Genesee, Lapeer and Shiawassee Counties Potential Conservation Areas

GLS Greenlinks Region

Prepared by:
Michigan Natural Features Inventory

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U.M. Flint's Center for Applied Environmental Research

Genesee, Lapeer, and Shiawassee Region (GLS Region) Potential Conservation Areas Report

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MNFI maintains a continuously updated information base, the only comprehensive, single source of data on Michigan's endangered, threatened, or special concern plant and animal species, natural communities, and other natural features. MNFI has responsibility for inventorying and tracking the State's rarest species and exceptional examples of the whole array of natural communities. MNFI also provides information to resource managers for many types of permit applications regarding these elements of diversity.

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Cover Photo: Shiawassee River-Floodplain Forest by Joshua Cohen

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Genesee, Lapeer and Shiawassee Counties (GLS Region) Potential Conservation Areas

Natural resource conservation is a fundamental component of a community's long-term environmental and economic health. Natural resource areas perform important natural functions such as water filtration and they provide recreational opportunities and wildlife habitat that enhance the overall vitality of a community. Abundant natural resources once surrounded population centers in the area. Now, much reduced in size, natural resource areas are becoming encircled by development. These remaining sites are the foundation of Genesee, Lapeer and Shiawassee counties natural heritage; they represent the last remaining remnants of the areas native ecosystems, natural plant communities and scenic qualities. Consequently, it is to a community's advantage that these sites be carefully integrated into the planning for future development. Striking a balance between development and natural resource conservation and preservation is critical if Genesee, Lapeer and Shiawassee counties are to maintain their unique natural heritage.

Successful land use planning requires more than simply protecting small preserves and trusting that they will remain in their current condition indefinitely. Many human activities such as road construction, chemical and fertilizer application, fire suppression, and residential development can have a detrimental impact on populations of plants, animals, and insects and the natural communities in which they live. Changes in zoning, building codes, and technology can cause areas that were once considered "safe" from development to be exposed to development. In order to maintain the integrity of the most fragile natural areas, a more holistic approach to resource conservation must be taken, an approach that looks beyond the borders of the site itself. What happens on adjacent farmland, in a nearby town, or upstream should be considered equally as important as what happens within the preserve

This report identifies and ranks Potential Conservation Areas (PCA's) remaining in Genesee, Lapeer and Shiawassee counties. Potential Conservation Areas are defined as places on the landscape dominated by native vegetation that have various levels of potential for harboring high quality natural areas and unique natural features. In addition these areas may provide critical ecological services such as maintaining water quality and quantity, soil development and stabilization, pollination of cropland, wildlife travel corridors, stopover sites for migratory birds, sources of genetic diversity, and floodwater retention. However, the actual ecological value of these areas can only be truly ascertained through on the ground biological surveys. The process established by the Michigan Natural Features Inventory (MNFI) for identifying potential conservation areas, can also be used to update and track the status of these remaining sites. MNFI recommends that local municipalities in Genesee, Lapeer and Shiawassee counties incorporate this information into their comprehensive natural area mapping services. The site map and ranking data can be used by local municipalities, land trusts, and other agencies to prioritize conservation efforts and assist in finding opportunities to establish an open space system of linked natural areas in the GLS Region.

Process for delineating and ranking Potential Conservation Areas

Materials and Interpretation Methodology

Identification of potential conservation areas in the GLS region was conducted using the Michigan Department of Natural Resources, 2000 IFMAP (Integrated Forest Monitoring Assessment and Prescription) Land Cover Data, MNFI's Circa 1800 Vegetation, MNFI's database (BIOTICS), and the State of Michigan Framework stream and roads data layers. The IFMAP Land cover data for Michigan was derived from classification of Landsat Thematic Mapper (TM) imagery. Image dates from 1997-2000 were used to identify land cover classes. Natural land cover classes for the PCA analysis were obtained from running a filter on the IFMAP land cover data set. The filter removed all patches less than 4 pixels in size, and replaced them with the nearest neighboring value.

The study area for the GLS region was delineated by buffering the three counties by one kilometer. This was so that the potential conservation areas (PCA's) were not given a lower score due to being cut off by the county boundary. Delineation of potential conservation areas was done through analysis in a geographic information system with emphasis placed on 1) intactness, 2) wetlands and wetland complexes, 3) riparian corridors, and 4) forested tracts. PCA's were identified by focusing on wetland and forested land cover and eliminating as much development (including roads), active agriculture, and old fields as much as possible. Water was included only if it was surrounded by other PCA land cover types. All natural land cover types were combined, and major roads were buffered by 30 meters and removed. The resulting blocks of natural vegetation were then converted into a shapefile. Boundaries were defined by hard edges such as roads, parking lots, developments and railroad beds. All potential conservation areas were identified and delineated regardless of size. Municipal boundaries were not utilized to delineate site boundaries unless the boundary corresponded to a defined hard edge, such as a road. Once all sites were delineated, sites under 20 acres were removed from the shapefile.

Site Selection and Prioritization

Following the delineation of PCA's, a more rigorous level of examination was undertaken based upon specific spatially based criteria to prioritize sites. Spatially based criteria that were determined to be important indicators of ecological health included: total size, size of core area, length of stream corridor, landscape connectivity, restorability of surrounding lands, vegetation quality, and bio rarity score. Each criterion was then divided into several different categories, or levels, which were translated to a numerical score. Each site was then assessed and compared to other sites based upon the sum of the scores for each criterion. Possible scores for the GLS Region sites ranged from 2 to 41.

Description of Criteria

Total Size - The total size of a site is recognized as an important factor for viability of species and ecosystem health. Larger sites tend to have higher species diversity, higher reproductive success, and improve the chances of plant and animal species surviving a catastrophic event such as a fire, tornado, ice storm, or flood.
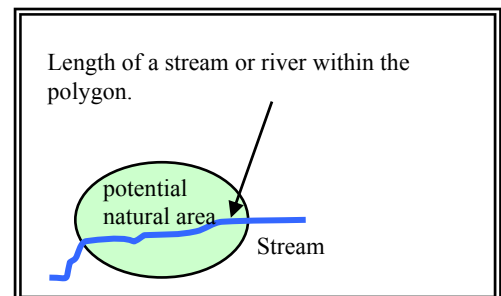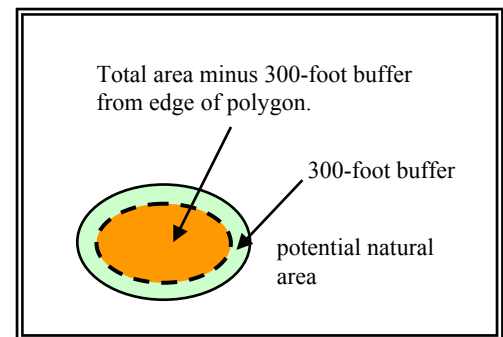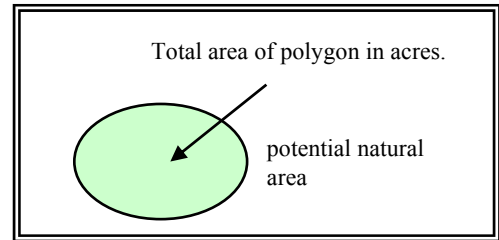
Size is defined as the total area of the resultant polygon.

