8.0 LANDSCAPE FUNCTIONS MODEL

The landscape performs several functions of value society, including stormwater storage, conveyance and infiltration, air and water quality enhancement, wildlife habitat, biodiversity, recreational opportunities, groundwater recharge, agricultural production, nutrient cycling, and other functions.

Different ecological communities serve different roles in performing these functions. Bottomland forests, for example, provide greater flood control functions than, say, a gravel hill prairie that provides greater groundwater infiltration functions. A wet meadow taken over by a monostand of reed canary grass—an exotic invasive species—would have significant stormwater storage, moderate water quality and low biodiversity function. By comparison, an intact wet prairie would have significant stormwater storage as well as high water quality and biodiversity functions.

The Landscape Function Model uses vegetation communities from the National Land Cover Data as a surrogate for predicting landscape functions. The model can be calibrated so that users can predict and quantify how ecosystem function would change as the variable "ecological community" is modified.

Ecological communities are weighted according to how well they perform landscape functions. The extent of projected ecological communities would affect landscape functions accordingly.

8.1 Methods

Watershed Summary

Vegetation communities, defined by National Land Cover Data (NLCD), within the watershed were scored according to how well they perform the landscape functions of Water Quality, Flood Protection, Ground Water Recharge, Biodiversity, and Habitat, (Table 8.1-i). Using professional judgment, each community was rated as high (2), medium (1) or low (0) as to how well it performs listed landscape functions. The sum of each rating per vegetation community was used to generate an Overall Score.

Table 8.1-i. NLCD classification of vegetative communities within the watershed (0=low, 1=medium, and 2=high).

NLCD Class	Biodiversity	at	Water Quality	Flood Protect ion	Gr Rec	Overal l score	Classification
	1	1	1	0	0	3	Medium Low
	0	1	1	0	0	2	Medium Low
	0	0	0	0	0	0	Low
	0	0	0	0	0	0	Low
	0	0	0	0	0	0	Low
Q es/Gravel Pits	0	0	0	0	0	0	Low
	0	1	0	0	1	2	Medium Low
	2	2	2	0	1	7	Medium High
	2	2	2	0	1	7	Medium High
	2	2	2	0	1	7	Medium High
	2	2	2	2	1	9	Best
O eyards/other	0	1	1	0	0	2	Medium Low
G us	0	1	1	0	0	2	Medium Low
	0	1	1	0	0	2	Medium Low
	0	0	0	0	0	0	Low
	0	0	0	0	0	0	Low
Fallow	0	1	1	0	1	3	Medium Low
Urban/Recreational Grasses	0	0	1	0	0	1	Low
	1	1	1	2	0	5	Medium
	1	2	2	2	0	7	Medium High

Subwatershed Summary

Each of the 23 subwatersheds was ranked according to how well it performed the suite of landscape functions described above. Subwatersheds that contained the highest percentage of ecological communities that performed the greatest landscape functions were scored higher than subwatersheds with a lower percentage of ecological communities with high landscape functional value. Table 8.1-ii summarizes individual landscape functional scores as well as overall subwatershed scores for each of the 23 subwatersheds.

Table 8.1-ii. Landscape function and overall scores for each subwatershed.

Subwatershed Name	Biodiversity Sco	Habitat Score	r Quality e	Flood	Ground Wate re	Overall Score
Bass/Hunters Confluence	1.75	1.84	0.86	0.04	0.86	5.36
Missouri River Tributary	1.68	1.76	0.81	0.02	0.81	5.07
Turkey/Bass Confluence	1.61	1.76	0.78	0.13	0.78	5.05
Fox Hollow Branch	1.38	1.67	0.68	0.01	0.68	4.42

Upper Bonne Femme Lower	1.33	1.61	0.66	0.02	0.66	4.27
Upper Little Bonne Femme	1.3	1.57	0.61	0.13	0.61	4.22
Bonne Femme Lower I	1.27	1.54	0.62	0.04	0.62	4.09
Smith Creek	1.16	1.47	0.57	0.03	0.57	3.8
Bonne Femme Lower II	1.22	1.32	0.56	0.1	0.56	3.75
Bonne Femme Middle	1.03	1.43	0.51	0.01	0.51	3.5
Lower Little Bonne Femme	0.91	1.36	0.44	0.04	0.44	3.19
Hunters Cave	0.86	1.36	0.42	0	0.42	3.06
Pierpont	0.83	1.34	0.41	0.01	0.41	3
North Branch Little Bonne Femme	0.82	1.25	0.39	0.03	0.39	2.87
South Branch Little Bonne Femme	0.73	1.3	0.36	0.01	0.36	2.76
Gans Creek	0.68	1.22	0.33	0.02	0.33	2.58
Middle Little Bonne Femme	0.6	1.21	0.25	0.17	0.25	2.47
Clear Creek	0.58	1.1	0.27	0.05	0.27	2.28
Bass Creek	0.47	0.95	0.23	0.04	0.23	1.9
Turkey Creek	0.44	0.97	0.21	0.02	0.21	1.84
Gans Creek South	0.38	0.96	0.18	0.01	0.18	1.72
Gans Creek North	0.32	0.93	0.14	0.02	0.14	1.56
Upper Bonne Femme	0.3	0.9	0.15	0.01	0.15	1.51

8.2 Results and Discussion

Ecological communities differ in how well they perform specific landscape functions. Understanding the functional role that a specific ecological community serves in the landscape is helpful when determining the best possible use of a specific piece of property. If one can assume that the landscape functioned at peak efficiency before European settlement of the Midwest, land use changes between pre-settlement times and today resulted in reduced ability and efficiency of the landscape to perform landscape functions.

A number of measures have been developed to assess and express various aspects of how the landscape functions. Most of the measures have to deal with stormwater runoff and

flooding. While these are useful and important measures, they do not capture non-water related functions such as biodiversity and habitat. The Landscape Functions Model provides a quantitative way to capture a greater suite of landscape functions than traditional stormwater models.

Figure 8.2-A, Landscape Function Ranking ranks ecological communities within the watershed based on measurements described in Table 8.1-ii. In general, rugged areas that contain remnant stands of the historic hardwood forests ranked the highest. Most of these areas occur within protected parks, and steep, rocky lands that would have been difficult to clear for pasture or agricultural uses. Areas that ranked the lowest occur in the upper reaches of the watershed where the historic prairie had been converted to pasture and row crops. Under historic, pre-settlement conditions, this trend would have been reversed with the prairie performing a greater or at least comparable suite of landscape functions as the upland woodlands. The Landscape Function Ranking provides the highest resolution information in this model as it is based entirely on the NLCD classes.

Figure 8.2-B, Landscape Function Score, ranks each of the 23 basins according to the extent of ecological communities remaining that performs the greatest suite of landscape functions. Much of the resolution contained in the previous Figure 8.2-A, Ecological Function Ranking, is lost when ecological communities are assessed at the subwatershed scale. However, the trend observed above generally holds true at the subwatershed scale. Prairie lands in the upper reaches of the watershed that performed important landscape functions during pre-settlement times have been lost. As a result, these lands have lost the ability to perform historic landscape functions. Developed subwatersheds also scored poorly. Subwatersheds with predominantly remnant timberland in steep, inaccessible areas scored the highest.

Watersheds ranked as Medium contain a combination of higher quality woodland as well as substantial floodplain habitat used for agricultural purposes. Poor agricultural management in the floodplain appears to be the main driver lowering the score of the Medium subwatersheds. A similar situation occurs within the Lower Little Bonne Femme and South Branch Little Bonne Femme.