INTEGRATING CONSERVATION AND RESTORATION INTO HIGHWAY PLANNING

2012 WVDOT/MPO/FHWA

Transportation Planning and Programming Conference

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The Conservation Fund

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PRESENTATION OUTLINE

I. **Why Integrate Transportation and Conservation Planning?** (Donna Buscemi)

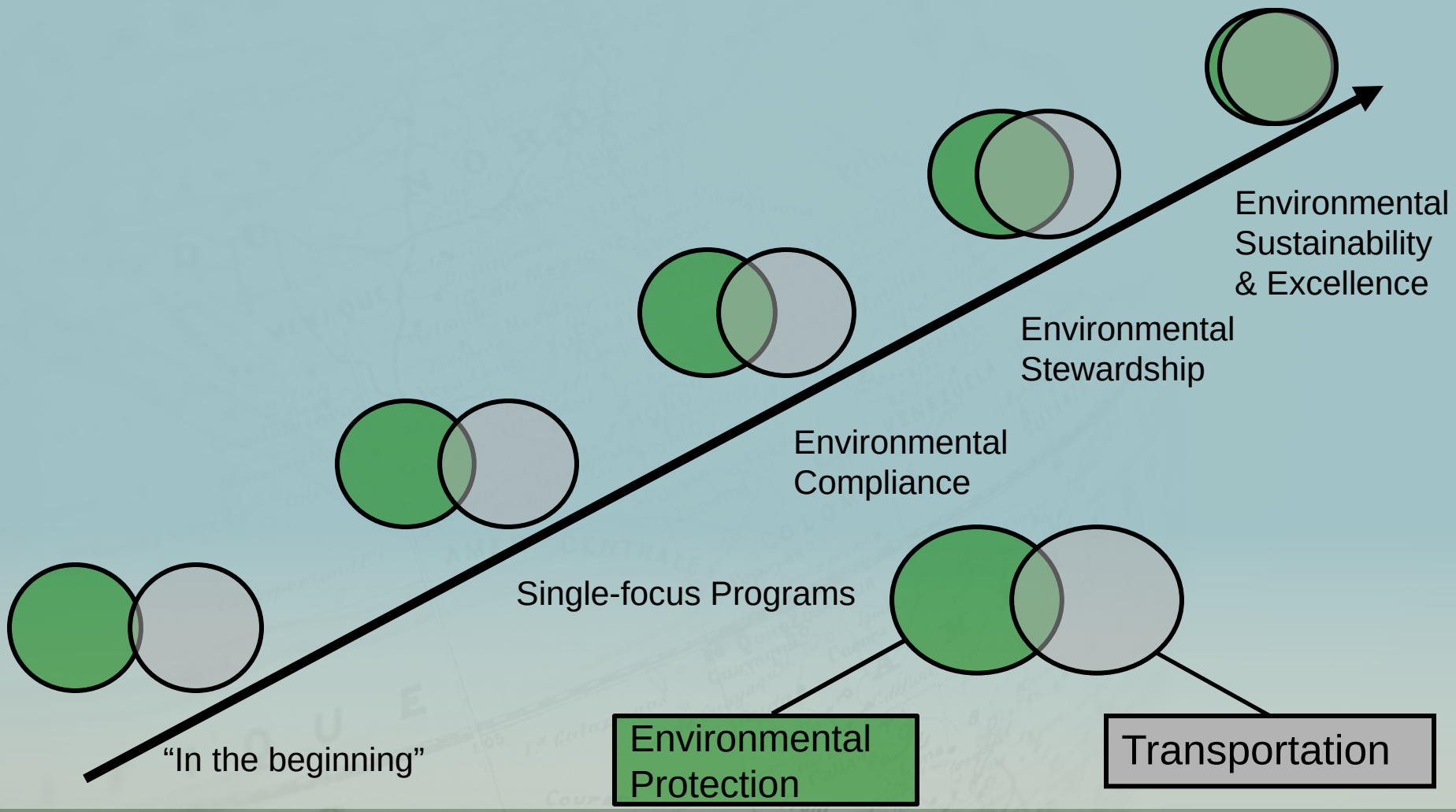
II. **Introduction to Maryland's US 301 Case Study** (Donna Buscemi)

III. **Green Infrastructure Concepts** (Ted Weber)

IV. **US 301 Planning and Implementation** (Ted Weber)

V. **Summary** (Ted Weber)

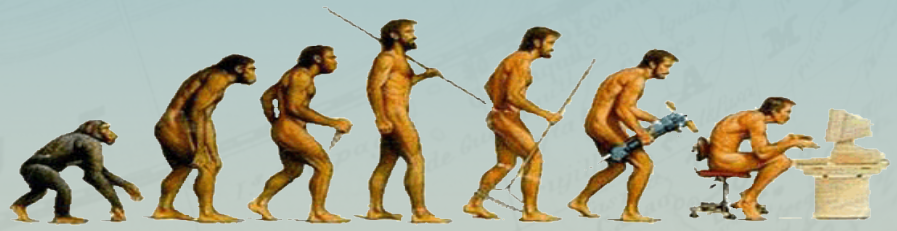
GOALS & MISSIONS OF ENVIRONMENTAL PROTECTION AND TRANSPORTATION ARE MERGING!



TRANSPORTATION PROJECT DEVELOPMENT IS EVOLVING

Key Milestones:

- 1970 NEPA signed into law
- 1970's MPOs for populations > 50,000
- CAA 1972
- ESA 1973
- 1966 Section 4(f) USDOT
- CWA1972, 1977
- CAAA 1990
- **2002 Executive Order 13274**
- 2005 SAFETEA-LU
- **2005 Green Highways Partnership**
- **2006 ECO-LOGICAL**
- **2006 FHWA Planning and Environment Linkages**
- 2008 CWA 404 Compensatory Mitigation Rule
- 2010 Chesapeake Bay TMDL



PROJECT DEVELOPMENT COMPARISON

THEN

- Focused on transportation needs
- Scoped projects without 1st understanding community and natural environmental resource context
- Environmental compliance in Isolation (permit-based)
- Stakeholder involvement was reactionary

NOW

- Transportation, environmental, social and economic needs given equal priority
- Scoped projects with the understanding of community and natural environmental resource context
- Compliance and Stewardship with a systems approach
- Stakeholder involvement throughout the transportation process

THE NEED TO IMPROVE ENVIRONMENTAL OUTCOMES

•Wetland mitigation projects often fail to replace lost functions. Better consideration of habitat, function, and landscape context is needed (Kihslinger, 2008).

•The Vermont Agency of Natural Resources found that active channel restoration was costly and ineffective (Kline and Cahoon, 2010).

•Doyle and Shields (2012) found low rates of success for stream restoration projects, and noted that watershed and landscape land use control water quality, hydrology, and biology.

GREEN INFRASTRUCTURE = WIN-WIN IN TRANSPORTATION

Data-Driven Decision Support System

- "Smart", defensible, transparent, improves credibility, integrates with existing GIS data

Systems Approach

- Cost efficient, improved resource protection, scalable, sustainable

Early Multi-Agency/Stakeholder Integration

- Speeds project delivery without sacrificing environment, aligns with federal priorities, strengthens working relationships