Size of Core Area - Many studies have shown that there are negative impacts associated with the perimeter of a site on "edge-sensitive" animal species, particularly amphibians, reptiles, and forest and grassland songbirds. Buffers vary by species, community type, and location, however most studies recommend a buffer somewhere between 200 and 600 ft. to minimize negative impacts. Three hundred feet is considered a sufficient buffer for most "edge-sensitive" species in forested landscapes.

For this project, core area is defined as the total area minus a 300-foot wide buffer measured inward from the edge of the polygon. Core area is different from total area of the site because it takes into account the shape of the site. Typically, round shapes contain a larger core area relative to the total site than long narrow shapes.

Stream Corridor (length) - Water is essential for life. Streams are also dynamic systems that interact with the surrounding terrestrial landscape creating new habitats. Waterways also provide the added benefit of a travel corridor for wildlife, connecting isolated patches of natural vegetation, particularly fragmented landscapes such as those found in Southeastern Michigan.

Sites that are part of riparian corridors were given a score 0-4 points depending upon the length of stream or river that was present at the site.

Total area of polygon in acres.

potential natural area

Total area minus 300-foot buffer from edge of polygon.

300-foot buffer

potential natural area

Length of a stream or river within the polygon.

potential natural area

Stream

Landscape Connectivity - Connectivity between habitat patches is considered a critical factor for wildlife health. High connectivity improves gene flow between populations, allows species to recolonize unoccupied habitat, improves resilience of the ecosystem, and allows ecological processes, such as flooding, fire, and pollination to occur at a more natural rate and scale. Landscape connectivity was measured in two ways, *percentage* and *proximity*.

Percentage
Landscape connectivity was measured by building a ¼ mile buffer around each polygon and measuring the percentage of area that falls within other potential conservation areas.

Percentage of potential natural areas of surrounding lands within ¼ mile.

¼ mile buffer

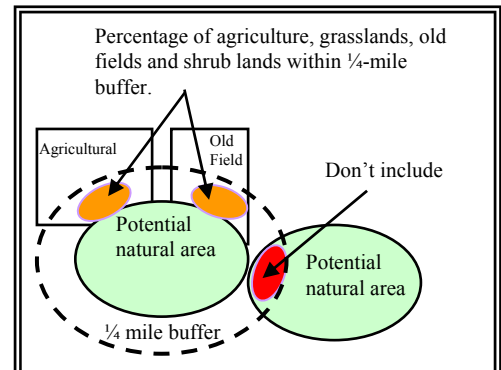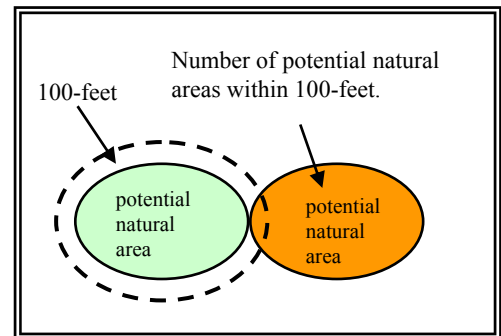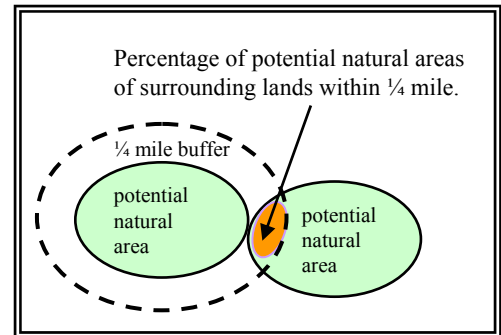potential natural area

potential natural area

Proximity
In addition to measuring the area around a polygon that is considered natural, connectivity can also be measured by the number of individual potential conservation areas in close proximity to the site. The greater the number of polygons in "close proximity," the higher the probability for good connectivity. Close proximity was determined to be 100 feet. One hundred feet was chosen as the threshold based on digitizing error and typical width of transportation right-of-ways, pipelines, and powerline corridors.

100-feet

Number of potential natural areas within 100-feet.

potential natural area

potential natural area

Restorability of Surrounding Lands
Restorability is important for increasing the size of existing natural communities, providing linkages to other habitat patches, and providing a natural buffer from development and human activities.

Restorability is measured by the potential for restoration activities in areas adjacent to the delineated site. First, a ¼ mile buffer was built around each site. Potential conservation areas as defined by MNFI, located within the buffer area were then removed, and the percentage of agricultural land, grasslands, shrub lands and old fields within the remaining buffer area was measured.

Percentage of agriculture, grasslands, old fields and shrub lands within ¼-mile buffer.

Agricultural

Old Field

Don't include

Potential natural area

Potential natural area

¼ mile buffer

Vegetation Quality – The quality of vegetation is critical in determining the quality of a natural area. Vegetation can reflect past disturbance, external impacts, soil texture, moisture gradient, aspect (cardinal direction of slope), and geology. Vegetative quality however is very difficult to measure without recent field information. As a surrogate to field surveys, a vegetation change map comparing the 2000 IFMAP land cover data layer to the MNFI circa 1800-vegetation data layer was created. The resulting potential unchanged vegetation can then act as an indicator of vegetation quality.

Percentage
Vegetation quality was measured by calculating the percentage of the site that contains potentially unchanged vegetation. This allows small sites with a high percentage of potentially unchanged vegetation to score points.

Area
Vegetation quality was also measured by calculating the area of potentially unchanged vegetation that falls within each site. This balances the bias of small sites with a high percentage of potentially unchanged vegetation by awarding points based on actual area covered.

Percentage and total area of unchanged vegetation

Unchanged compared to circa 1800 vegetation data layer

Bio Rarity Score - The location of quality natural communities and rare species tracked by MNFI are often, although not always, indicative of the quality of a site. The occurrences in and of themselves are important.

The Bio Rarity Score is based on the cumulative score of each element occurrence (EO) found within a site. Each EO is scored based on its probability of being found, global rarity, state rarity, and condition or viability. For example, a much higher score would be awarded to a population of Mitchell's satyr, which is globally and state imperiled, and that is in good condition, compared to a population of box turtles, which is globally secure and rare in the state, and is in fair condition.

