Data sets and methodology used to create an Opportunity Lands map for the Greater Blue Earth River watershed in south central Minnesota and north central Iowa

To create our map for the greater Blue Earth River watershed, we puled together data from a wide variety of sources. These included:

- USGS GAP land cover data for MN and IA
- USDA and Minnesota Department of Agriculture (MDA) data for CRP, CREP and RIM locations
- Prairie information from Iowa created from satellite, aerial photos, and GPS data
- USFW's National Wetland Inventory data
- USFW satellite data from 2000
- Minnesota County Biological Survey (MCBS) data
- Federal Emergency Management Agency (FEMA) floodway data
- Stream, slope, and ditch data from Minnesota Department of Natural Resources (MDNR), Minnesota Board of Water and Soil Resources (BWSR), MDA
- And USDA's SSURGO soils data for wind and water erosive soils and sandy, gravelly soils.
- Major roads, highways, railway from the Minnesota Department of Transportation
- MDNR for watershed, township and county boundaries

Summary: What we sought to do

1. Create a land cover data layer.
2. Using slope, soil and stream data, create a corridor layer of potential 3rd crop and conservation land.
3. Run habit analysis models using the land cover layer for forest interior, ephemeral wetlands in forests, grasslands, and wetlands.
4. Combine the resulting habitat patches into a patch composite layer. These are the ecological patches.
5. Run the corridor analysis model using the land cover and 3rd crop corridor data to find the best ecological corridors between the ecological patches. This analysis was run four times, each iteration creating a complex of patches and corridors which are then linked during the next running.
6. Present the data as:
   - Ecological patches (the habitat patches)
   - Ecological corridors (the best links between the ecological patches)
   - Potential 3rd crop and conservation land—additional areas that could function to enhance the ecological corridors

Data Sources

1. For the land cover data

1. USGS Gap Analysis Project (GAP) data for both Minnesota and Iowa to create a seamless and uniform coverage over the project area.
2. The Iowa non-urban areas were refined with satellite data from 2002.
3. The Minnesota urban and natural areas were refined with data satellite data from the 1990's and 2000.
4. The wetland areas in non-urban areas were refined for both Minnesota and Iowa with National Wetland Inventory data.
5. Data was further cleaned up with new data from the USFWS.
6. Natural areas were refined with MCBS, CRP and Iowa prairie data.
7. Major roads were then overlayed.

2. For the potential corridor areas

1. Using the Digital Elevation Model (DEM) data for Iowa and Minnesota, we identified areas greater than 5%. The relative shallow 5% was used because the majority of the project area is so flat.
2. We buffered the major rivers 50 meters out from the center of the river, creating a 100 meter wide corridor.
3. We buffered the natural streams out to 30 meters from the center of the stream, creating a 60-meter wide corridor.
4. Using the USDA's most current SSURGO data we selected soils that were highly water erodible (>12%) and removed areas that were classified as prime ag land.
5. Again, using the SSURGO data we selected the highly wind erodible soils (WEG# < 3). And again, we removed areas that were classified as prime ag land.
6. Finally, we selected from the SSURGO data all highly drained gravelly and sandy soils (KSAT value > 20). And, again, we removed areas that were classified as prime ag land.

3. For the habitat models

These models were developed to map significant habitat. Native animals sensitive to habitat fragmentation and representing a diversity of habitats indigenous to the 7-county Metropolitan area (and applicable to the Blue Earth landscape) were selected using literature reviews and expert opinion. The habitat requirements of these animals informed landscape variables such as patch size, distance between patches and forest edge width. Every effort was made by the core modeling team to select the best variables based on the local landscape, the literature, and professional expertise. Minnesota County Biological Survey animal survey staff acted as primary consultants for this process. Habitats identified by the models harbor many other plants and animals in addition to the species used to identify model parameters.

For the Forest Models

Due to the limitations of satellite interpretation and land use data layers, the forest models were run using land cover that included natural forest stands as well as semi-natural working forests including tree farms, nurseries, and plantations.

Forest Interior

The habitat requirements of 5 bird species, the red-eyed vireo, wood thrush, scarlet tanager, ovenbird and eastern wood pewee, were used to map interior forest. Interior forest (core) patches were identified and scored based on:

- Forest patch size (minimum patch size was 24 hectares)
- Edge effect (edges, by definition not forest interior, were 120 meters wide)
- Percent of total patch that was core
- Distance to a source patch (i.e., forest patch 100 hectares or greater in size with more than 40% core)
- Additional forest areas at least 150 meters wide and connected to a forest core patch were included for their habitat, buffer, and connectivity benefits

Forests with Ephemeral Wetlands

The habitat requirements of Cope's gray tree frog, spring peeper, wood frog, and the tiger salamander. Forests with ephemeral wetlands were identified and scored based on:

- Forest patch size (minimum patch size was 3 hectares)
- Ephemeral wetland size (between 0.5 and 4 hectares)
- Connection (connected by forest to a wetland 10 ha or larger and not more than 200 meters away)

Riparian Forests

The habitat requirements of 3 birds, the cerulean warbler, Louisiana waterthrush, and the red-shouldered hawk, were used to map riparian forests. Riparian forests were identified and scored based on:

- Forest patch size (minimum patch size was 4 hectares)
- Edge effect (edges, by definition not forest interior, were 90 meters wide)
- Adjacent to rivers or streams and/or in a flood zone.

For the Grasslands Model

Due to satellite limitations some of the grasslands used in the model may be semi-natural vegetation, such as: hayfields, fallow fields or infrequently mowed grass. Grasslands in the GAP data used in the models is not well represented, and most likely has been under counted.