US 301: A STRATEGIC APPROACH

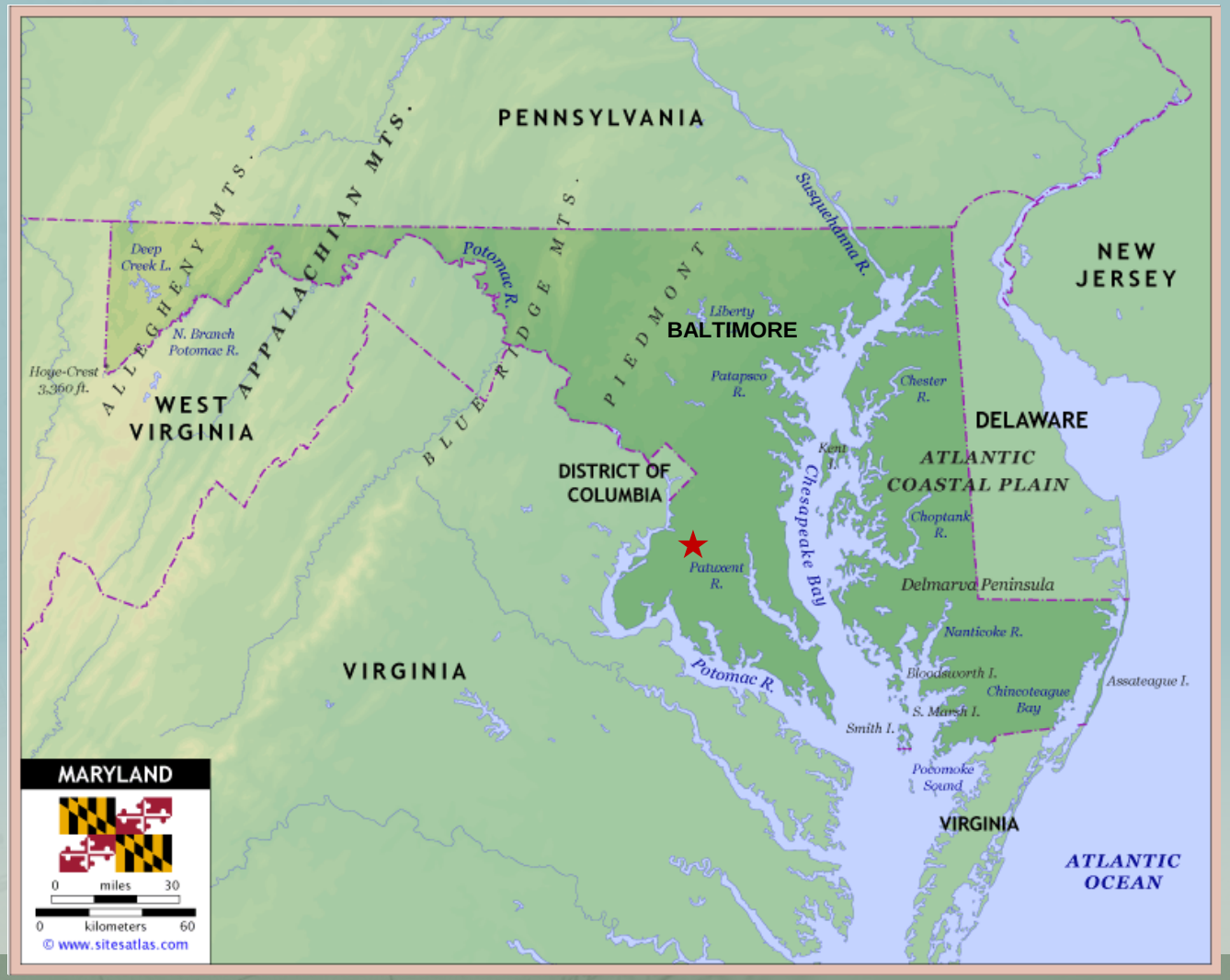
Introduction to Maryland's Case Study

PROJECT LOCATION/BACKGROUND

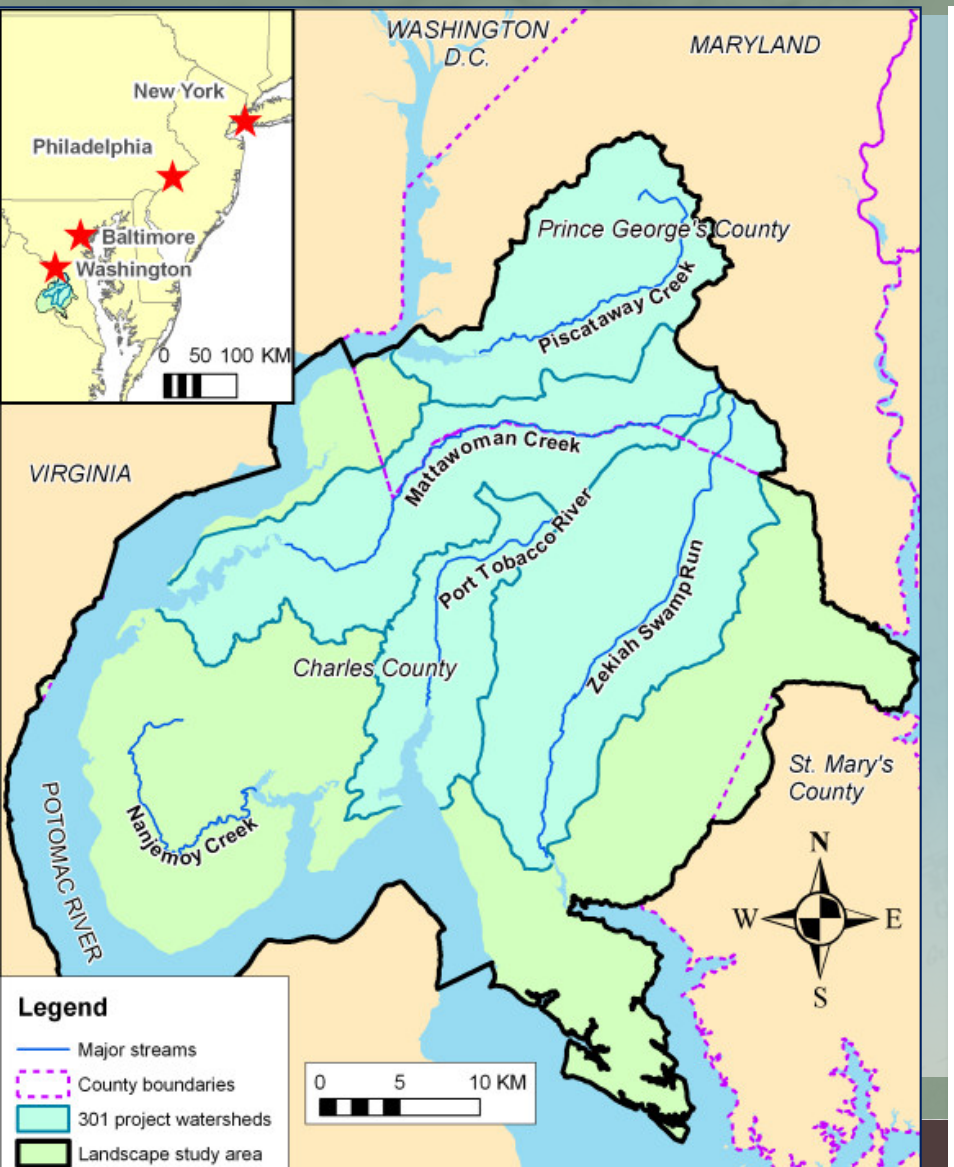
Address current and projected traffic congestion around the Waldorf, MD area

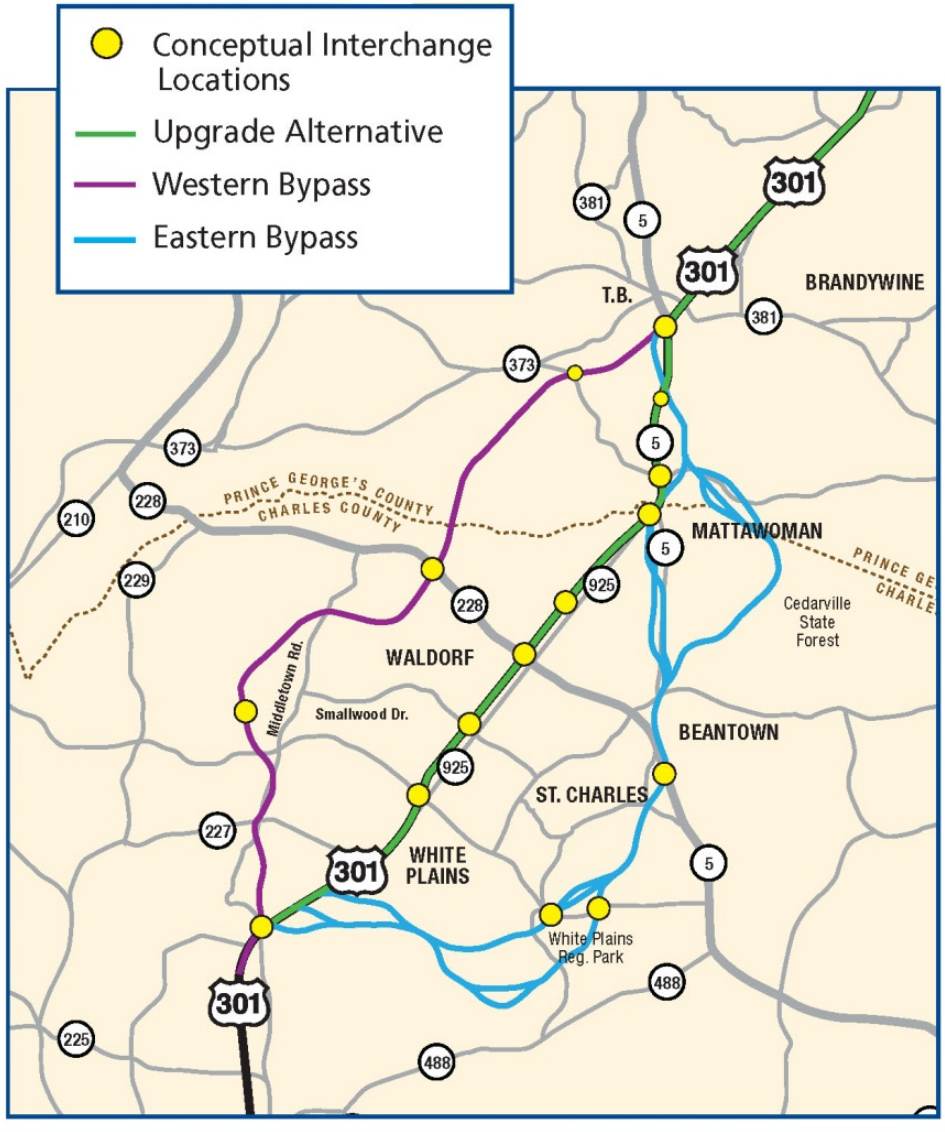
Three major alternatives:

- **Upgrade US 301**
- **Eastern Bypass**
- **Western Bypass**



PROJECT LOCATION/BACKGROUND





PARTNERSHIPS

SHA

MARYLAND DEPARTMENT OF NATURAL RESOURCES

THE CONSERVATION FUND

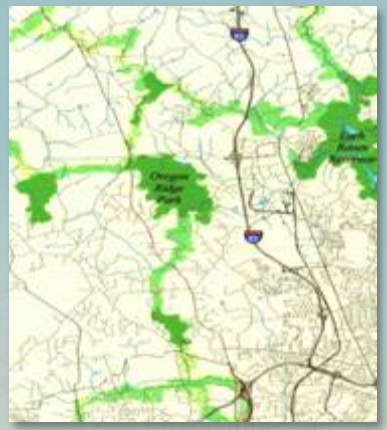
GREEN HIGHWAYS PARTNERSHIP

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

U.S. Department of Transportation
Federal Highway Administration

WHAT IS GREEN INFRASTRUCTURE?

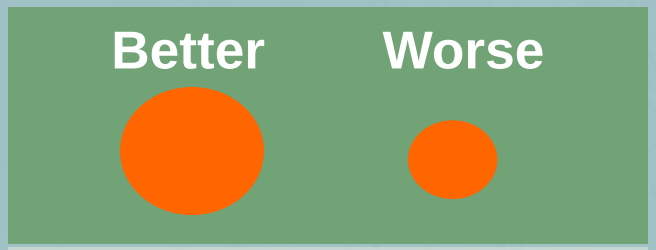
"Strategically planned and managed **networks** of natural lands, working landscapes and other open spaces that **conserve ecosystem functions**, and provide associated **benefits to human populations**"



Jane Hawkey, Jane Thomas, IAN Image Library (www.ian.umces.edu/imagelibrary/)

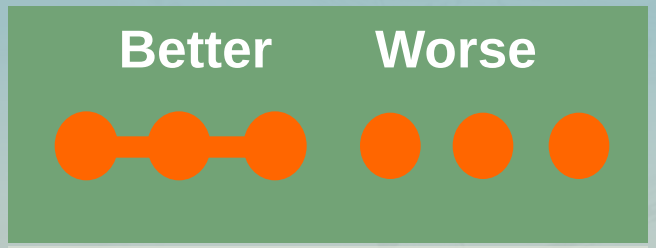
DESIGN PRINCIPLES

- **Conservation Biology**



Larger vs. smaller

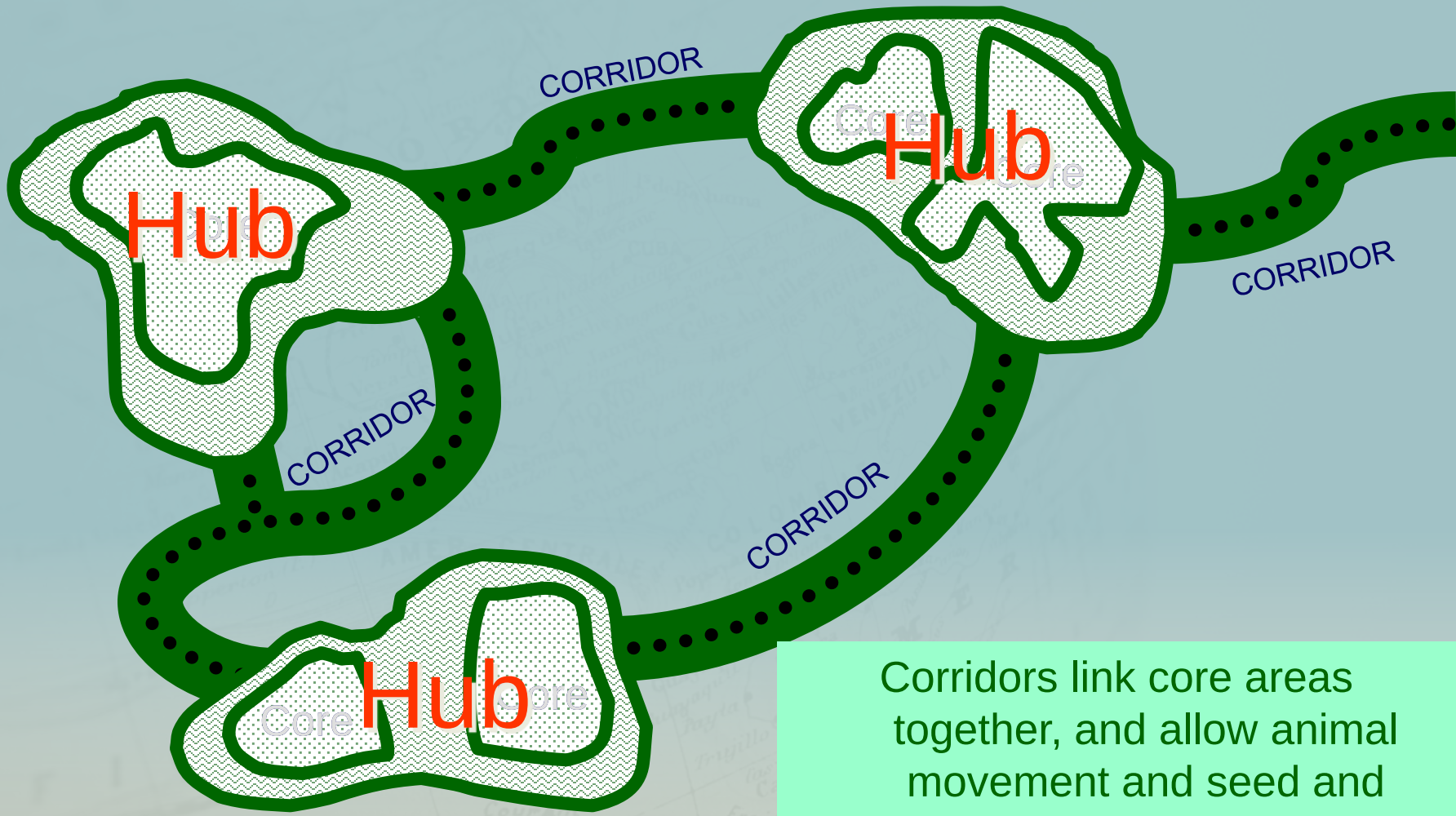
- **Landscape Ecology**



Connections are better

Forest Interior Dependent Species (FIDS)

CONCEPTUAL GREEN INFRASTRUCTURE MODEL



Corridors link core areas together, and allow animal movement and seed and pollen transfer between them.

301 STAKEHOLDER RESULTS

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/Archaeological	6%
Agriculture	9%

US 301 WALDORF AREA TRANSPORTATION IMPROVEMENTS PROJECT

- Identify species and natural communities occurring in the study area
- Habitat preferences and requirements
- Home range size
- Dispersal abilities
- Suitable landscape features for dispersal
- Barriers to dispersal (e.g., highways, development)
- Species role in ecosystem function

CORE FOREST AREAS

At least 100 ha of relatively undisturbed, mature interior forest.

Using forest interior birds (FIDS) as umbrella guild. Areas that meet the breeding habitat requirements of FIDS may also provide habitat for other animals and plants that rely on undisturbed forest.

