An Application of the Dakota County Greenway Analysis Protocol to Rank Land Cover Polygons by Ecological Significance within the Minnesota and St. Croix River Valleys in the 7 County Twin Cities Metropolitan Area

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ABSTRACT

Priority areas for targeting conservation, management and restoration projects in the Twin Cities' major river valleys were identified in an analysis of GIS land cover data. This analysis ranked individual land cover polygons for significant ecological features including rare species, intact native vegetation, high priority native plant communities, trout streams, lake and stream buffers, and large landscape patches composed of natural to semi-natural vegetation.

The analysis was based on the Dakota County Greenway Analysis Protocol, created in 2002 by the Dakota County Soil and Water Conservation District (DSWCD). This was created to analyze land cover polygons of the Minnesota Land Cover Classification System (MLCCS – from MNDNR metro region). As of May 2004, MLCCS had been completed for approximately 60 percent of the project area. As it would be several years before complete MLCCS coverage was completed, the gaps in the MLCCS coverage were filled in with a 2002 Landsat cover created by the MNDNR from interpretations by the University of Minnesota Remote Sensing Laboratory. The analysis protocol was correspondingly modified for application to the more general Landsat data. Each polygon in the composite dataset was scored for significant features as noted in Table 1 below. Cumulative totals of all scores for each polygon were tallied, grouped, and assigned an ecological rank ranging from Very High to Not Ranked. This analysis was then scripted in Avenue script for future re-use and modification.

Table 1: Summary of Criteria and Assigned Values

Vegetation	**Value (1-10)**
Minnesota County Biological Survey Sites: MLCCS/Landsat polygons intersecting with MCBS sites	10
Native/Semi-Native MLCCS/Landsat polygons not in above	6
Maintained/Greenspace/Parks/Pasture MLCCS/Landsat polygons not in above 2 groups	3
Urban Areas with <11% impervious cover MLCCS/Landsat polygons not in above 3 groups	1
High priority native plant communities with state rank of S1 or S2 (all prairie, savanna, oak forest, maple basswood forest, calcareous fen, wet meadow and rock outcrop plant communities)	5
Trout Streams, Other Stream & Lake Shore Vegetated 300 ft. Buffers	
MCBS/Native/Maintained polygons containing designated trout streams	7
MCBS/Native/Maintained polygons within stream buffers not in above group	5
MCBS/Native/Maintained polygons within lake shore buffers not in above 2 groups	5
Rare Species	
All polygons containing a recent occurrence (>1975) of a State Endangered or Threatened species – scored for each occurrence	10
All polygons containing a recent occurrence of a State Special Concern species – scored for each occurrence	7
Large Landscape Patches	
MCBS/Native/Maintained polygons plus palustrine wetlands within significant large patches as assessed by total acreage and shape of patches	10

PROTOCOL

GIS layers used in analysis:

1) Project area boundaries – source: modified from BRP boundaries
2) MLCCS – source: MNDNR May 2003 version
3) 2002 Hybrid Landsat land cover – source: MN DNR metro staff
4) DNR rare features point data – source: MN Natural Heritage Program (license agreement)
5) MCBS plant community polygons – source: MN DNR data deli
6) Hydro_luse2000 with nria table (lakes) – source: Met Council GIS
7) Stream_net with nria table (streams) – source: Met Council GIS
8) FSA 2003 color photography – source: MNDNR data deli

Preparation of land cover data set for analysis:

1) Created project area boundaries for the Minnesota and St. Croix River Valleys
2) Clipped 2003 MLCCS land cover (MNDNR) to the project area boundaries
3) Clipped 2002 Hybrid Landsat Cover (MNDNR) to project area boundaries and then to fill gaps between MLCCS polygons
4) Union clipped MLCCS and 2002 Hybrid Landsat covers to form a composite MLCCS-Landsat cover
5) Removed redundant fields in composite land cover, recalculated area, perimeter and length fields for each polygon.

Review and edit ecological data

1) Change known incorrectly coded mlccs polygons attributes: e.g. in instances in the Minnesota valley where old fields are incorrectly coded as mesic prairie
2) Edit rare species point data
   a) Clip data to project area boundaries
   b) Remove all species elements not listed as E, T, SPC, Colonial Waterbird, Bat Colony
   c) Remove all freshwater mussel records (dead shells of former residents)
   d) Remove all geology and plant community records
   e) Remove all records last observed <1975
   f) Remove all records confirmed destroyed
   g) Check all remaining points to make sure they are in the correct locations; make adjustments to locations that are obviously not in the location described in the EOR general descriptions
3) Update MCBS native plant community polygon data: removed polygons that are obviously destroyed by development (use 2003 FSA photography) since the polygon was created (e.g. former savannas in Shakopee that are now dense houses)
4) Create a shapefile of high priority native plant communities: state ranks S1-S3
   a) all dry, mesic, & wet prairie types
   b) all savanna types
   c) all oak and maple-basswood forest types
   d) all calcareous fens and wet meadows
   e) all floodplain and lowland hardwood forest types
   f) all black ash and shrub swamp seepage types
   g) all rock outcrops
5) Modify lake cover (hydro_luse2000): remove St Croix & Minnesota River polygons, which are redundant with the streams cover

Create buffers for selected rare animal species points. Buffer sizes are based on expert opinion and data on nesting requirements.