Bio Rarity Score

Known quality natural communities and rare species.
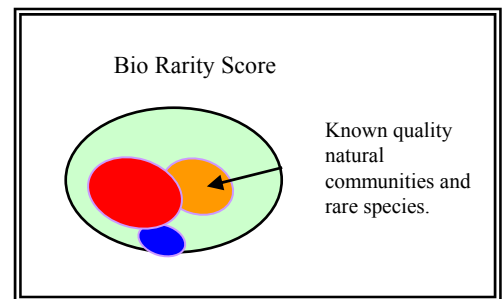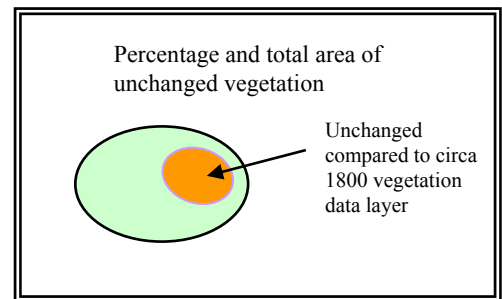
Note: The number of points assigned for each criterion is in the *site criteria table* on page 13.

An element occurrence is an occurrence record of a federally and/or state listed species, state special concern species, exemplary and/or rare natural community, or another type of natural feature such as a unique geologic formation or bird colony.

Priority Rankings for the GLS Region

Potential Conservation Areas were tallied for the GLS region as well as within each county. The tally of PCA's for the GLS region includes all of the PCA's within each county as well as those located within a one-kilometer buffer zone around each county. Only those PCA's which originate in one of the three counties and extend into the buffer zone were included in this analysis for the region. Those PCA's which are entirely outside of any of the three counties were not included. The analysis for each county only included the portion of the PCA's that were contained within the county and did not include any portion of the PCA that extended into the buffer area. PCA's that straddle more than one county were divided at the county line and were counted within each county. Thus, the sum of the PCA's for the three counties will be greater than the number of PCA's in the GLS region.

A total of 1,815 sites, totaling 250,471 acres were identified as potential conservation areas (PCA's) in the GLS Region. The acreage for only the portion of the PCA's that are completely contained within one of the three counties totals 229,878. **This represents 19% of the total land base in the three-county area**. Each of the 1,815 delineated sites was scored based upon the criteria described in the following table. Total scores ranged from a high of 35 points (out of a possible 41 points) to a low of 2 points. The mean score was nine.

The top three sites are all located in Lapeer County. The site that received the highest score of 35 is located in Lapeer County in the Lapeer State Game Area. It is located along the South Branch of the Flint River at the junction of Marathon, Deerfield, Mayfield and Oregon Townships. It includes 5,778 acres in total size, with a core area of 3,572 acres. The site with the second highest score of 31 is also located in the Lapeer State Game area in Mayfield, Arcadia, North Branch and Deerfield Townships**.** It is bounded on the west by Highway 24 and on the east by Pleasant Lake Road. It encompasses 8,520 acres in total size with a core area of 3,090 acres. The site with the third highest score of 29 straddles Lapeer and Genesee Counties (primarily in Lapeer) and includes a large wetland complex along Hasler Creek near a concentration of small lakes and streams south of the Holloway Reservoir. The Genesee County Parks and Recreation Department own a large portion of this site. This site includes 4,347 acres in total size and has a core area of 892 acres.
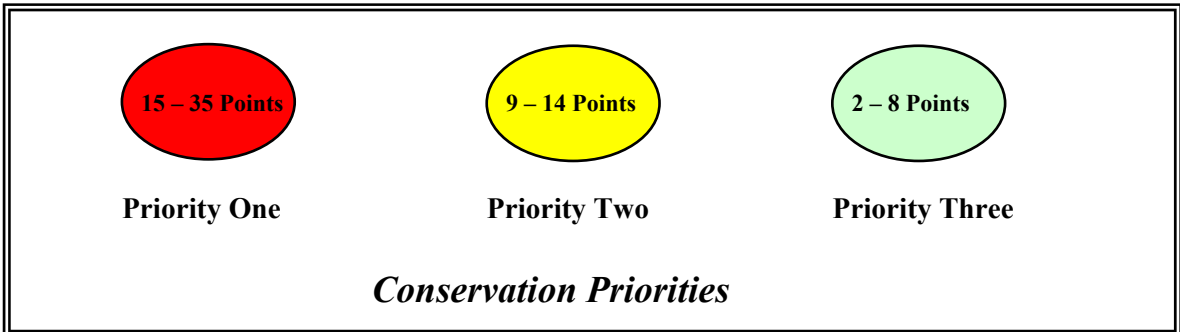
Once the total scores were tabulated, the next step was to determine a logical and reasonable break between high priority, medium priority, and low priority sites. Many potential natural area sites can be just one point away from being placed into another category. Natural break and equal interval classification are two legitimate methods for classifying sites. Equal interval classification, as defined for this project, is based on absolute values. It shows the value of each site relative to the highest (41) and lowest (1) possible values. Equal interval classification breaks all possible scores into equal classes regardless of actual scores. This eliminates the relative nature of scores when sites are compared only to other sites within a given area.