CORE WETLAND AREAS

Unimpaired wetlands in floodplains or forested matrix

STREAM STABILITY AND AQUATIC HABITAT

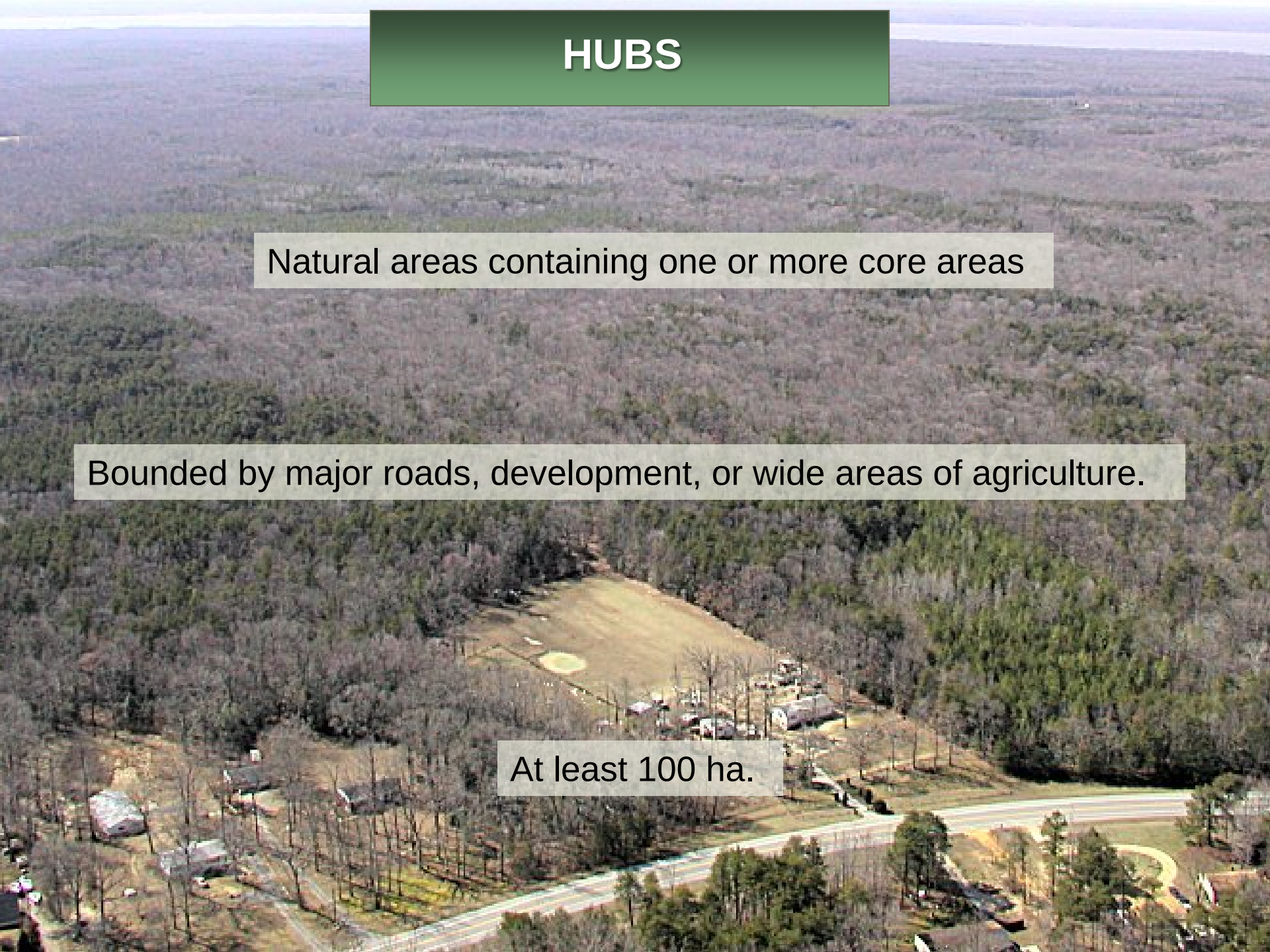
CORE AQUATIC AREAS

Forests and wetlands containing core streams

HUBS

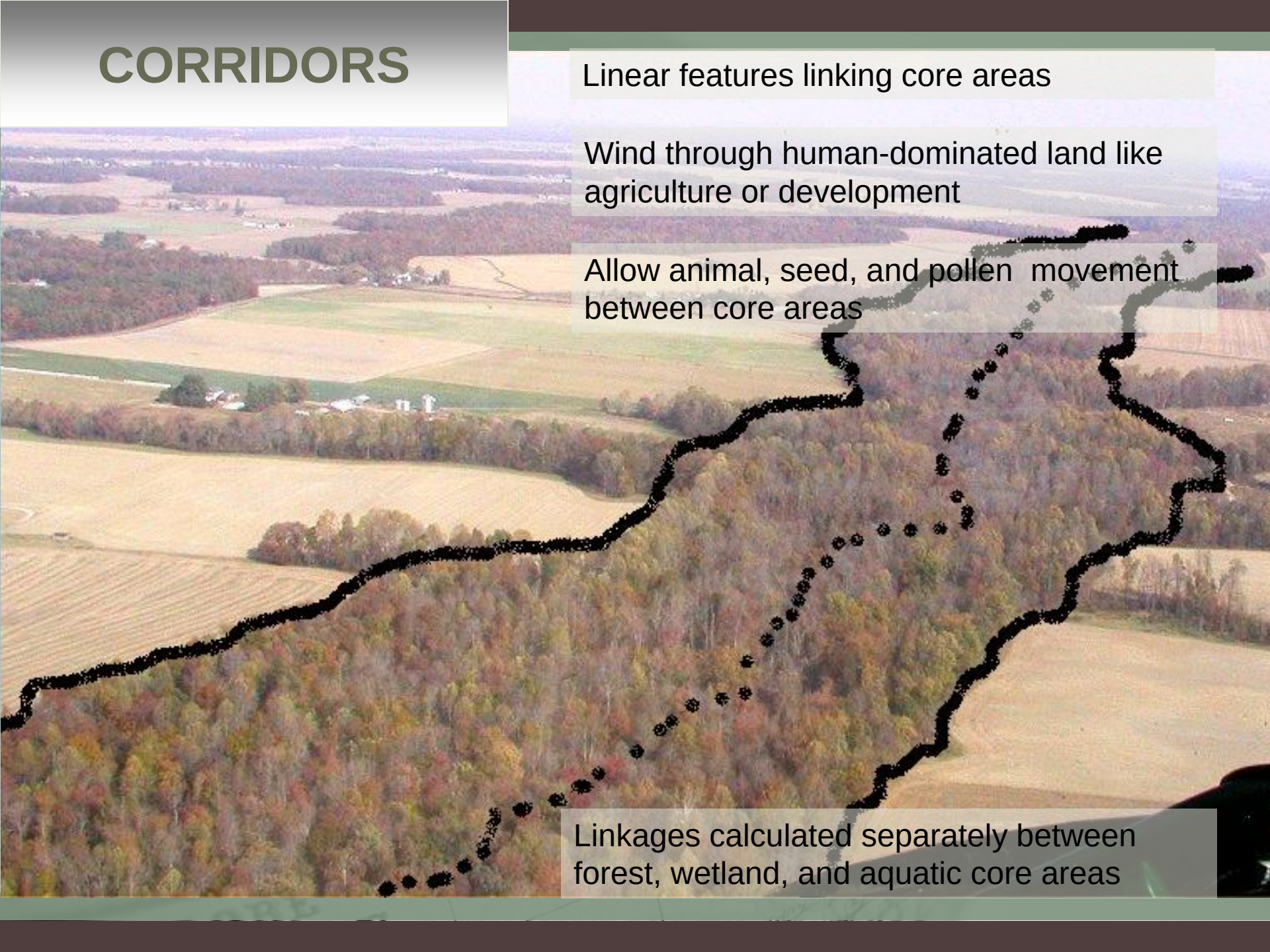
Natural areas containing one or more core areas

Bounded by major roads, development, or wide areas of agriculture.



At least 100 ha.

