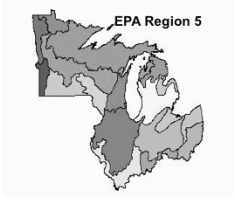


Assessing Ecosystem Condition in Region 5

by
Mary L. White & Charles G. Maurice

1

Goal 4

HEALTHY COMMUNITIES AND ECOSYSTEMS

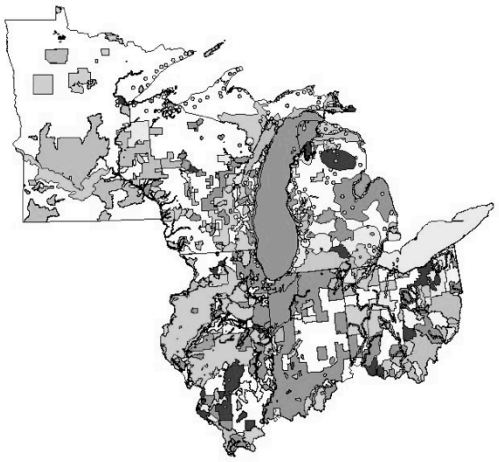
Protect, sustain or restore the health of people, communities, and ecosystems using integrated and comprehensive approaches and partnerships.

Objective 4.3 Restore and protect critical ecosystems

But how do we
Prioritize issues?
Measure success?

2

Partner Identified Ecosystems



3

Critical Ecosystem Assessment Model

CrEAM

Three Criteria –

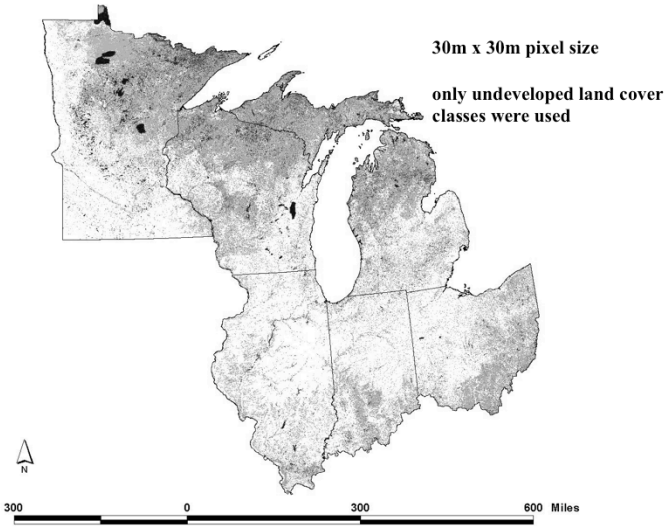
- **Diversity**
- **Sustainability**
- **Rarity**

Indicator data sets to populate these criteria

- **Diversity – four data sets**
- **Sustainability – twelve data sets**
- **Rarity – four data sets**

