At 219 miles long, the Muskegon River is the second longest river in Michigan. The drainage basin encompasses 2,724 sq. mi. and contains 122 county subdivisions known as Minor Civil Divisions (MCD) which are composed of legal units such as towns and townships. The Muskegon River Watershed (MRW) is slightly larger than the state of Delaware. The river’s head waters originates from Higgins and Houghton Lakes and flows southwest draining into Muskegon Lake, which in turn drains into Lake Michigan via a one mile long channel. The river drops a total of 575 feet from its headwaters to Lake Michigan and has approximately 94 tributaries that flow into it (see FIG. 1).

This bulletin is divided into five headings: wetlands, agricultural land use, urban land use, shrublands, and forest cover. A sixth section offers some concluding remarks. Review FIG. 2 below for an overview of land cover change in the MRW between 1978 and 1998.
Wetlands

A wetland is the area of land found between terrestrial and aquatic ecosystems. They are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and bogs. Wetlands have high ecological value because of their extensive biodiversity and water quantity control. There are currently laws that protect wetlands in the United States to ensure there are no net losses of wetlands. Of the 122 MCDs in the MRW that had a change in wetland area, 47 MCDs experienced a loss. Despite this high number there was a net increase of wetland area totaling 8.1 sq. mi. In fact, 75 MCDs gained wetlands between the years of 1978 and 1998. This increase was found around areas that were already classified as wetlands in the 1978 land use/cover study.

Agricultural Land Use

Agricultural land can be broadly defined as land that is used primarily for the production of farm commodities. This can include row crops (corn and soy beans), permanent pasture, confined feeding, and specialty crops among other things. During the years of 1978 and 1998, there was a net loss of 216.8 sq. mi. of agricultural land in the MRW. In fact, 120 of the 122 MCDs experienced some type of change in the amount of agriculture lands. The two MCDs of North Muskegon and Muskegon Heights had neither a gain nor loss due to the fact that in both study years no land was classified as being used for agriculture. Of the 120 MCDs that had a change in the amount of farmland, 116 MCDs had some type of loss, including three townships (Blue Lake, Lyon, and Higgins) that lost 100% of their agricultural land. When accounting for all 116 MCDs which lost agricultural land, the mean percentage of land lost was 34.9%, in terms of area, this was approximately 1.9 sq. mi. Such results suggest that the MCD with the largest percentage of agricultural land loss may not have had much of its land classified as agriculture in the 1978 land use/cover survey. Thus, solely looking at the percent of land loss between 1978 and 1998 may be inadequate when assessing the change in agricultural land within the MCDs of the MRW.

Lastly, four MCDs in the MRW had an increase in the amount of agricultural land. The townships of Big Rapids, Lincoln, Summerfield, and Harrison experienced a gain of orchards and other specialty crops, confined feeding, and other agricultural lands. The mean gain for these four MCDs was only 0.2 sq. mi.

Urban Land Use

Urban land use is a classification that encompasses all types of land that has been developed for humans uses, including residential, industrial, commercial, and transportation. Most of the time these areas are covered by structures, but urban land can also be areas that are used for mining or recreation. Urban land growth occurred in 120 of the 122 MCDs in the MRW. There was a net gain of 118.8 sq. mi. of urban land in the years between 1978 and 1998. 85.5% of the total urban land gained was the result of land being converted into residential development.

North Muskegon and Roosevelt Park were the only two MCDs in the watershed that had a net loss of urban area. Both of these MCDs are cities and the majority of urban land loss was transformed into grasslands (approximately 50%).

Useful Land Conversions

1 sq. kilometer = 0.4 sq. miles
1 sq. kilometer = 247 acres
1 sq. mile = 2.59 sq. kilometers
1 sq. mile = 640 acres
Shrubland