CORRIDORS



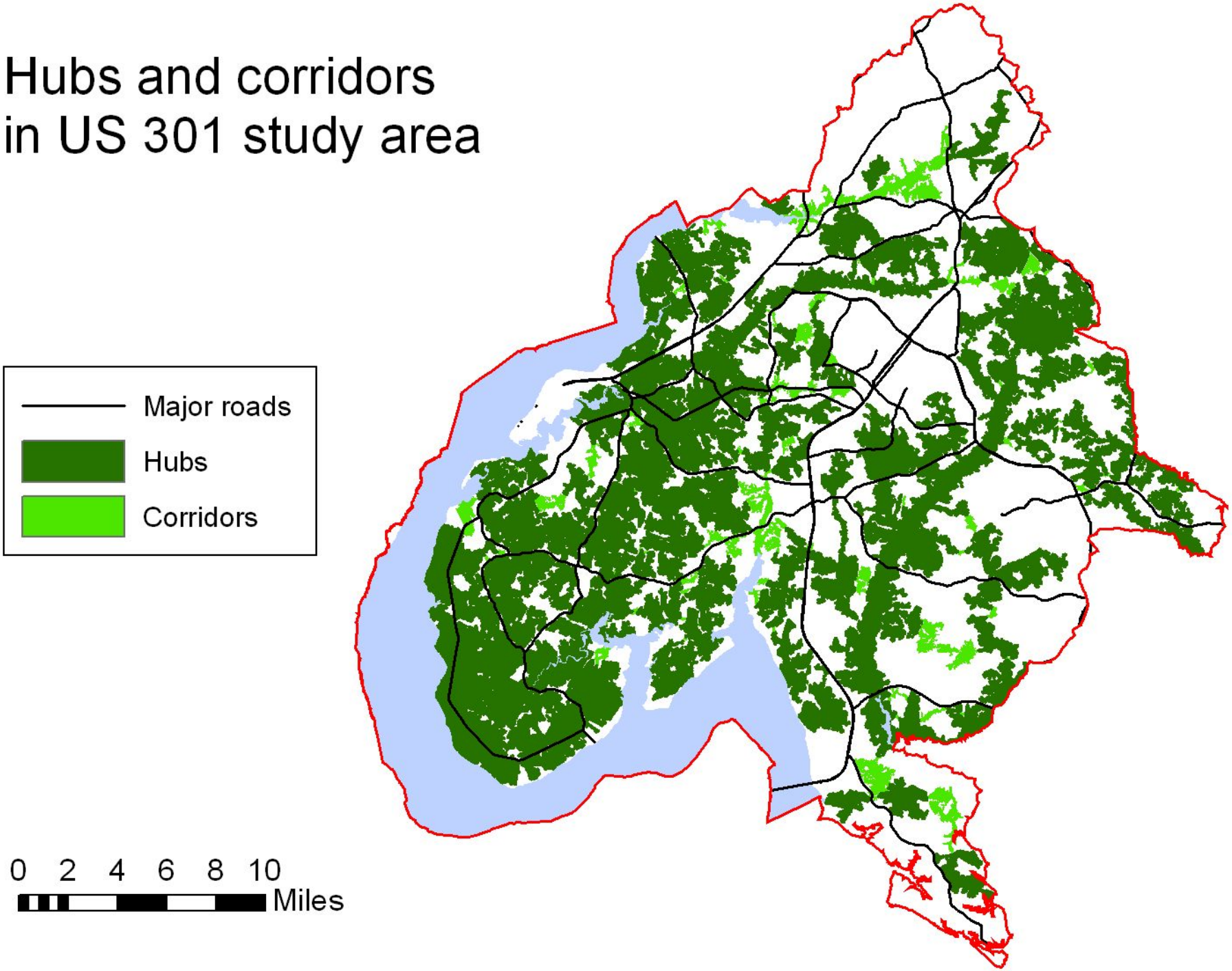
Linear features linking core areas

Wind through human-dominated land like agriculture or development

Allow animal, seed, and pollen movement between core areas

Linkages calculated separately between forest, wetland, and aquatic core areas

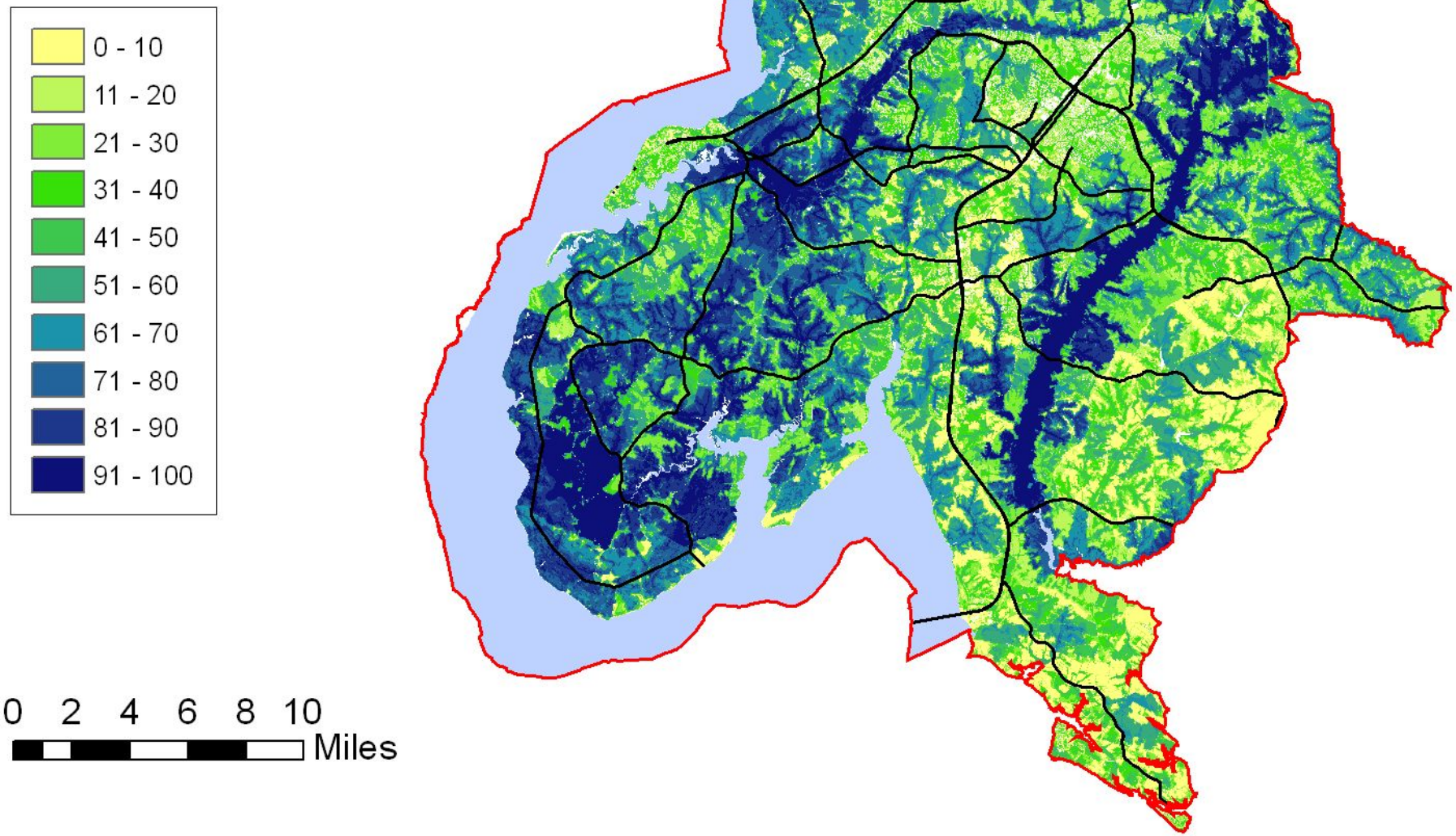
Hubs and corridors in US 301 study area



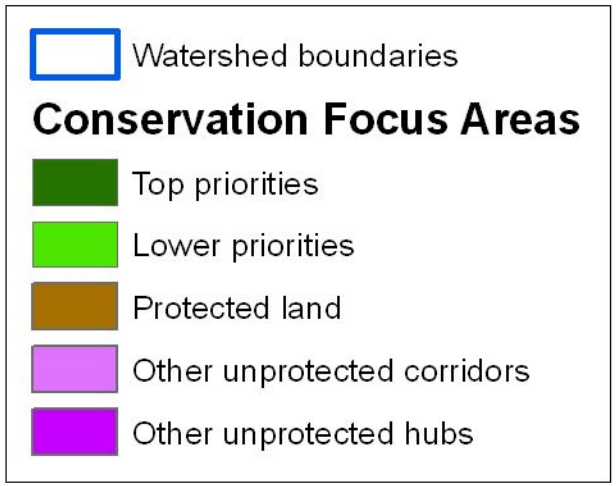
US 301 PROJECT OVERALL ECOLOGICAL SCORE

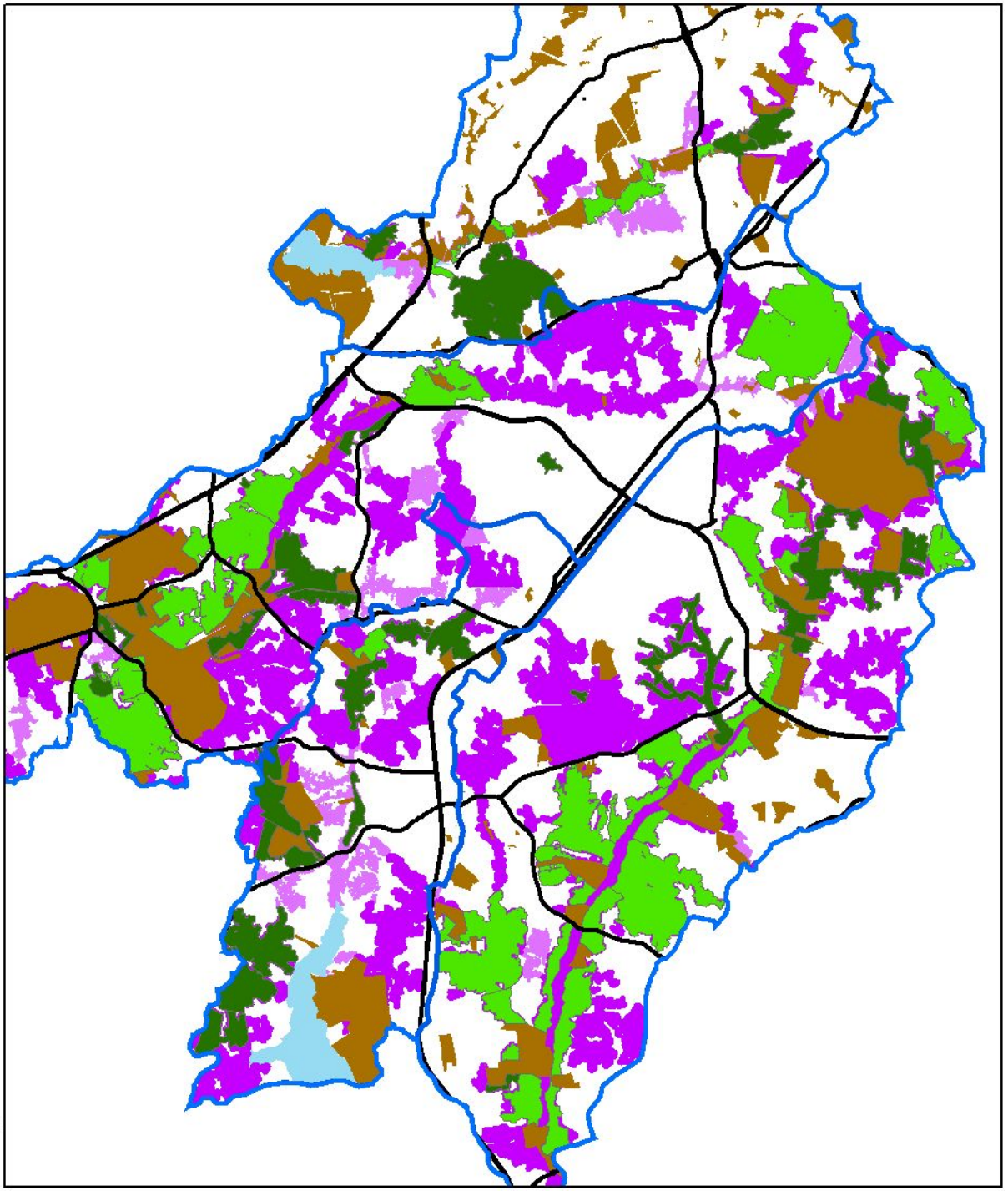
Scale	Variable	Scale weight	Variable weight within scale	Total weight
Core area/Site	Hub area	20.0	0.100	2.0
	ESA area		0.100	2.0
	Area of mature interior forest		0.100	2.0
	Area of unimpacted wetlands		0.100	2.0
	Length of core streams		0.100	2.0
	Maximum depth of core or site		0.100	2.0
	Distance to major roads		0.100	2.0
	Distance to development		0.100	2.0
	Proximity index		0.100	2.0
	Connectivity index		0.100	2.0
Hub	ESA area	20.0	0.182	3.6
	Area of mature interior forest		0.182	3.6
	Area of unimpacted wetlands		0.091	1.8
	Length of core streams		0.091	1.8
	Maximum depth of hub		0.091	1.8
	Distance to major roads		0.091	1.8
	Distance to development		0.091	1.8
	Proximity index		0.091	1.8
	Connectivity index		0.091	1.8
Corridor	Average rank of linked hubs	10.0	0.333	3.3
	Number of hubs linked		0.333	3.3
	Major road crossings without bridges		0.333	3.3
8-digit watershed	Anadromous fish spawning habitat use	10.0	0.500	5.0
	Percent core streams in watershed		0.500	5.0
12-digit watershed	Stronghold watershed (Tier 1/Tier 2/neither)	10.0	0.500	5.0
	Mean combined IBI score		0.500	5.0
Grid cell (36 m^2)	ESA presence and rank	40.0	0.071	2.9
	Ecological Community Group rank		0.071	2.9
	Forest maturity		0.286	11.4
	Wetland condition and proximity		0.143	5.7
	Proximity to core streams		0.143	5.7
	Proximity to water		0.143	5.7
	Distance to edge of forest, wetland, or water		0.143	5.7
	Distance to development		0.000	0.0
TOTAL		**100.0**		**100.0**