The natural break method is the default classification method in ArcView. This method identifies breakpoints between classes using a statistical formula called Jenk's optimization. The Jenk's method finds groupings and patterns inherent in the data by minimizing the sum of the variance within each of the classes. Based on the results of each method, MNFI recommends using the natural break method for the GLS Region. If the equal interval system were used, 48.5% of the total acres and 92% of the sites would fall into the priority three category.
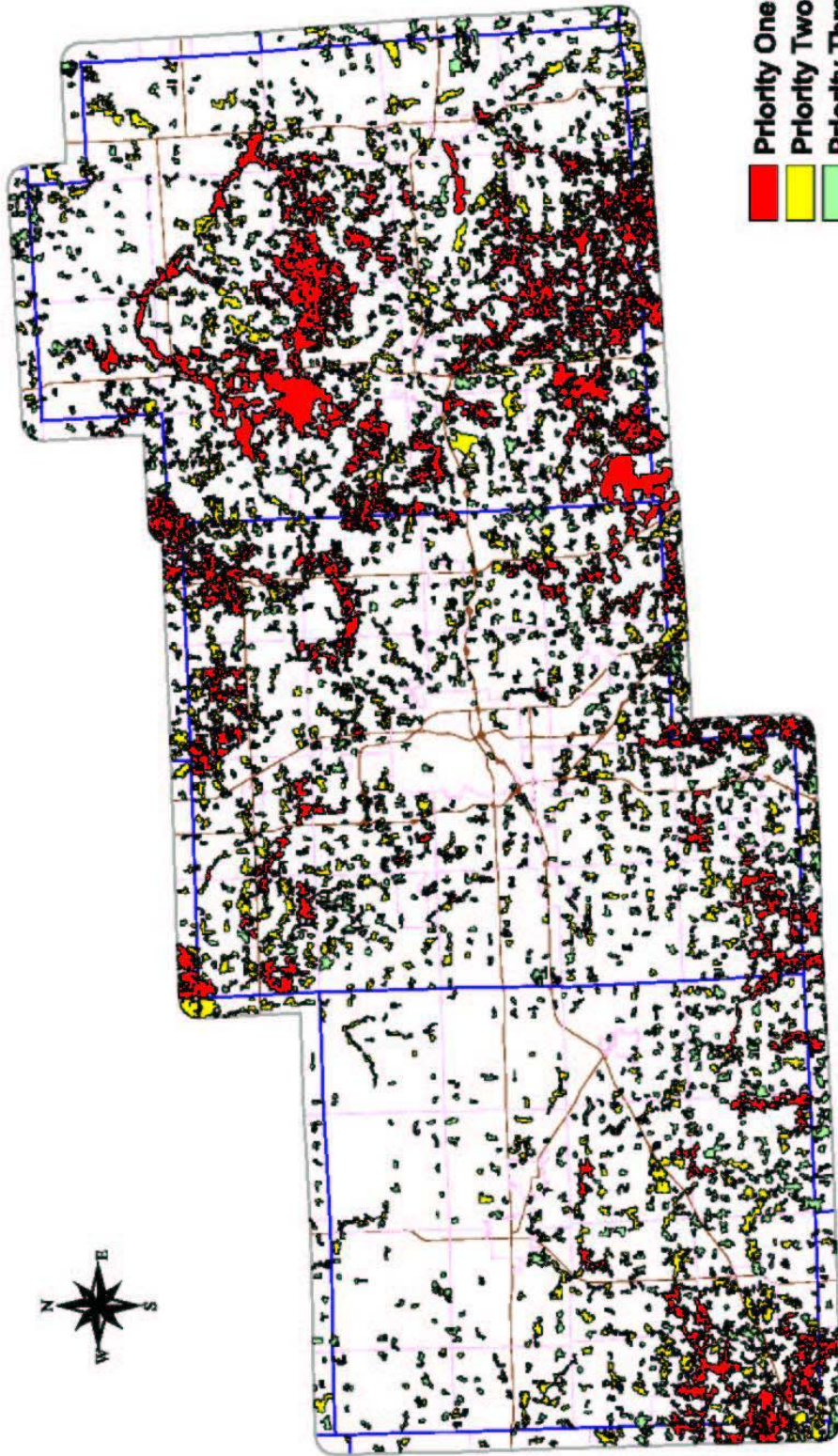
As a result of applying the natural break method, 819 sites were placed in the low priority category, 895 sites were placed in the middle category, and 101 sites were placed in the high priority category. Breaking it down into percentages of total sites identified, **45% were labeled low priority, 49% were labeled medium priority, and 6% of the sites were identified as high priority. Breaking it down by acreage, 19% (47,463 acres) fell into the low quality category, 33% (82,936 acres) fell into the medium quality category, and 48% (120,073 acres) fell into the high priority category.**

Lapeer County contains the highest number of acres (64,625) of high priority sites in the GLS region. These 64,625 acres represent 54% of the total area of high priority sites.

Despite the more methodical approach to classification, it still could be argued that sites scoring one point below should be included in the higher category or that sites scoring right at the low end of a category should be placed in the next lowest category. To help alleviate anxieties about which category a particular site is placed, actual numeric total scores can be displayed in the middle of each polygon. This would allow the viewer to see how a site compares directly to another site without artificially categorizing it within a group.

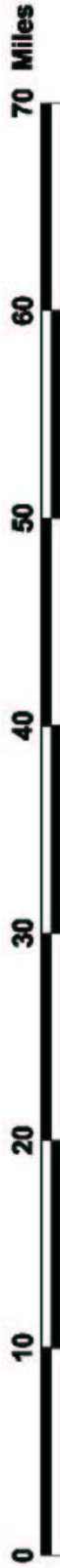| 15 – 35 Points	9 – 14 Points	2 – 8 Points
Priority One	**Priority Two**	**Priority Three**

Conservation Priorities

Priority Conservation Areas for the GLS Region

Priority One
Priority Two
Priority Three

Map Created: May 2006

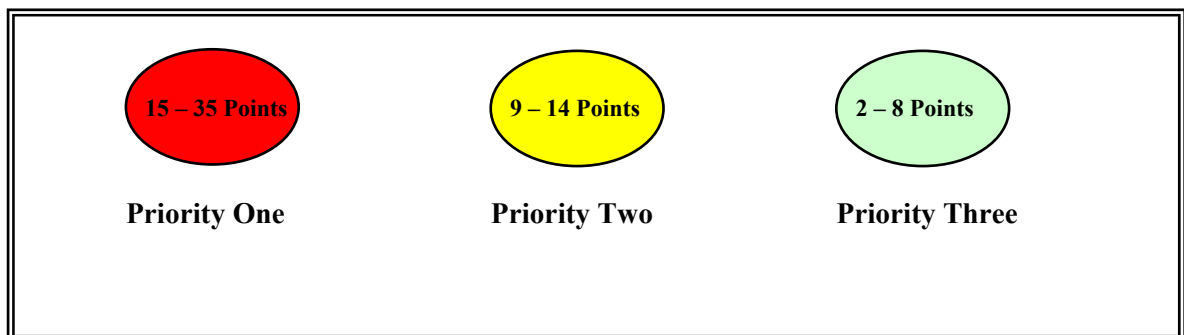0   10   20   30   40   50   60   70 Miles

8

Priority Rankings for Genesee County

In Genesee County, there were **754 sites**, **totaling 77,041 acres** that were identified as potential conservation areas. **This represents 18.5 % of the total area in the county**. Each of the 754 delineated sites was given a total score based upon the criteria described in the following table. Total scores ranged from a high of 29 points (out of a possible 41 points) to a low of 2 points. The mean score was 10. **The site that received the highest score of 29 straddles Lapeer and Genesee Counties (primarily in Lapeer) and includes a large wetland complex along Hasler Creek in the vicinity of a concentration of small lakes and streams south of the Holloway Reservoir**. The Genesee County Parks and Recreation Department own a large portion of this site in Richfield Township. **It includes 4,347 acres in total size and a core area of 892 acres**. The site with the second highest score of 27 also straddles Genesee and Lapeer County. It is located in the southeast part of Genesee County in Atlas Township although most of the conservation area is in Lapeer County in Hadley Township. It includes the wetland complex along Kearsley Creek and the natural areas in the Ortonville State Recreation Area. It encompasses 4,973 acres in total size and a core area of 3,050 acres. The site with the third highest score of 25 is located in southwestern Genesee County in Argentine township along the Shiawassee River. This area extends into Shiawassee and Livingston counties. It is 4,412 acres in total size and has a core area of 1,109 acres.

As a result of applying the natural break method, 294 sites were placed in the low priority category, 413 sites were placed in the medium category, and 47 sites were placed in the high priority category. Breaking it down into percentages of total sites identified, 39% were labeled low priority, 55% were labeled medium priority, and 6% of the sites were identified as high priority. Breaking it down by acreage, 20 % (15,643 acres) fell into the low quality category, 44 % (33,594 acres) fell into the medium quality category, and 36 % (27,805 acres) fell into the high priority category.