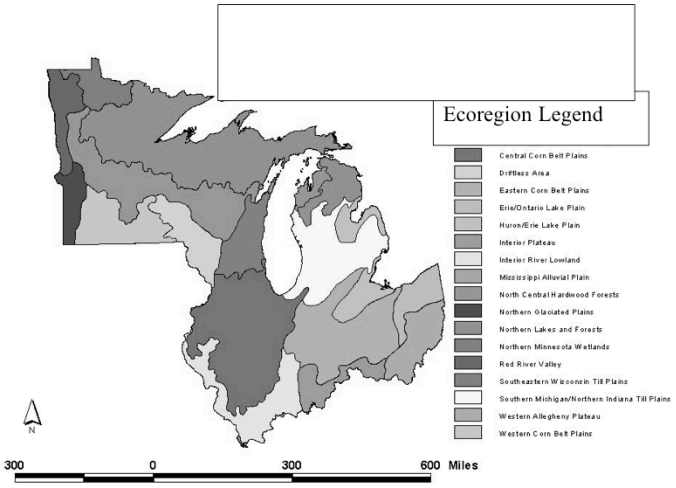
4

Base Map – National Land Cover Data Base 1992

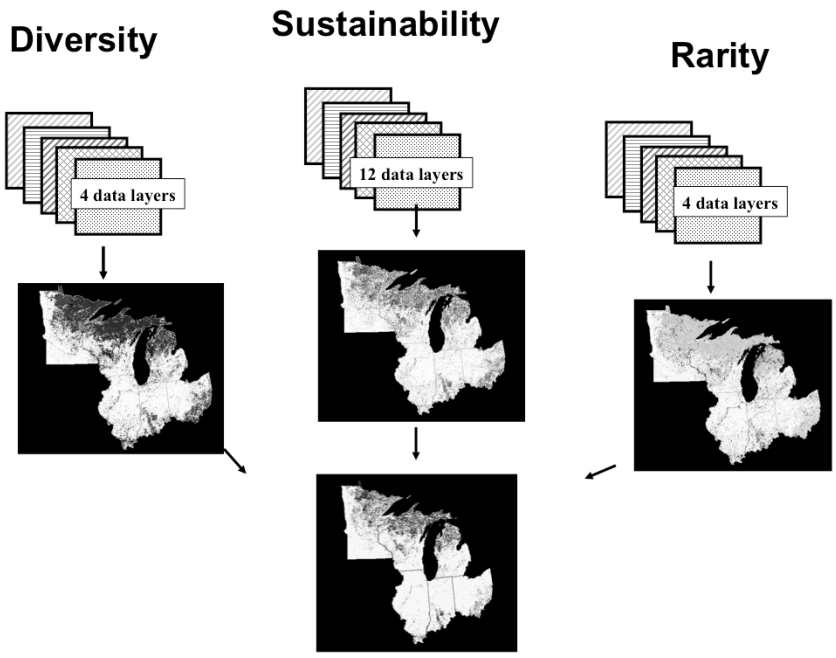


5

Omernik Ecoregions for Region 5



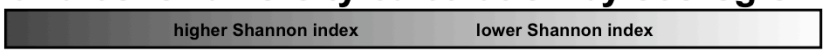
6


Diversity
Sustainability
Rarity
4 data layers
12 data layers
4 data layers
final composite ecosystem score