Overall ecological scores in US 301 study area



US 301 NRWG Conservation Priority Areas





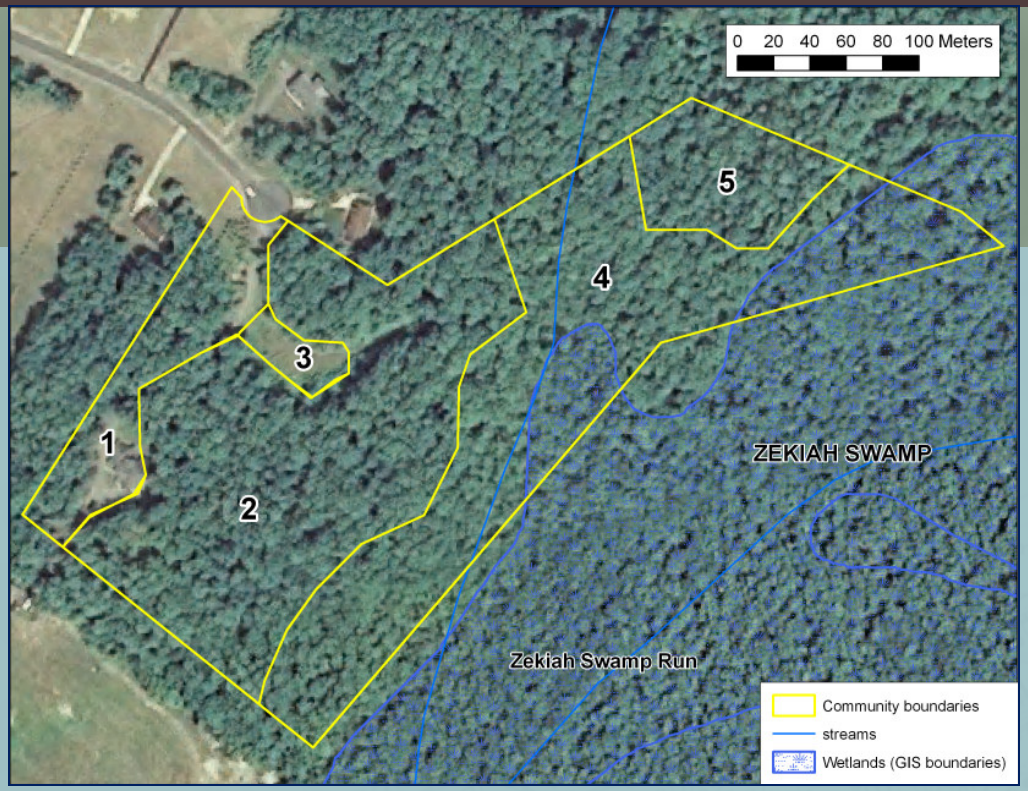
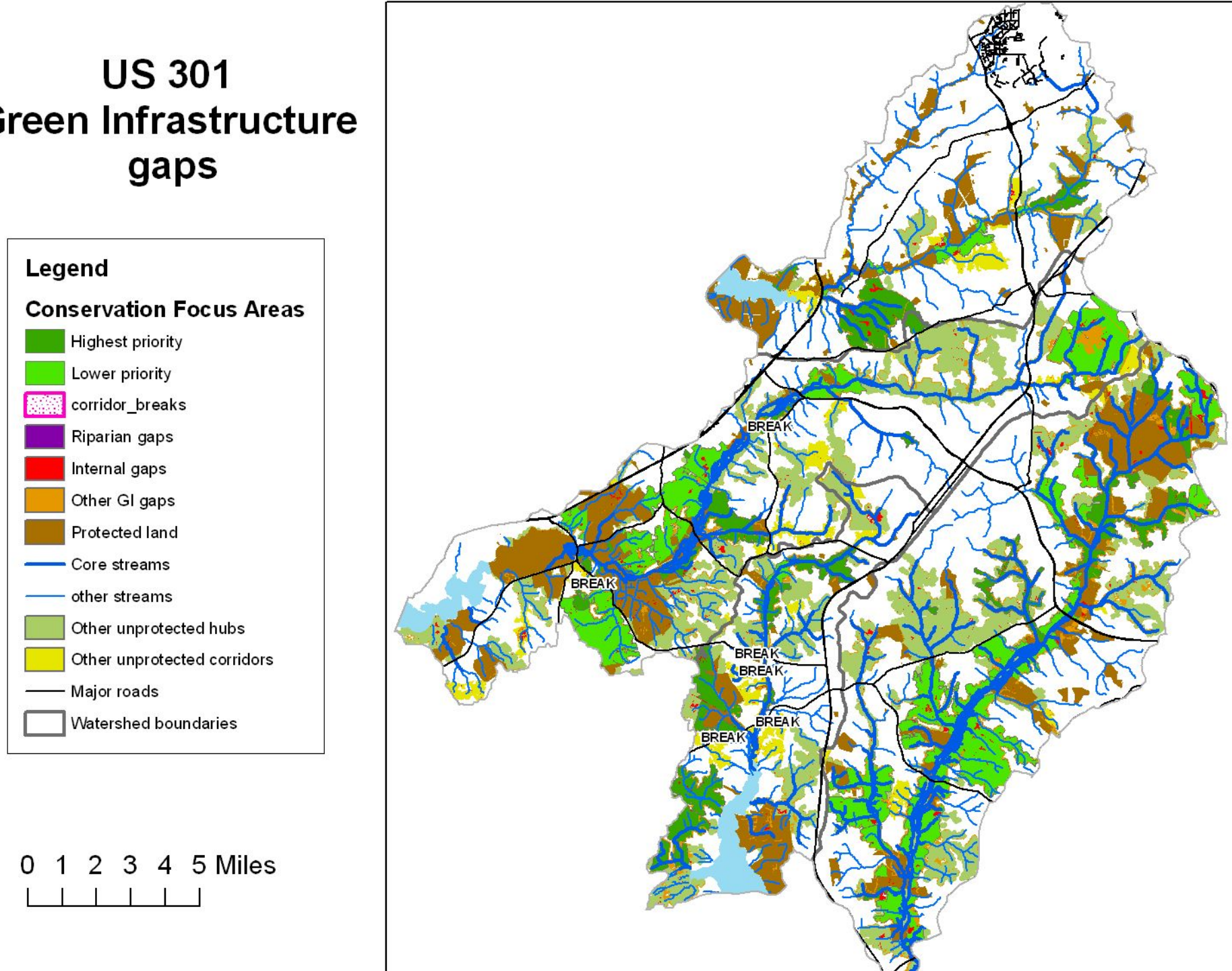


Table 7
Developed land and natural communities, with descriptions and field scores, in a sample focus area parcel. The polygon ID corresponds to the numbers in Fig. 6. The total score is the area-weighted average of upland forest scores, with the old field scored as early successional forest, plus the wetland score (the site contained only one wetland). This parcel had no natural streams and we did not find rare species; thus, those scores were 0.

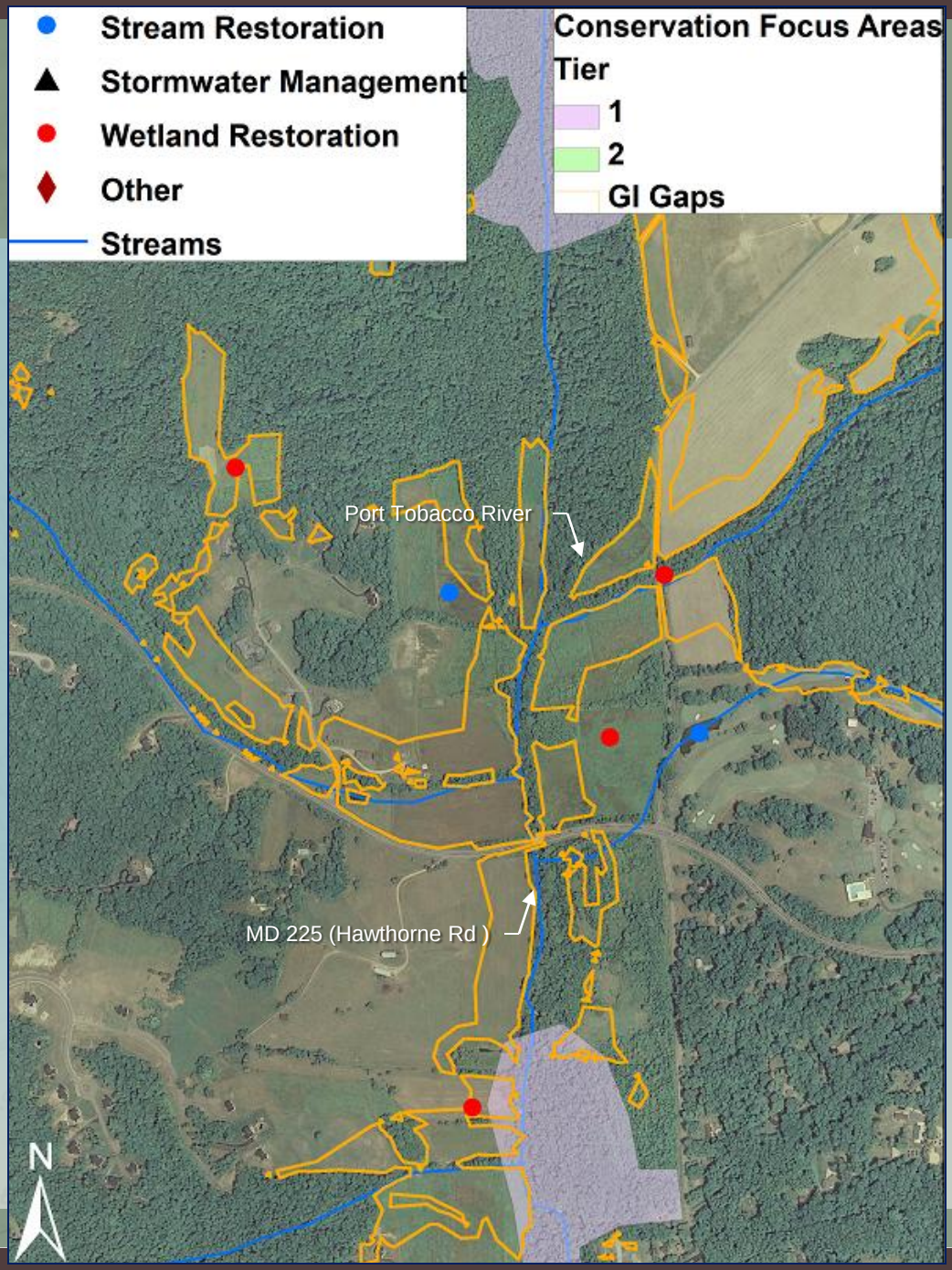
Polygon ID	Community type	Community area (ha)	Description	Community score as fraction of reference score
1	Developed	Not part of assessment	House, yard, and driveway	Not part of assessment
2	Upland forest	3.12	Mid-successional mixed mesic forest, ~70 yrs old, selectively cut ~40 yrs ago	0.688
3	Upland old field	0.14	Old field undergoing succession to forest	0.379
4	Wetland	3.04	Floodplain wetland (PFO1A/C) with old ditches throughout, probably selectively cut ~40 yrs ago	0.825
5	Upland forest	0.63	Mid-successional mixed mesic forest, ~70 yrs old, selectively cut ~40 yrs ago	0.839
Total		6.93		1.526

US 301 Green Infrastructure gaps



INTEGRATED SITE SELECTION

- Multiple stream and wetland opportunities
  - Severely degraded stream
- Proximity to Tier 1 conservation areas
- Fills in GI Gaps
- Protects floodplain