Shrubland is a habitat type dominated by woody shrubs. A shrub is a perennial woody plant that branches at ground level to form several stems. Shrublands may be either a permanent habitat type or a transitional one, caused when another habitat type is transformed by natural or human disturbances, like fire or logging. Some shrublands came about as a result of the degradation of forests through over-exploitation by humans. Similar to agriculture, shrubland experienced a net loss of land in the MRW. Between the years of 1978 and 1998, shrubland had a net loss of 105.1 sq. mi. The largest amount of land that shrublands lost was transferred to forest. Forest cover took over approximately 96.6 sq. mi. of shrubland in the entire MRW. Urban land cover developed 14.7 sq. mi. of shrubland in the years between 1978 and 1998, while during the same time only 1.4 sq. mi. of urban land was converted back to shrubland. The MRW also experienced 10.5 sq. mi. of agricultural land transitioned into shrublands. This gain in shrubland is nearly nullified by the 8.3 sq. mi. of land that converted back to agriculture. The largest gain of shrubland was the transition of grasslands and other open lands to shrubland. The total amount added up to a gain of 37.1 sq. mi. of shrubland in the MRW. Wetlands and water were also transformed into shrubland, but the total amount of land was less than 1.9 sq. mi., which is probably an error in the classification process. Review FIG. 3 below for an overview of shrubland cover change in the MRW between 1978 and 1998.

All things considered, many of the changes that shrubland experienced in the 20 years between land use/cover studies are consistent with the stages of succession. To summarize, succession is the change in plant species that inhabit an area through out a given time. It begins with a disturbance (fire, logging, farming, etc.) and ends when the ecological system becomes stable again. This study of the MRW land use/cover is a classic example of this process since grasslands naturally transform into shrublands, and shrublands (if left unmanaged) will typically convert into forest.

Forest Cover

A forest is simply defined as an area that has a high density of trees (deciduous and/or coniferous), and must have a crown cover of at least 25%. In the MRW there was a net gain of forest totaling 59.1 sq. mi. Within the drainage basin of the Muskegon River, 82 MCDs had a gain of forested areas while 40 MCDs experienced a loss. When broken down into individual forest types, the deciduous forest had the greatest gain followed by the coniferous forest. Mixed forest experienced a net loss of area within the watershed.
Muskegon River Watershed in Relation to Other Areas in the Great Lakes

Research being conducted at Purdue University on rates and patterns of land use change in the Great Lakes Basin (see FIG. 4) has revealed that the ratio of urban expansion to population increase is about average in the MRW compared to other areas in Michigan, Wisconsin, Minnesota, Indiana, and Illinois. In general, urban is doubling in size approximately every 25-30 years. The major loser is agriculture. Forests are increasing in amounts in Michigan and Wisconsin and are declining slightly in amounts in Illinois and Indiana.

Compared to the other regions that have been studied in the Great lakes Basin (US side only), the average annual loss of agriculture is greatest in the MRW compared to areas around Milwaukee, Chicago, Detroit, and the Twin Cities. Forest gain was the largest of these regions as well suggesting that most of the agricultural loss is not directly to urban, but to forest. In fact, a major transition in the MRW is agriculture to forest, and then to urban (mostly residential).

When translated into a rate expressed as acres lost per day, the MRW lost 21.08 acres per day (average for the Great Lakes during the last twenty years is 30.2 acres per day). Residential gain was 19.1 acres per day.

Another result of land use change is that land uses are becoming more scattered (i.e., fragmented) across the watershed.

Fragmented land uses mean that transportation costs increase, management of resources across land uses becomes more complex, and natural habitat becomes segmented into smaller patches. The “patchiness of urban” in the MRW was greater than in any of the sites examined in the Purdue study (there was a tripling of urban land use patches during the 1978 to 1998 time period, far more than the other areas).

FIGURE 4.

Great Lakes Metropolitan Areas Land Use Change Study

Muskegon River Watershed (MUSKEGON) 1978-1998
Twelve county region
Aerial photography (1:6,000)

Twin Cities Metro Area (TWIN CITIES)
1980-1997
Seven county region
Aerial photography (1:6,000)

Southeastern Wisconsin Regional Planning Comm. (MILWAUKEE)
Seven county region
Aerial photography (various)

Southeast Michigan Council of Governments (DETROIT)
1975, 1995, and 2000
Seven county region
Aerial photography (various)

Northeastern Illinois Planning Commission (CHICAGO)
1980-2001
Six county region
Aerial photography (1:2,000)

Historical Photo Archive

In a separate study funded by the National Science Foundation, Purdue University researchers scanned and rectified over 500 historical aerial photos across the watershed. These aerial photos represent large areas (generally three to nine sq. mi.) of black and white snapshots of landscapes. The study has used these to calibrate and validate the back cast model. Below is an aerial photo sequence from the archive (FIG. 5).

Figure 5.

Land Use Change at US 31 and I-96 Interchange

1938
1962

For more detailed information visit our website at www.mwrp.net/