7

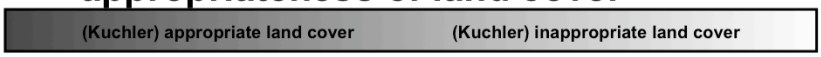
"Diversity" Layers

land cover diversity calculation by ecoregion

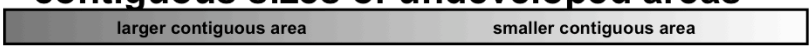


temp. and precipitation maxima by ecoregion

appropriateness of land cover

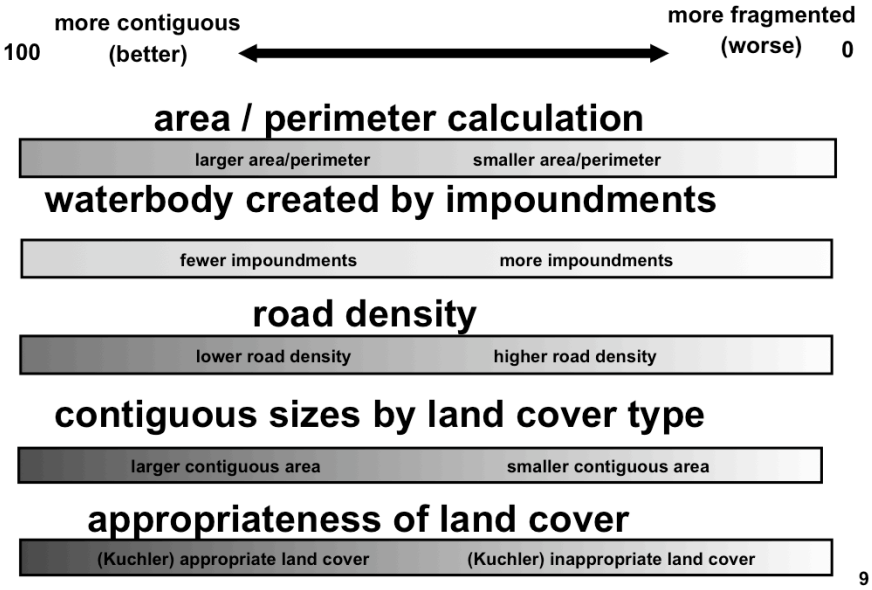


contiguous sizes of undeveloped areas

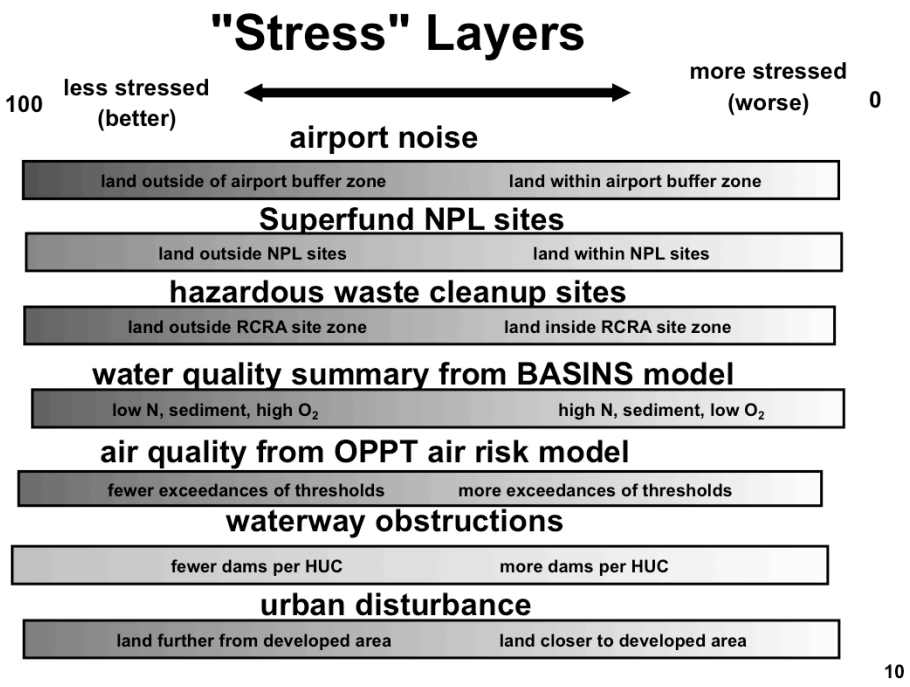


8

"Fragmentation" Layers



9


"Stress" Layers
100
less stressed
(better)
more stressed
(worse)
0
airport noise
land outside of airport buffer zone
land within airport buffer zone
Superfund NPL sites
land outside NPL sites
land within NPL sites
hazardous waste cleanup sites
land outside RCRA site zone
land inside RCRA site zone
water quality summary from BASINS model
low N, sediment, high O_2
high N, sediment, low O_2
air quality from OPPT air risk model
fewer exceedances of thresholds
more exceedances of thresholds
waterway obstructions
fewer dams per HUC
more dams per HUC
urban disturbance
land further from developed area
land closer to developed area
10

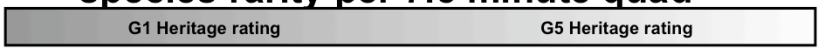
"Rarity" Layers

more rare species and features — fewer rare species and features

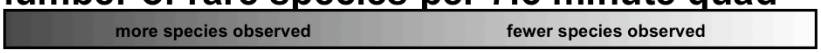
100 (better) ⟷ (worse) 0

land cover rarity by ecoregion

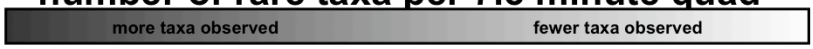
species rarity per 7.5 minute quad



number of rare species per 7.5 minute quad



number of rare taxa per 7.5 minute quad



* Raw rare species data used to generate these 3 layers were provided by the Natural Heritage Programs of Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin in cooperation with The Nature Conservancy. These data are confidential business information and cannot be provided or reproduced without written consent of the corresponding Natural Heritage Program.

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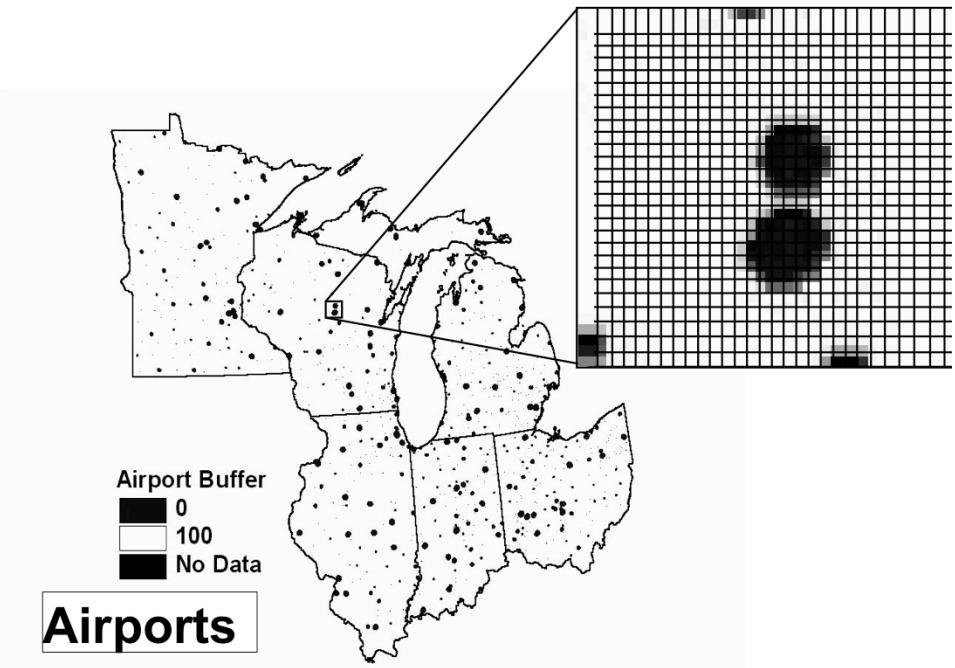
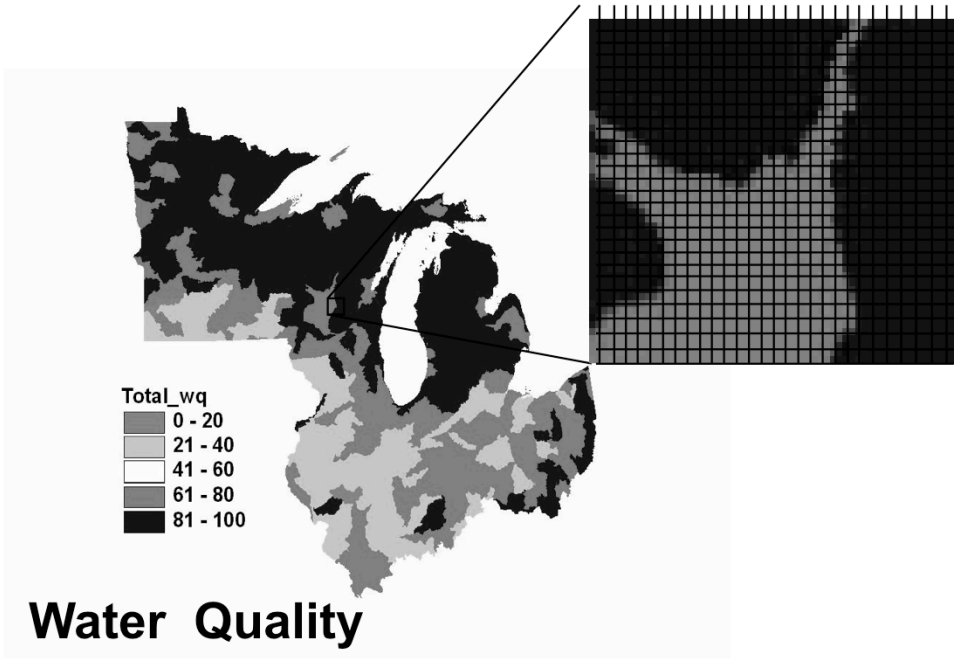
CrEAM / Essential Ecological Attributes Crosswalk