15 – 35 Points	9 – 14 Points	2 – 8 Points
Priority One	**Priority Two**	**Priority Three**

Genesee County:
Potential Conservation Areas
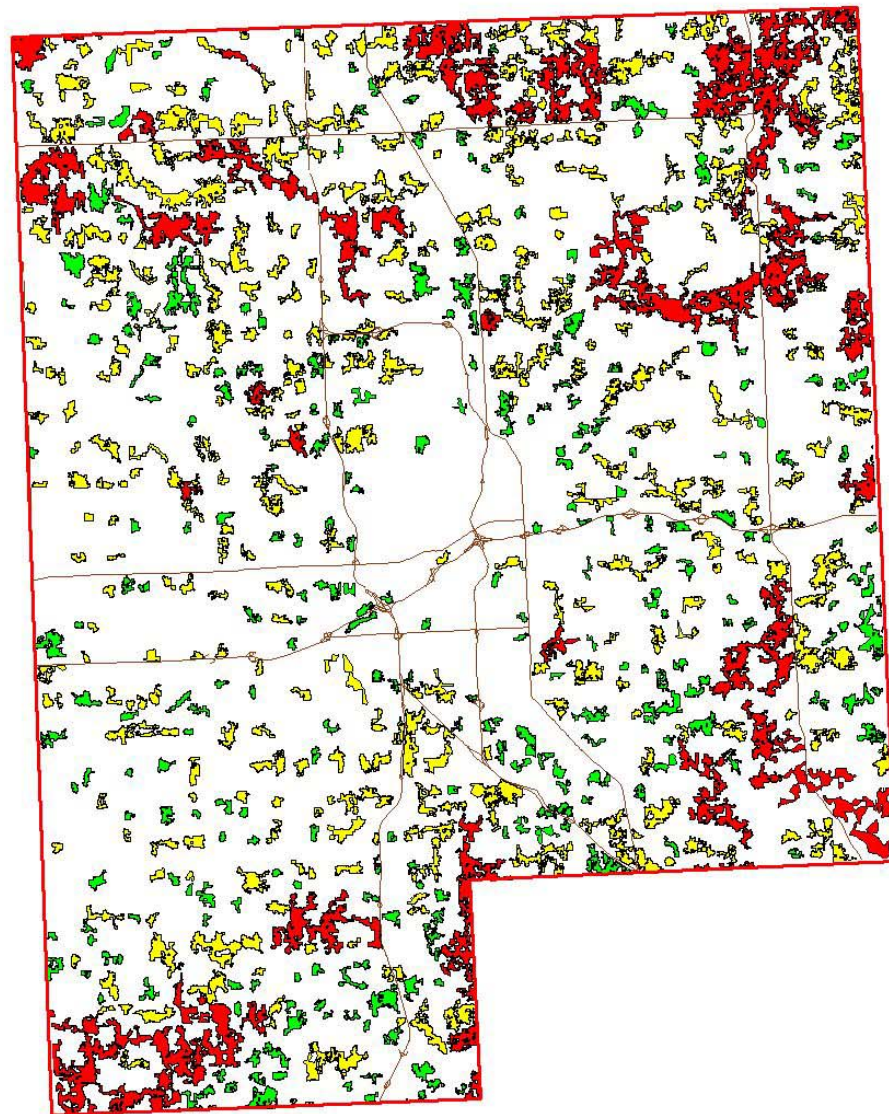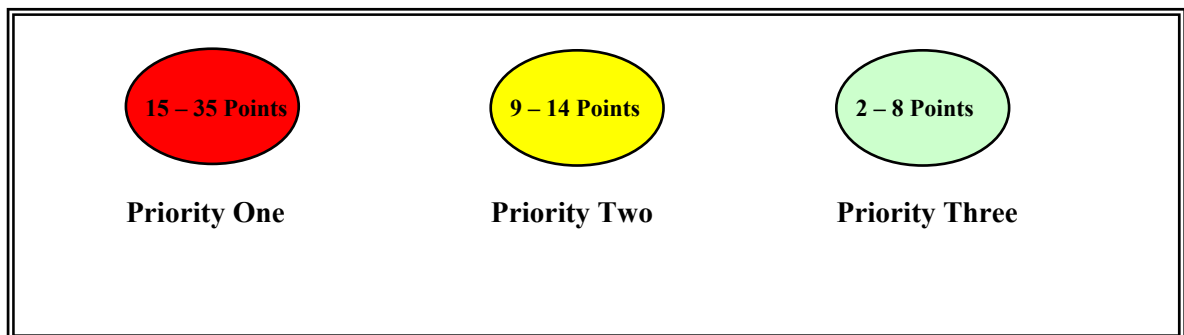

0   5   10   15   20 Miles

Map Created: May 2006

N
W   E
S

■ Priority One
■ Priority Two
■ Priority Three
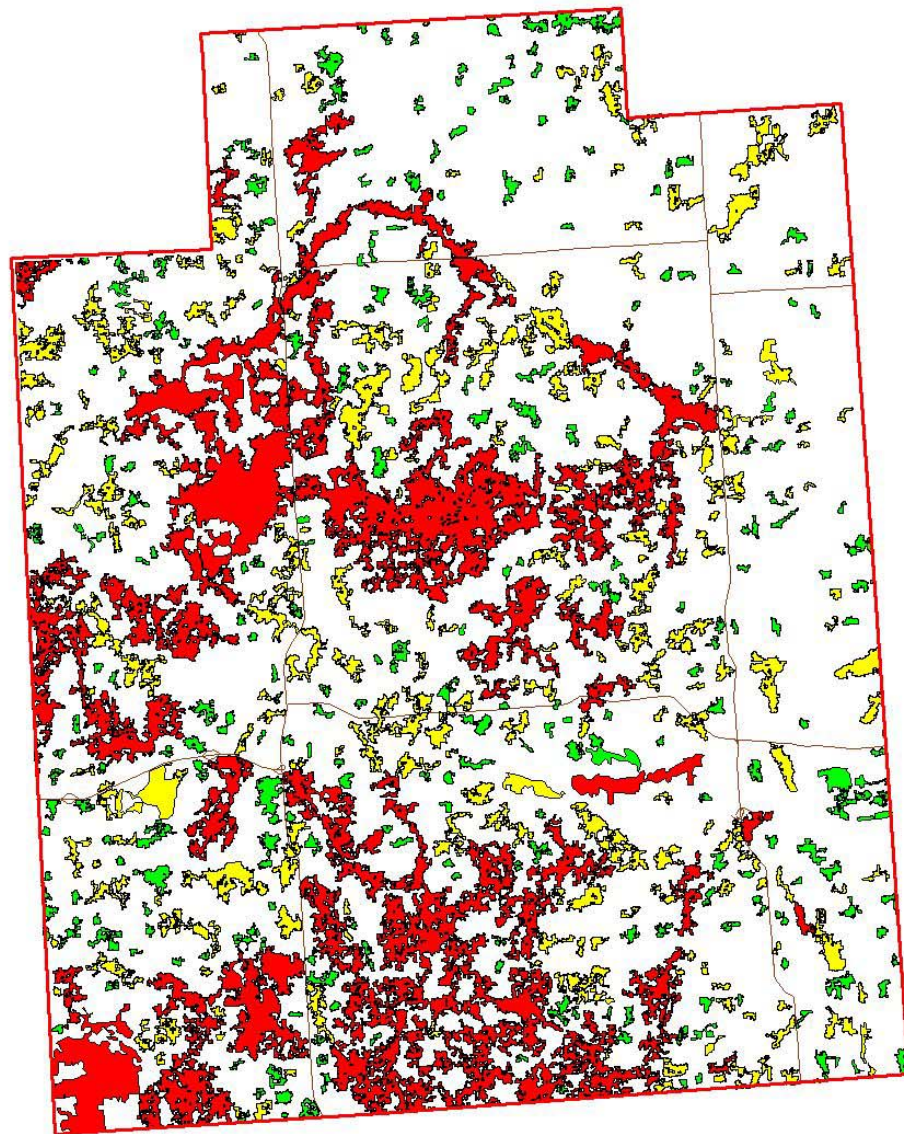
Priority Rankings for Lapeer County

