	358510	36	33	23	47	0	67	0	$ 9,959
10	0901057766	134670	24	21	23	47	0	62	0	$ 5,611

Table 28. Sample comparison of optimization and rank-based selection of projects for fee simple purchase with a budget of $15 million.

Maximum Allowable Acquisitions	Selection method	Number of projects selected	Total Cost	Area of GI Network selected (acres)	Aggregate conservation value (normalized)
30	Rank-based	30	$14,650,170	4,596	41,848
30	Optimized	30	$11,502,541	5,291	42,410
unlimited	Rank-based	31	$14,997,362	5,403	43,624
unlimited	Optimized	117	$14,985,997	7,044	136,354