	Diversity	Sustainability	Rarity
Biotic Condition	1	2	3
Landscape Condition	2	5	1
Chem. & Phys. Characteristics		7	
Hydrology & Geomorphology		4	
Natural Disturbance Regimes	1		
Ecological Processes			

12



13



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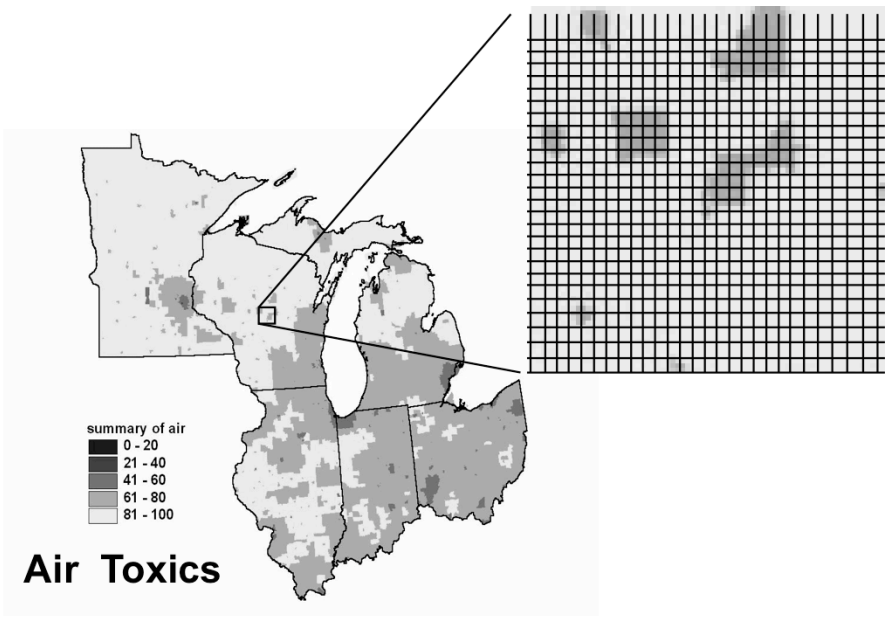
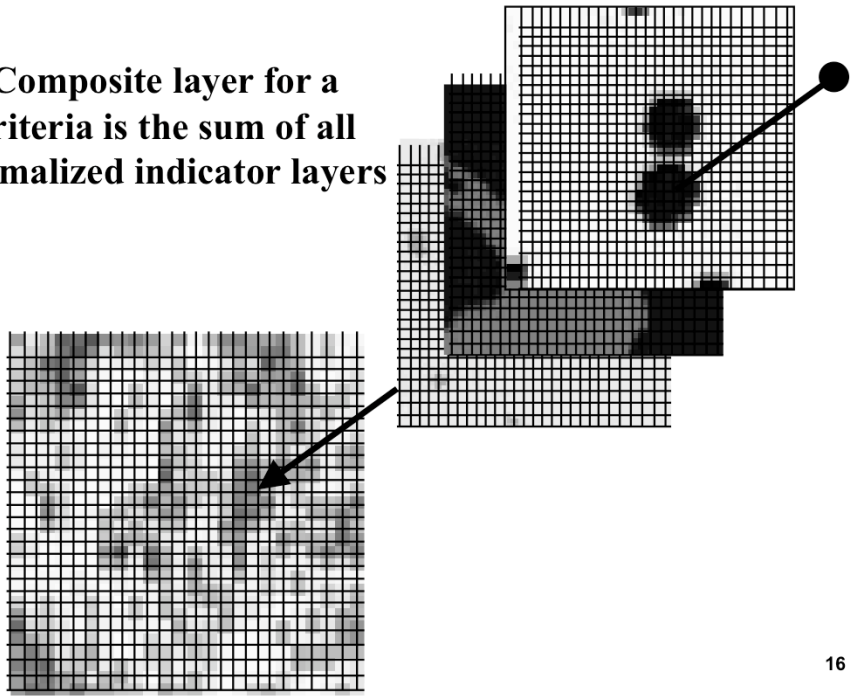