In Lapeer County, there were **607 sites, totaling 108,030 acres** that were identified as potential conservation areas. **This represents 25.5 % of the total area in the county**. Each of the 607 delineated sites was given a total score based upon the criteria described in the following table. Total scores ranged from a high of 35 points (out of a possible 41 points) to a low of 3 points. The mean score was nine. The three sites that scored the highest for the GLS Region all occur in Lapeer County. **The site that received the highest score of 35 is located in the Lapeer State Game Area**. It is bordered on its western side by the South Branch of the Flint River and is bounded on the east by Hwy 24. It is located in Marathon, Deerfield, Mayfield and Oregon Townships. It is 5,778 acres in total size, with a core area of 3,572 acres. The second highest-ranking site in the county (31) is also located in the Lapeer State Game Area. It is bounded on the west by Hwy 24 and on the east by Pleasant Lake Road. It is located in Mayfield, Arcadia, North Branch and Deerfield Townships. It encompasses 8,520 acres in total size with a core area of 3,090 acres. The third highest-ranking site includes a large wetland complex along Hasler Creek that occurs in the vicinity of a concentration of small lakes and streams south of the Holloway Reservoir and north of I-69. This site extends into Genesee County although most of the site is in Lapeer County. The Genesee County Parks and Recreation Department owns a large portion of this site in Richfield Township. This area is 4,347 acres in total size and has a core area of 892 acres.

As a result of applying the natural break method, 277 sites were placed in the low priority category, 286 sites were placed in the medium category, and 44 sites were placed in the high priority category. Breaking it down into percentages of total sites identified, 46 % were labeled low priority, 47 % were labeled medium priority, and 7 % of the sites were identified as high priority. Breaking it down by acreage, 14 % (14,906 acres) fell into the low quality category, 26 % (28,499 acres) fell into the medium quality category, and 60 % (64,625 acres) fell into the high priority category.

| 15 – 35 Points | 9 – 14 Points | 2 – 8 Points |
| Priority One | Priority Two | Priority Three |