1) Red-shouldered Hawk: 3289 feet
2) Bald Eagle: 0.25 mile
3) Forster's tern: 1/8 mile
4) Hooded warbler: 1/8 mile
5) Cerulean warbler: 1/8 mile
6) Acadian flycatcher: 1/8 mile
7) Peregrine falcon: 0.25 mile
8) Loggerhead shrike: 555 feet
9) Colonial waterbird nest: 0.25 mile
10) Louisiana waterthrush: 1/8 mile
11) Hooded warbler: 1/8 mile
12) Blanding's turtle: 1/8 mile

Score polygons for ecological features

1) Add a field for each ecological criterion to the composite land cover shapefile attribute table (see table 1 for criteria); all fields are numerical fields 3 characters long
2) Add points to fields based on overlay with shape files (see Table 1 for point values assigned)

Criteria and Point Values for Ranking Land Cover Polygons:

FIELD NAME	**SELECTED MLCCS and LANDSAT POLYGONS**	**POINTS**
cr_cbs	select polygons for which: c_num = 30,000 – 90,000 [mlccs data], or for which value = 31,32,51,52,62,63,81 [landsat data] select by theme subset of polygons that intersect MCBS native plant community polygons	10
cr_semi_na	select from all polygons not coded as MCBS plant communities select subset of these polygons for which: c_num = 30,000 – 90,000 [mlccs data], or for which value = 31,32,51,52,62,63,81 [landsat data]	6
cr_maint	from all polygons not coded as cr_cbs or cr_semi_na: (c_num >= 21000) and (c_num <24000) or m_2xx = 275 or m_2xx = 240-245 or value = 21,23,25,61,65	3
cr_urban_l	from all polygons not coded as cr_cbs, cr_maint or cr_semi_na: c_alpha = “*i10.*” or value = 11	1
veg	select all polygons coded as cr_cbs, cr_semi_na and cr_maint and cr_urban_l: code as "v"—these are referred to as the “vegetated” polygons	

FIELD NAME	SELECTED MLCCS and LANDSAT POLYGONS	POINTS
cr_trout	select all polygons with veg = "v" select all streams in stream_net coded "Y" for trout select by theme all polygons intersecting 300' buffer of selected streams	7
cr_s1s2	select all MCBS native plant community polygons for communities with S1 or S2 state rank – convert to shapefile select by theme all polygons that intersect s1s2 polygons eliminate by hand all selected polygons that intersect s1s2 polygons but are not s1s2 plant communities	5
cr_streamb	select by theme all "v" polygons not already given points in cr_troutst that intersect 300' buffer of streams	5
cr_shorebu	select by theme all "v" polygons that intersect 300' buffer of lakes that do not already get points in cr_troutst or cr_streamb	5

Coding polygons for presence of rare species.
All polygons containing rare species points were coded as indicated in the table below. Buffers were created for selected species as indicated in the table. Polygons intersecting the buffers were assigned the point values given in the table.

MRV = Minnesota River Valley; StC = St Croix River Valley

FIELD	COMMENT	POINTS
Acadian_fly	Acadian Flycatcher. buffer: polygon overlap; MRV	7
aureolaria	Fernleaf False Foxglove. StC	10
b_eagle	Bald Eagle. buffer: polygon overlap MRV, StC	7
bat_conc	Bat Concentration. MRV, StC	7
bk_spike	Beaked Spikerush. MRV	10
bland_turtle	Blanding's Turtle. StC	10
botry_oneid	Oneida Grape Fern. StC	10
botry_rug	Rugulose Grape Fern. StC	10
cerulean	Cerulean Warbler. buffer: polygon overlap; MRV, StC	7
col_wat_bird	Colonial Waterbird Nesting Site; buffer polygon overlap MRV	7
crick_frg	Cricket Frog. MRV	10
cx_typhina	Carex typhina. StC	7
desmo_nud	Tick Trefoil. StC	7
f_chickweed	Forked Chickweed. StC	10
forst_tern	Forster's Tern. buffer: polygon overlap. MRV	7
g_snake	Gopher Snake. MRV, StC	7
ginseng	Ginseng. MRV, StC	7
gold_fern	Goldie's Fern. StC	7
henslow	Henslow's Sparrow. MRV, StC	10
hills_thist	Hill's Thistle. MRV, StC	7
hooded	Hooded Warbler. buffer: polygon overlap MRV, StC	7
horiz_j	Horizontal Juniper. MRV, StC	7
hr_bk_rush	Hairlike Beakrush. MRV	10
hydrocotyle	Water Pennywort. StC	7