15

Composite layer for a criteria is the sum of all normalized indicator layers



16

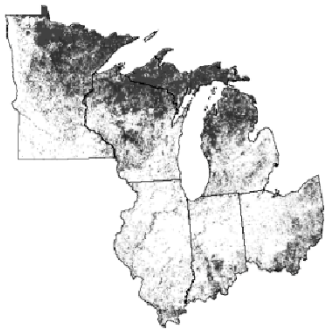
Diversity composite scores 0 - 397

Sustainability composite scores 464 - 1157

Rarity composite scores 0 - 331

Results

Criteria scores were normalized between 0 – 100 and added for a final ecosystem score.
range = 23-253
mean = 139



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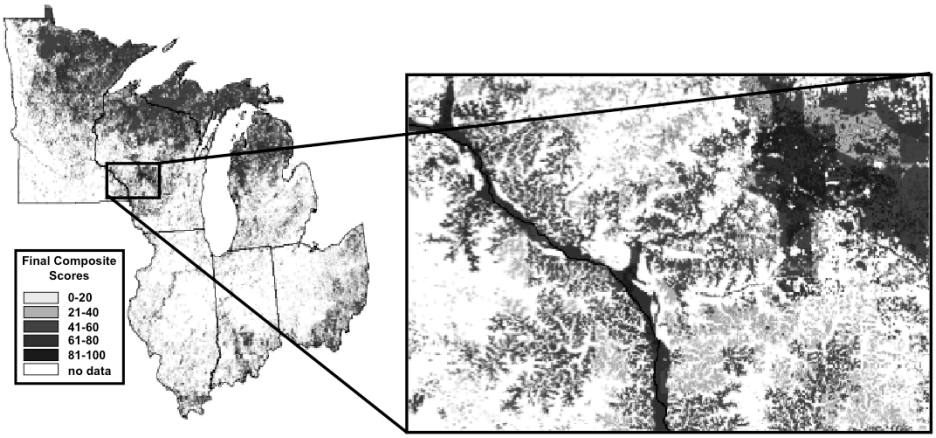
Final Composite of Ecological Condition



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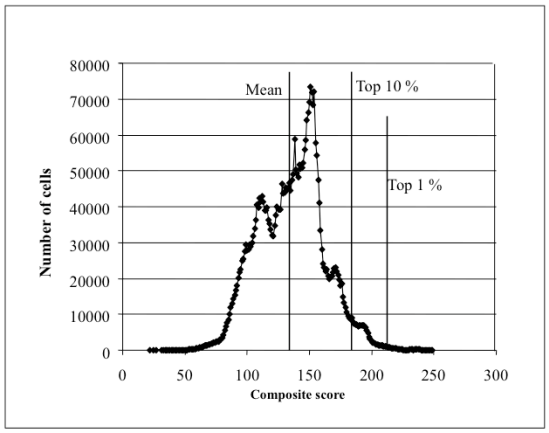
Results

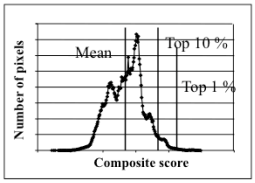
Distribution of composite ecosystem scores