Lapeer County:
Potential Conservation Areas

0   4   8   12   16   20 Miles

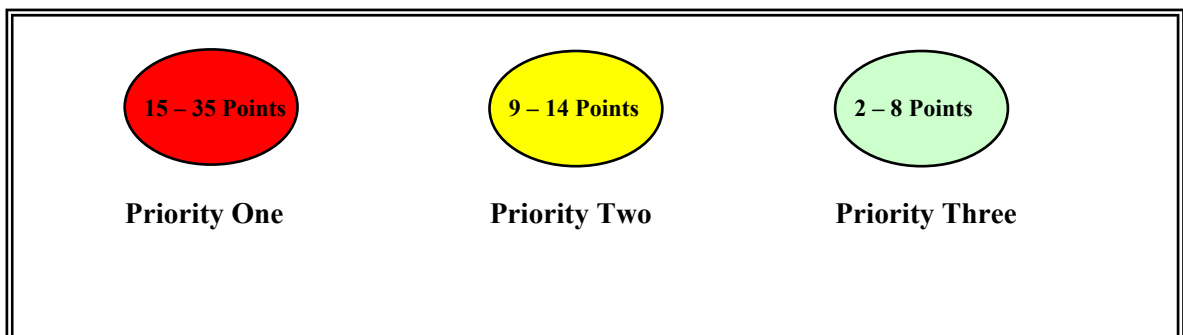Map Created: May 2006

Priority One
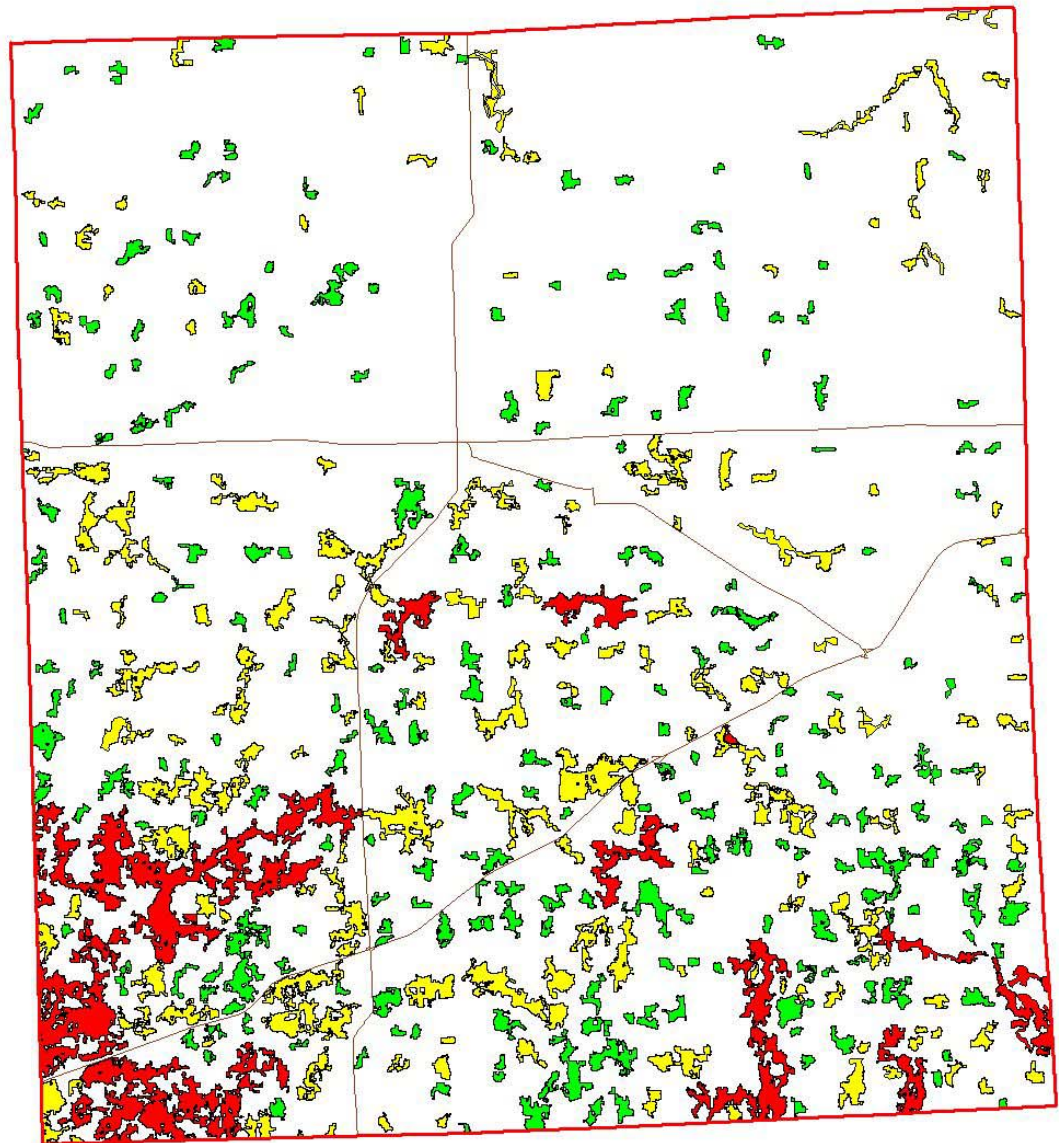Priority Two
Priority Three

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Priority Rankings for Shiawasee County

In Shiawassee County there were **469 sites totaling 44,808 acres** that were identified as potential conservation areas. **This represents 13 % of the total area of the county**. Each of the 469 delineated sites was given a total score based upon the criteria described in the following table. Total scores ranged from a high of 27 points (out of a possible 41 points) to a low of 3 points. The mean score was eight. **The site that received the highest score of 27 is located in the southwestern part of the county in Sciota Township along the Looking Glass River**. It includes a total area of 3,897 acres and a core area of 1,229 acres. The site with the second highest score of 26 is located in the southwestern corner of the county in Woodhull Township in the Rose Lake State Wildlife Research Area. Part of this area extends into Clinton County. The total acreage of this area is 3,235 acres with a core area of 971 acres. The third highest scoring site (25) is located the southeastern part of the county in Burns Township where the Shiawassee River splits into the north and south branches near the town of Byron. This conservation area extends into Genesee County where the majority of this site is located. The total acreage is 4,412 acres with a core area of 1,109 acres.

As a result of applying the natural break method, 253 sites were placed in the low priority category, 201 sites were placed in the medium category, and 15 sites were placed in the high priority category. Breaking it down into percentages of total sites identified, 54 % were labeled low priority, 43 % were labeled medium priority, and 3% of the sites were identified as high priority. Breaking it down by acreage, 31 % (13,824 acres) fell into the low quality category, 41 % (18,256 acres) fell into the medium quality category, and 3 % (12,727 acres) fell into the high priority category.

15 – 35 Points	9 – 14 Points	2 – 8 Points
Priority One	**Priority Two**	**Priority Three**

Shiawassee County:
Potential Conservation Areas

| 0 | 5 | 10 | 15 | 20 Miles |

N
W E
S

Map Created: May 2006

Table 1. Site Criteria
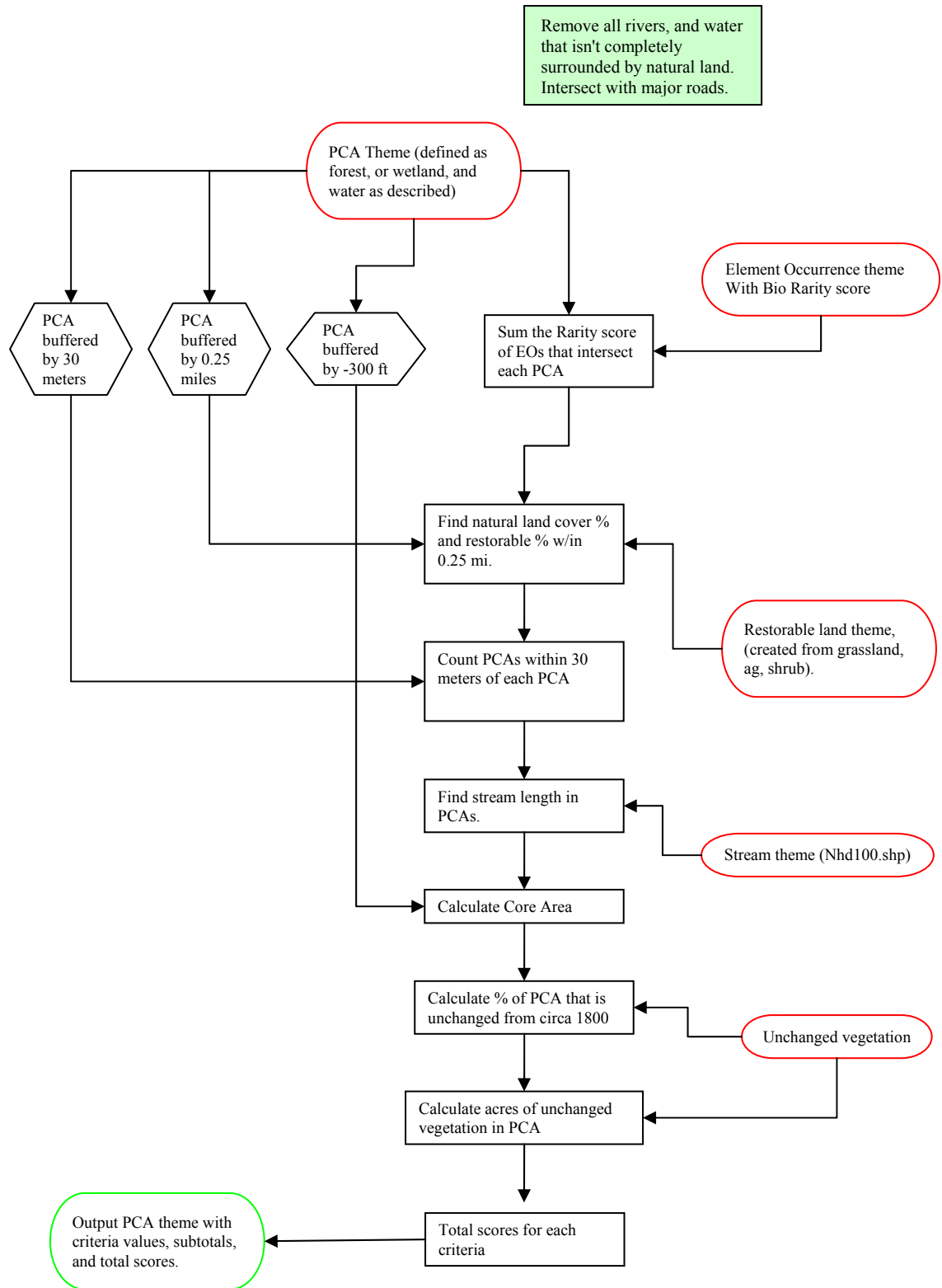
CRITERIA	DESCRIPTION	DETAIL	PTS
Total Size	Total size of the polygon in acres. ❑ *Size is recognized as an important factor for viability of species and ecosystems.*	20 - 40 ac.	0
		>40 - 80 ac.	1
		>80 - 240 ac.	2
		>240 ac.	4
Size of Core area	Acres of core area. - Defined as total area minus 300 ft. buffer from edge of polygon. ❑ *Greater core area limits negative impacts on "edge-sensitive" animal species.*	0 - 60ac	0
		>60 - 120 ac	2
		>120 - 230 ac	4
		>230 ac	8
Stream Corridor (length)	Length of a stream or river within the polygon. ❑ *Stream corridors provide wildlife connections between patches of habitat.*	0	0
		>0-400 m	1
		>400-800m	2
		>800-1600m	3
		>1600-3200m	4
		>3200 m	6
Landscape Connectivity Percentage	Percentage of potential conservation areas within 1/4 mile. - build 1/4 mile buffer - measure % of buffer that is a potential conservation area	0 - 11%	0
		>11 - 22%	2
		>22 - 33%	3
		>33%	4
Proximity	Number of potential conservation areas within 100 ft. ❑ *Connectivity between habitat patches is considered a critical factor for wildlife health.*	0	0
		1	1
		2	2
		3	3
		4+	4
Restorability of surrounding lands	Restorability of surrounding lands within 1/4 mi. - build 1/4 mile buffer - subtract potential conservation areas from buffer - measure % agricultural lands and old fields ❑ *Restorability is important for increasing size of existing natural communities, providing linkages to other habitat patches, and providing a natural buffer from development.*	0 - 35%	1
		>35 - 65%	2
		>65%	3