james_pol	James' Polanisia. StC	10
kittentail	Kittentails. MRV, StC	10
lechea	Pinweed. StC	10
leo_skip	Leonard's Skipper. StC	7
loggerhead	Loggerhead Shrike. buffer: polygon overlap MRV	10
marpissa	A species of jumping spider. StC	7
metaphidippus	A species of jumping spider. StC	7
moorhen	Common Moorhen. MRV, StC	7
myotis	Northern Myotis. StC	7
opuntia_m	Great Plains Prickly Pear. StC	7
peregrine	Peregrine Falcon. buffer: polygon overlap; MRV, StC	10
pipistrelle	Eastern Pipistrelle. StC	7
plains_pocket_mse	Plains Pocket Mouse. MRV	7
poa_pal	Bog Bluegrass. StC	10
r_sandwort	Rock Sandwort. StC	7
racer	Blue Racer. StC	7
rattlesnake_m	Rattlesnake Master. MRV	7
red_shoulder	Red Shouldered Hawk. buffer: polygon; MRV, StC	7
rhom_prim	Rhombic-petaled Evening Primrose. MRV	7
rough_fame	Rough-seeded Fameflower. MRV	10
snaketail	Snaketail (dragonfly). StC	7
sn_trill	Snow Trillium. MRV	7
st_sedge	Sterile Sedge. MRV	10
tiger_b	Tiger Beetle. MRV	7
tub_indian	Tuberous Indian Plantain. MRV	10
twig_rsh	Twig Rush. MRV	7
valerian	Valerian. MRV	
waterbird	Colonial Waterbird nest site. buffer: polygon overlap MRV, StC	7
waterthrush	Louisiana Waterthrush. buffer: polygon; StC	7
w_hyssop	Water Hyssop. MRV	7

w_hognose	Western Hognose Snake. MRV	7
wh_nut_rsh	Whorled Nut Rush. MRV	10
white_ladys_sl	White Lady's Slipper. MRV	7
wolf_spike	Wolf's Spike Rush. MRV	10
ww_indigo	White Wild Indigo. MRV, StC	7

Coding polygons that occur within significant landscape-sized patches (patches greater than 500 acres and patches greater than 40 acres that have shape index < 1.5)

1) Select all "vegetated" polygons for which veg = v
2) convert to shapefile: fpatch_base
3) using geoprocessor, dissolve features of sum1.shp using count as attribute to dissolve: new shapefile = fpatch_snglpart.shp
4) use arcview utility tools to ungroup multipart shapes in fpatch_snglpart.shp: new shapefile = fpatch_multprt.shp;
5) calculate acres for polygons in fpatch_multprt.shp
6) select all patches > 40 acres; convert to shapefile = fpatch_40acres1.shp
7) create internal buffer of 328 feet in fpatch_40acres1.shp; new shapefile = fpatch_328buff.shp
8) union fpatch_40acres1.shp with fpatch_328buff.shp; new shapefile = 40ac_buff_union1.shp
9) sel all buff = 328 in attribute table; then inverse to select interior polygons; convert to shapefile = fpatch_erase.shp
10) convert multipart to single part shapes; new shapefile = fpatch_erase_snglpart.shp; calculate polygon acres
11) buffer fpatch_erase_snglpart by 328 feet; new shapefile = fpatch_328buff_add.shp
12) ungroup multipart shapes; new shapefile = fpatch_328buff_add_snglpart.shp; calculate polygon acres
13) set patches >40 acres within fpatch_328buff_add_snglpart.shp; convert to shapefile = fpatch_40acres2.shp (this shapefile consists of all 40 acre patches that have a width greater than 200 meters)
14) calculate shape index (SI) using Patch Analyst
15) select all patches with SI < 1.5 and patches > 500acres; new shapefile = fpatch3.shp
16) Assign scores to cr_patch field in attribute table of composite MLCCS/Landsat cover: 10 points for all polygons within fpatches in fpatch3.shp

Assign values to groups of scores

1) tally the total score for each polygon
2) assign values as follows:

Value	**Score**
Very High	35+
High	20-34
Medium	10-19
Low	5-9
Very Low	1-4
Not Ranked	0