low = 23
high = 253
mean = 139

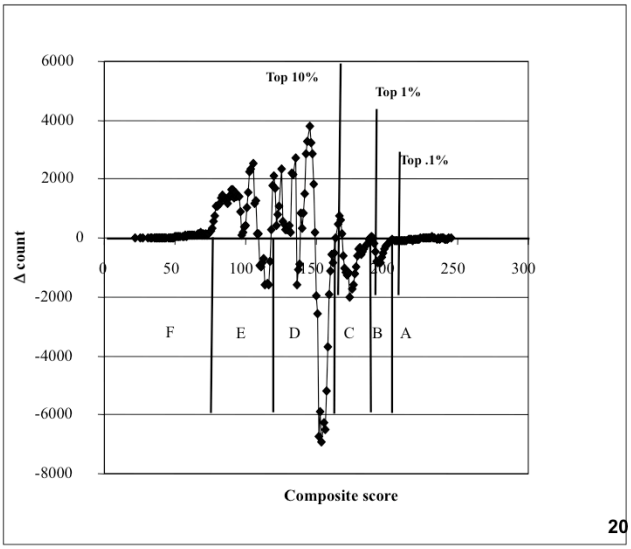


19

Results



first derivative



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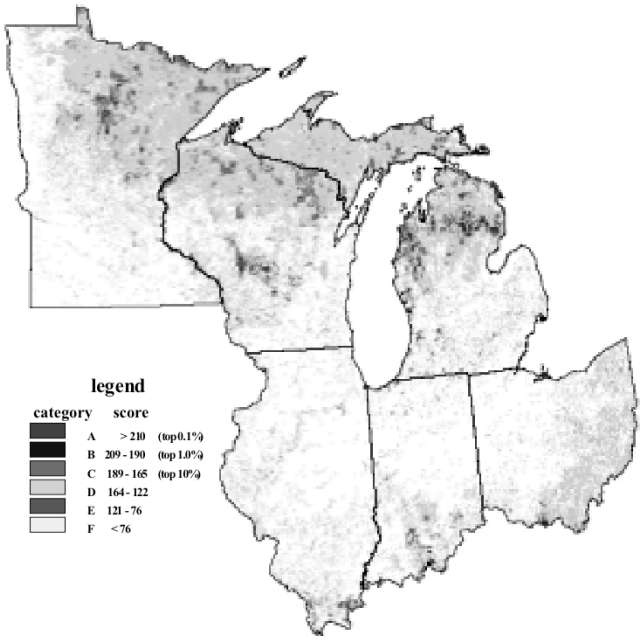
Ecological Significance Ratings



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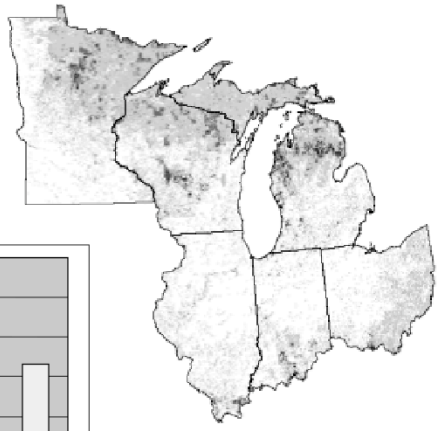
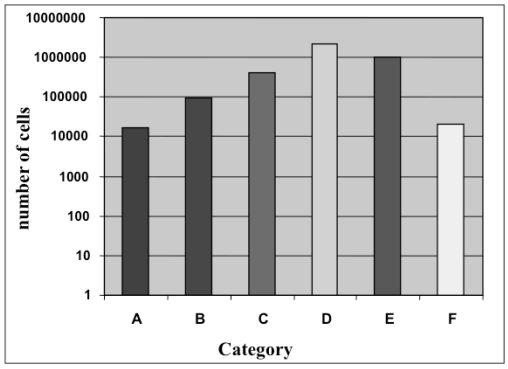
Ecological Significance Ratings





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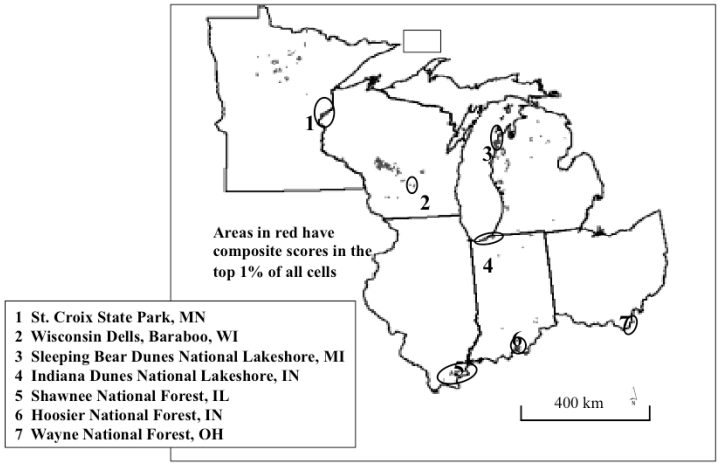
Critical Ecosystem Assessment Model

To validate and evaluate model:

1. **Best Professional Judgment**
2. **Statistical Analysis**
5. **SAB review**
6. **Field validation (RARE grant)**
7. **Peer review in journals**

Validation

1. Best Professional Judgment



1 St. Croix State Park, MN
2 Wisconsin Dells, Baraboo, WI
3 Sleeping Bear Dunes National Lakeshore, MI
4 Indiana Dunes National Lakeshore, IN
5 Shawnee National Forest, IL
6 Hoosier National Forest, IN
7 Wayne National Forest, OH

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2. Sensitivity Analysis

Within criterion correlation of data layers:

Diversity

0.41 between land cover diversity and contiguous area of undeveloped land

Sustainability

0.45 between weighted road density and development buffer

Rarity

0.52 between rare species abundance and rare taxa abundance

Thus we conclude that the individual data layers *within* a criterion do not duplicate each other.

Sensitivity Analysis

Correlations between individual criteria and their relationship with the total composite score. All correlations are significant at p < .0001; N = 3,634,183.