CRITERIA	DESCRIPTION	DETAIL	PTS
Vegetation Quality	Estimates the quality of vegetation based on circa 1800 vegetation maps and 2000 IFMAP land cover data (only done for Michigan sites).	1 - 10%	0
		10.1 -30%	1
		30.1 – 65%	2
Percentage	Measures the percentage of potentially unchanged vegetation within a polygon.	65.1 – 100%	4
Area	Measures the actual area within a polygon of potentially unchanged vegetation regardless of the size of the polygon.	0 – 10ac	0
		10.1 – 40ac	1
	The quality of vegetation is critical to determining the quality of a natural area.	40.1 – 80ac	2
		80.1 - 160	3
		> 160ac	4
Bio Rarity Score	Known element occurrences increase the significance of a site and increase the bio rarity score.	0 – 5.75	1
		5.75 – 19.5	2
		19.5 -41.5	3
	❑ *The location of quality natural communities and rare species tracked by MNFI are often, although not always, indicative of the quality of a site.*	41.5 -68	4
	❑ *Values were determined using the Jenk's optimization formula.*		
Note Total possible points = 41			

Table 2. Results of PCA Analysis for Each County

County	# Sites	Total Acres	Core Area	% Area
Genesee	754	77,041	18,424	18.5%
Lapeer	607	108,030	29,922	25.5%
Shiawassee	469	44,808	10,515	13%

Greenlinks flow chart for PCA model

Remove all rivers, and water that isn't completely surrounded by natural land. Intersect with major roads.

PCA Theme (defined as forest, or wetland, and water as described)

Element Occurrence theme With Bio Rarity score

PCA buffered by 30 meters

PCA buffered by 0.25 miles

PCA buffered by -300 ft

Sum the Rarity score of EOs that intersect each PCA

Find natural land cover % and restorable % w/in 0.25 mi.

Restorable land theme, (created from grassland, ag, shrub).

Count PCAs within 30 meters of each PCA

Find stream length in PCAs.

Stream theme (Nhd100.shp)

Calculate Core Area

Calculate % of PCA that is unchanged from circa 1800

Unchanged vegetation

Calculate acres of unchanged vegetation in PCA

Output PCA theme with criteria values, subtotals, and total scores.

Total scores for each criteria

Conclusion

This inventory documents that GLS Region has several high quality natural areas that still look and function the way they did 200 years ago. Of the remaining high quality sites, some have the potential of harboring endangered, threatened, or special concern animal and plant species. With the high rate of development and its associated stresses on the natural environment, conservation of these remaining areas and their native plant and animal populations are vital if the Region's diverse, natural heritage is to be conserved.

When using this information it is important to keep in mind that site boundaries and rankings are a starting point and tend to be somewhat general in nature. Consequently, each community, group or individual using this information should determine what additional expertise is needed in order to establish more exact boundaries and the most appropriate conservation efforts.

Comments/Recommendations

1) Local units of government, individuals and interest groups using this information should consult a publication produced by SEMCOG in 2003 entitled, "Land use Tools and Techniques." The publication includes information on tools and techniques that conserve natural resources and create open space linkages while allowing for economically viable development.

2) Municipalities should identify opportunities to link other possible natural resource sites not mapped during this survey. This would include small patches of land, tree and fence row plantings, agriculture land, and open fields (greenways).

3) Field inventories should be conducted on identified potential conservation areas. This fieldwork would provide much needed additional site-specific data that should be considered when developing in and around such areas.

4) All identified sites, regardless of their priority, have significance to their local setting. This is especially true in areas that have experienced a high degree of development and landscape fragmentation.

5) A direct relationship exists between natural area protection and long-term water quality. With the abundance of water resources found in the GLS Region and the potential impact on the economy associated with degradation of these resources, natural area protection should be integrated into local water quality management plans.

6) Municipalities should work together and adopt a comprehensive green infrastructure plan. The conservation of critical natural areas is most effective, and successful, in the context of an overall plan.

7) Funding should be secured to update the mapping and assessment of this project's potential conservation areas approximately every three to five years.

8) Efforts to conserve potential conservation areas should include on-going site assessment and stewardship.

9) Local units of government in Genesee, Lapeer and Shiawassee Counties should undertake widespread distribution of this information in order to build awareness and encourage long-term resource planning and stewardship. Knowledge of potential conservation areas is meaningless unless action is taken to ensure that they will remain part of this area's natural heritage.

10) When establishing sites for possible field inventory, each community, group or individual should consider all available criteria in conjunction with their unique local conditions. Site selection may well be influenced by local growth pressure and ownership of the land.

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