Tall Grasslands
This model identifies 'tall grasslands', which are relatively large areas of unmowed grasses, both native and non-native.

Grasslands were identified and scored based on:

- Size (minimum size for tall grasslands was 16 hectares with a minimum width of 90 meters)
- Maintained grasslands (i.e., infrequently mowed hayfields and pastures) at least 90 meters wide and connected to tall grasslands 16 hectares or greater in size were included for their habitat, buffering, and connectivity benefits

For the Wetlands Models

While many wetlands are regulated under state and/or federal laws, this model evaluates wetlands on 2 characteristics: (1) connectivity to uplands and other wetlands, (2) diversity of wetland and upland cover types associated with the wetland.

Wetland Complex
The model finds wetlands that are close enough to separated by thin strips of upland natural vegetation. Wetlands were identified and scored based on:

- Wetland size (minimum wetland size 1 hectares)
- Connection to other wetlands (3 or more wetlands connected by natural vegetation within 120 m of a wetland)
- Complex size (minimum 60 hectares)

Wetland Diversity
The model finds large wetlands with a diversity of cover types. Wetlands were identified and scored based on:

- Wetland size (minimum 1 hectares)
- Diversity of cover (individual wetlands must have at least 2 different natural cover types, one being at least 25% of the total area)

For the MCBS native plant communities (and Iowa native prairies)

All native plant communities mapped to date by the Minnesota County Biological Survey (MCBS) were incorporated. These native plant communities were ranked according to the Biodiversity Significance Rank of the MCBS sites within which they occurred. Biodiversity Significance Ranks have been applied to sites by the MCBS program. All sites with ranks of outstanding, high and moderate are considered by the MCBS program to be significant, but relative ranks help to prioritize sites for preservation. Brief definitions of these ranks follow:

<u>Outstanding biodiversity sites</u> contain the best occurrences of the rarest species and/or the most outstanding examples of the rarest native plant communities, and/or the largest, most intact ecological landscapes present in the state.

<u>High biodiversity sites</u> contain very good quality occurrences of rare species and/or high quality examples of rare native plant communities, and/or important ecological landscapes. These areas may be smaller in size, or have fewer occurrences of rare plants and/or plant communities than have the outstanding sites.

<u>Moderate biodiversity</u> sites contain important occurrences of rare species, and/or moderately disturbed native plant communities, and/or landscapes that have a strong potential for recovery

4. For the Ecological Patch Composite Model (Note - ecological scores were not emphasized in the Blue Earth results, but they exist)

Patch Scores

Natural areas identified through the individual forest, wetland, and grassland models are integrated with Minnesota County Biological Survey sites to identify the final ecological patches. The patches are then assigned a final score of 3, 2, or 1 (3 being the highest) based on how well the area meets standards for size, shape, connectivity, adjacent land use/cover, and species diversity.

Score 3 - These areas tend to be larger in size, and/or with few adjacent land cover types or land uses that could adversely affect the area; may have greater diversity of vegetation cover types; or the area may be an isolated native plant community mapped and given a score of outstanding biodiversity significance by the Minnesota County Biological Survey.

Score 2 - These areas tend to be moderate in size and/or with more adjacent land cover types or land uses that could adversely affect the area and may have less diversity of vegetation cover types; or the area may be an isolated native plant community mapped and given a score of high biodiversity significance by the Minnesota County Biological Survey.

Score 1 - These areas tend to be smaller in size while still meeting the minimum size requirements for regional significance (minimum size is variable based on cover type); may have less diversity of vegetation cover types; may have more adjacent cover types or land uses that could adversely affect the area; or the area may be an isolated native plant community mapped and given a score of moderate biodiversity significance by the Minnesota County Biological Survey.

Patch Composite Methodology

1. Integrate the results of the habitat models (forest interior, forests with wetlands, floodplain forests, grasslands, and wetlands) with the MCBS native plant community data. Use a maximum score rule where patches overlap, such that the highest score overlapping data is given to area.

2. Identify lakes associated with these integrated patches and incorporate the lakes into the patch. Select lakes where at least 60% of the lake is surrounded by a preliminary patch.

3. Fill the holes in the patch when the holes are natural vegetation (referencing the Hybrid Land Cover data). Merge the natural vegetation holes with the preliminary patches.

4. Score the patches using a majority rule. After identifying the percentages of scores within each patch, apply the following rules:

Score 3: 51% or greater of the entire patch area is score 3

Score 2: 51% or greater of the entire patch area is score 2

Score 1: 51% or greater of the entire patch area is score 1, and no score 3s are present

Score 2: 51% or greater of the entire patch area is score 1, and score 3’s are present.

5. Delete patches that are less than 10 hectares. (Due to the limited number of patches found, this was not implemented in Blue Earth)

5. For the Corridor model

The corridor data was combined with the land cover to create a resistance layer for the GIS corridor analysis. The values in the resistance layer pertain to the ease or difficulty of a species moving across the landscape; the lower the number, the easier it is move, the higher the number, the more difficult.

Resistance factors for the corridor model

- 1 = all natural cover types and the 3rd crop/conservation areas (erodible, steep, stream beds, and gravel soils)
- 2 = ag and hayfields
- 5 = 11 to 25 percent impervious
- 6 = greater than 25 percent impervious

The corridor model was run four times. The first run linked the closest ecological patches together. The second run identified the linked patches as ecological complexes, and looked for connections from those to patches not already linked, or to other complexes. This process was repeated 3 more times, creating ever expanding ecological complexes. The maximum distance of these corridors was set to 5 km.