	Total Composite Score	C1 Composite Score	C2 Composite Score	C3 Composite Score
Total Composite Score	1.00	.59	.51	.34
C1 Composite Score	.59	1.00	.40	-0.02
C2 Composite Score	.51	.40	1.00	-0.08
C3 Composite Score	.34	-0.02	-0.08	1.00

Thus we conclude that the criteria do not duplicate each other

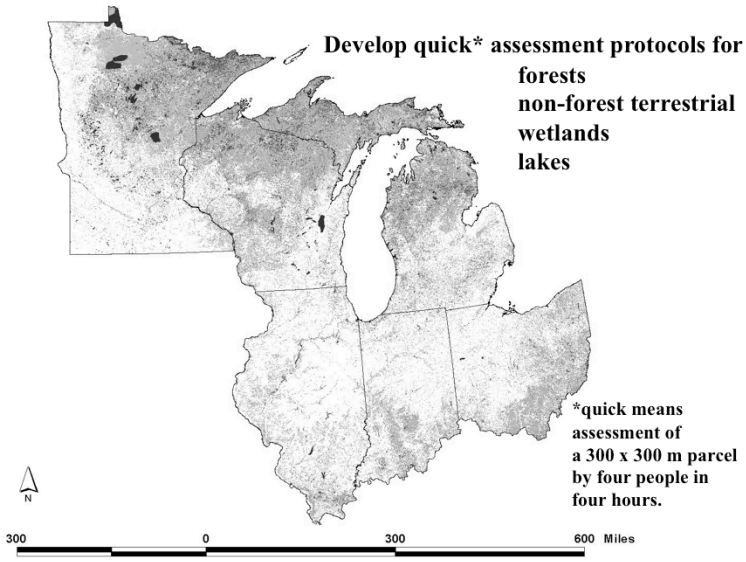
Evaluation of Model
3. SAB Review June 2004

http://www.epa.gov/sab/panels/epec_crmpesls.html

5. Peer Review journal article

The Critical Ecosystem Assessment Model (CrEAM)
Identifying healthy ecosystems for environmental protection planning
Mary L. White, Charles G. Maurice, Amy Mysz, Thomas Brody
In
Campbell, J.C., K. B. Jones, J. H. Smith and M. T. Koppe
North American Land Cover Summit
Association of American Geographers, 2008

Validation of Model
4. RARE Grant 2003-2005



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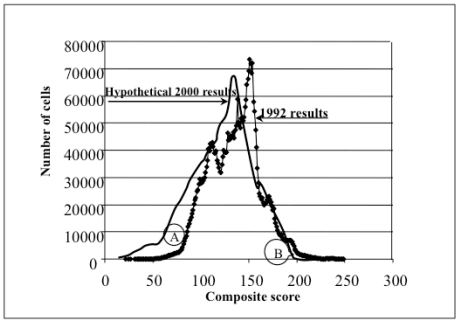
Proposed Uses of the CrEAM

1. Quantify and Track Ecosystem Quality



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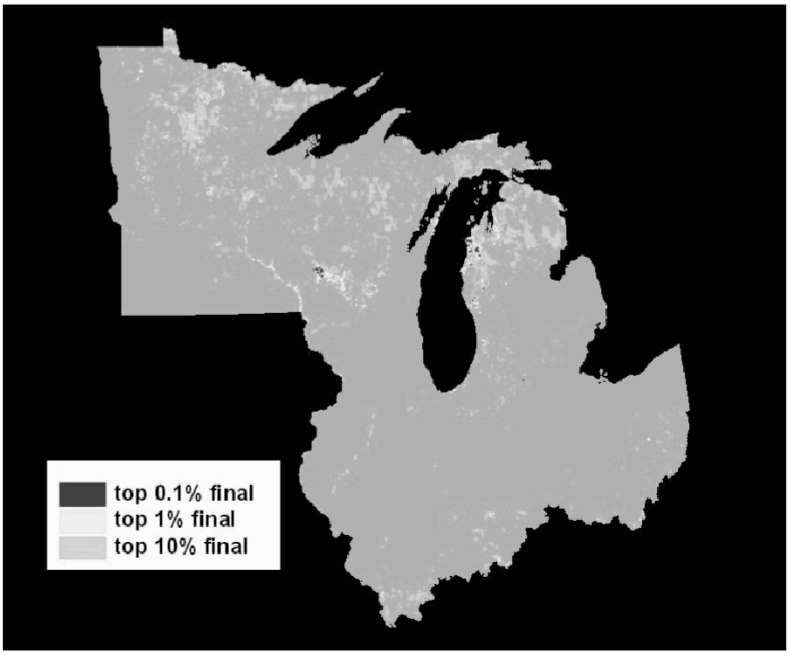