REFORESTATION DATA SHEET

Site: _____ Assessor(s): _____

Location ID: _____ Date: _____

RESTORATION BENEFITS AND FEASIBILITY

Parameter	Category and score			
1a. Landscape benefits - Green Infrastructure	Green Infrastructure core, hub, or corridor rank in top 10%	Green Infrastructure core, hub, or corridor rank in 10-25%	Other Green Infrastructure	Not in Green Infrastructure
SCORE _____	4	3	2	0
1b. Landscape benefits - gap position	Corridor break or other critical interruption of connectivity	Green Infrastructure interior gap (but not a corridor break)	Green Infrastructure exterior gap (but not a corridor break)	Not in Green Infrastructure
SCORE _____	4	3	1	0
2a. Local benefits - adjacency	Rare species or natural community (e.g., seepage bog) would benefit from the reforestation	No explicit rare species benefit, but reforestation would benefit downstream hydrology and water quality	Other high-quality natural community adjacent	Other
SCORE _____	4	3	2	0
2b. Local benefits - soil erosion	Highly erodible soil adjacent to stream, river, or bay; or along eroding stream banks	Highly erodible soil on steep slope (>25%); not adjacent to stream, river, or bay	Other highly erodible soil	Not highly erodible soil
SCORE _____	4	2	1	0
3a. Restoration difficulty: Soil/water conditions	Site suitable for planting with minimal preparation (assumes initial watering and mulching)	Soil needs fertilizing or conditioning, but otherwise site is ok	Site is dry (e.g., well-drained soils or chronically low water table) or exposed, or soil has high erosion potential.	Little to no organic material in soil, or insufficient topsoil.
SCORE _____	3	2	1	0
3b. Restoration difficulty: Earth moving	No earth moving required	Minor contouring required	Significant contouring required, but all soil on-site	Significant earth moving required, and topsoil needed from elsewhere
SCORE _____	3	2	1	0
4. Physical Accessibility	Site readily accessible by road or 4WD, terrain easily traversible, and water available, or site is close enough to vehicle access to carry or otherwise transport water, seedlings, and equipment.	Site far from 4WD access, but accessible by ATV.	Site is far from roads or trails, with difficult terrain and vegetation, but water is available.	Site is far from roads or trails, with difficult terrain and vegetation, and no water available.
SCORE _____	4	2	1	0
5a. Potential negative impacts from the reforestation - economic or habitat	Site has no current economic use and does not provide good grassland habitat	Site is NOT being actively used for agriculture and does not provide good grassland habitat, but has value for some species of wildlife	Site is being actively used for agriculture or provides good grassland habitat	Site is being actively managed as grassland habitat (if so, consider retaining as such)
SCORE _____	3	2	1	0
5b. Potential negative impacts from the reforestation - if earth moving, sludge application, or chemicals required	Site does not drain into streams, rivers, bays, or wetlands (artificial ponds and stormwater basins excluded)	Site drains into streams, rivers, bays, or wetlands (note: should use BMPs to prevent sedimentation and pollution)		
SCORE _____	2	0		
6. Protection against herbivory	Shelters	No shelters		
SCORE _____	2	0		
Restoration Potential Description				
Restoration Total Score _____				

RESTORATION ESTIMATED COST

Parameter	Category and cost			
Project difficulty	Without shelters	With shelters	Sludge or compost application	Contouring
Sample cost/acre	$525	$1,275	add $1000	add $5000

DIFFERENCES IN SELECTION MODELS

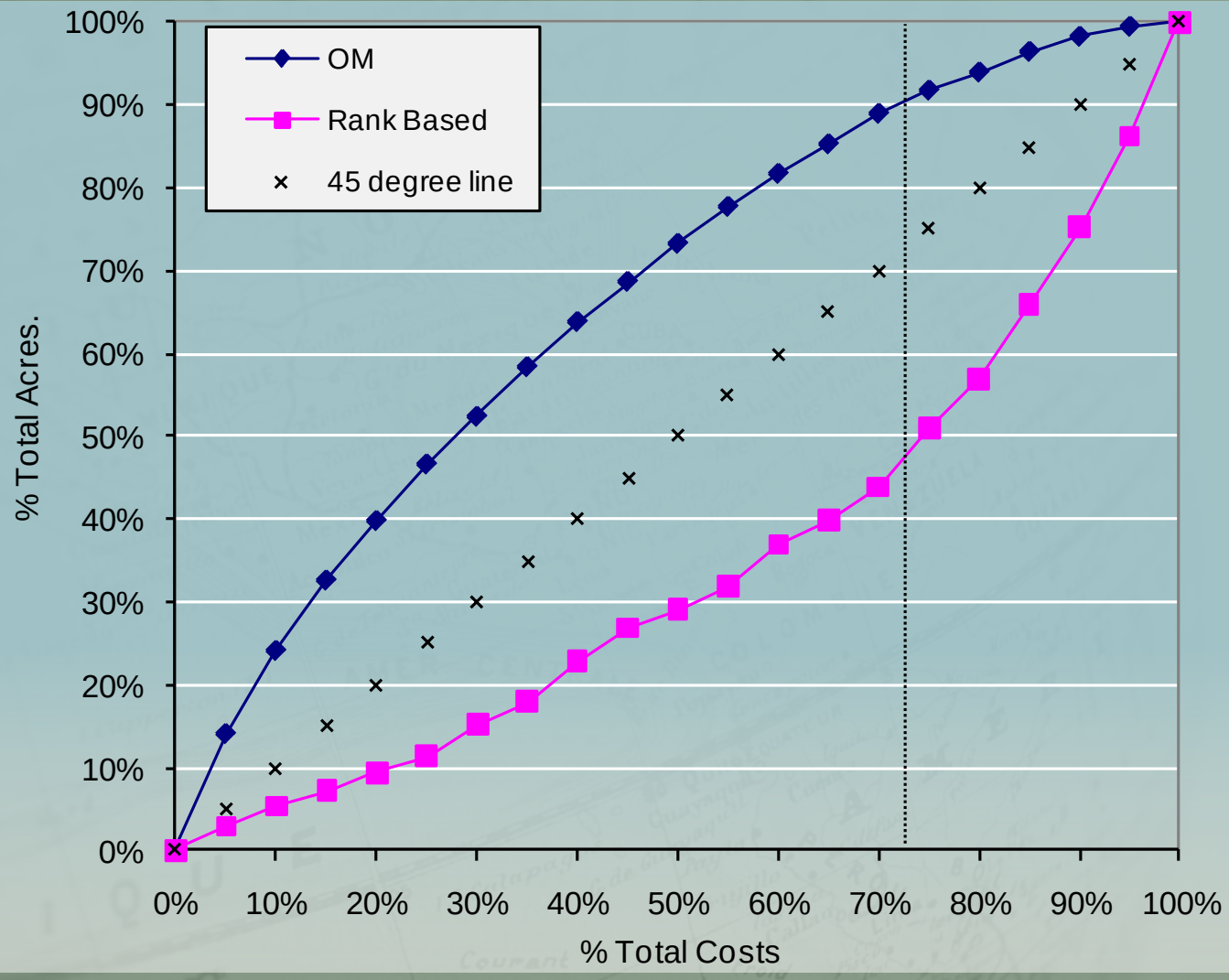
Rank-Based Models

- 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, staff resources, etc.)
- Model selects “Best Buys” by using optimization method (i.e. binary linear programming) or cost-effective analysis method

DIFFERENCES IN SELECTION MODELS



SAMPLE OPTIMIZATION RESULTS:

BUDGET: US$5 MILLION, MAXIMUM 15 PROJECTS
CONSERVATION VALUE = GI ACRES + ECOLOGICAL SCORE + (PROXIMITY SCORE/2)

Total	Optimization	Rank-based	Difference	%
Number of projects	15	11	4	26.67%
Cost	$3,655,096	$4,999,800	-$1,344,704	-36.79%
Conservation value	21.8057	16.3936	5.4122	24.82%
Green Infrastructure area (ac)	3301.00	3870.00	-569.00	-17.24%
Ecological score	1285.00	938.00	347.00	27.00%
Proximity score	13.75	9.50	4.25	30.91%

WVDNR CONSERVATION PRIORITIZATION PROJECT

- Goal
  - Develop conservation priorities for critical habitats and species in greatest need of conservation
  - Provide planners with tools necessary to make informed land use decisions
- Outputs
  - Prioritized conservation network consisting of core forest, wetland, grassland, and aquatic areas
  - Connectivity
- Completion Date - June 2013
- Contact

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SUMMARY

- Identify important natural resources at the beginning of highway project development
- Consider watershed and landscape context when developing mitigation projects
- Use best available science and document your methods
- Maintain connectivity
- Focus restoration in high priority conservation areas
- Use benefit-cost optimization

QUESTIONS?