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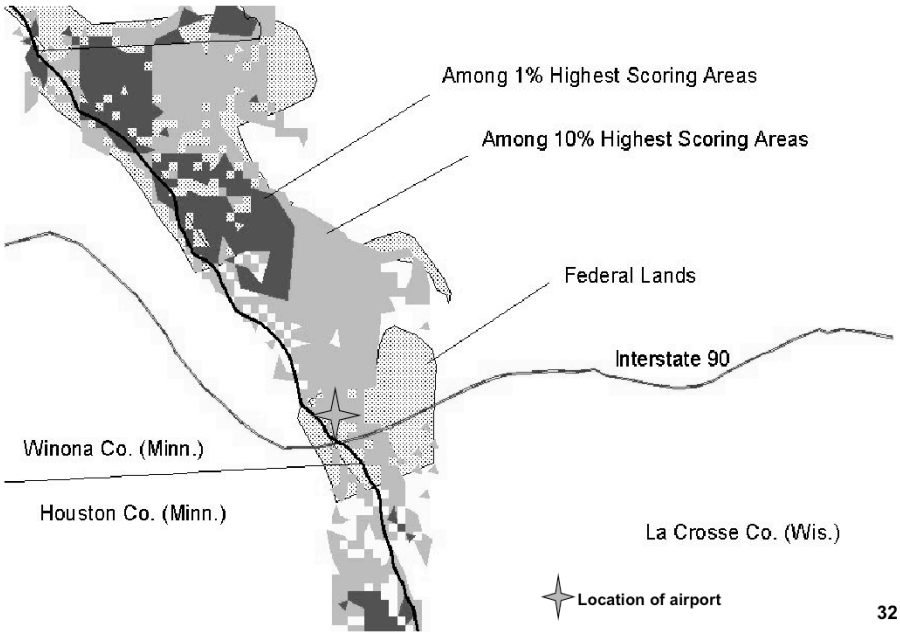
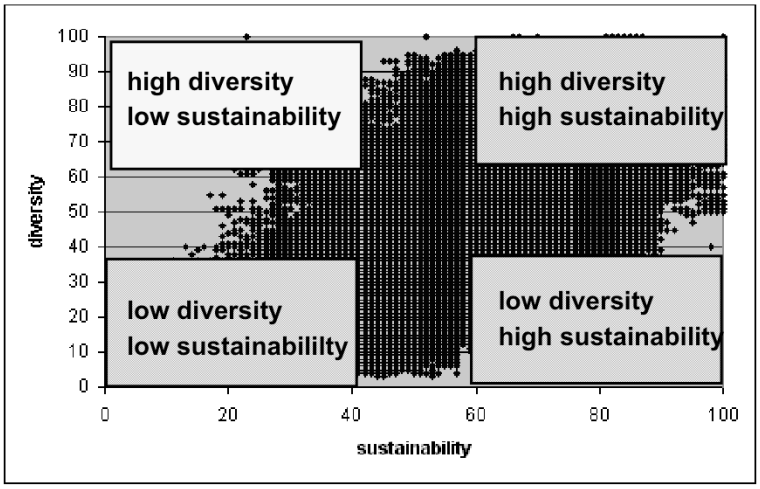
3. NEPA Reviews



4. Targeting



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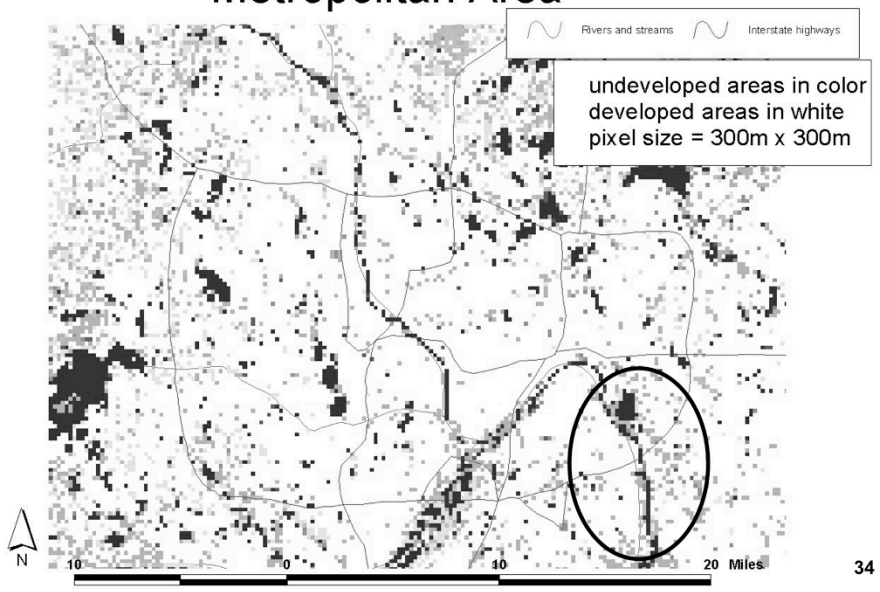
St. Paul, Minneapolis Metropolitan Area



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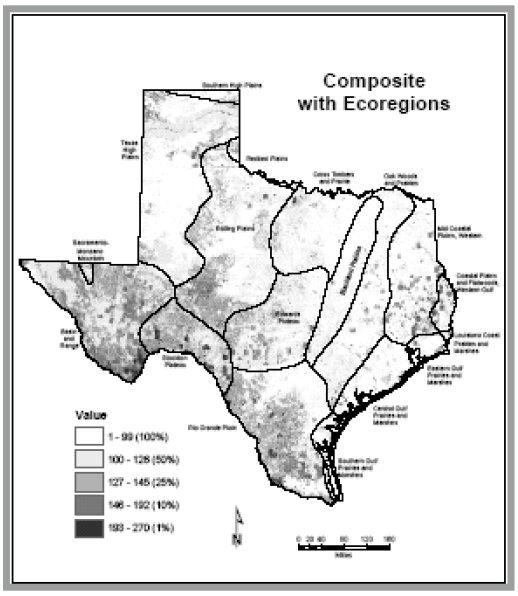
Texas Environmental Resource Stewards



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Primary Collaborators

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Thank You

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