Muskegon Futures: Landuse Trend in the Muskegon River Watershed

Muskegon Watershed Research Partnership Volume 5

Introduction

At 212 miles long, the Muskegon River is the second longest river in Michigan. The drainage basin encompasses 7,057 km^2 and contains 123 Minor Civil Divisions (MCDs). The Muskegon River Watershed is slightly larger than the entire 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 landuse, urban landuse, shrublands, and forest cover. A sixth section offers some concluding remarks. Review FIG.2 below for a overview of Land Cover Change in the Muskegon River Watershed between 1978 and 1998

FIGURE 1

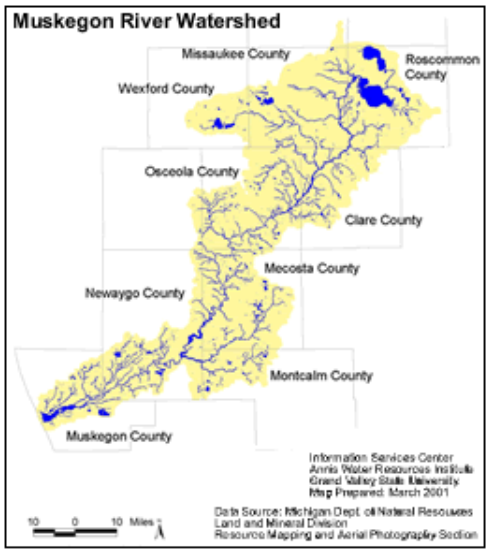
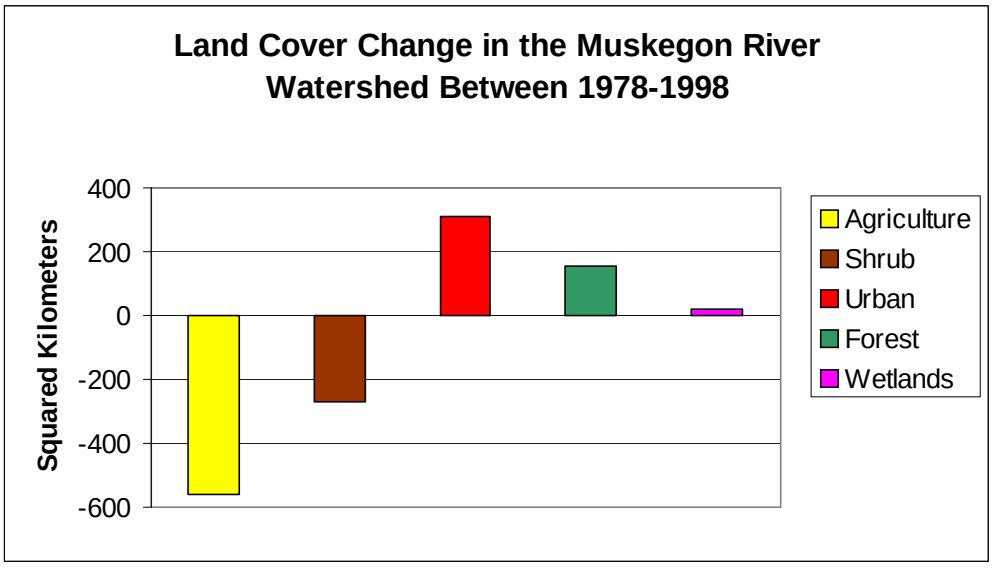


FIGURE 2. The greatest amount of change between was the loss of 561 km^2 of Agricultural land. This was countered with 307 km^2 Urban land being gained during the same period.



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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 there 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 Muskegon River Watershed 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 21 km^2. 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.


Photo Courtesy of AWRI

Agricultural Landuse

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 561.4 km^2 of agricultural land in the Muskegon River Watershed. In fact, 121 of the 123 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 years no land was classified as being used for agriculture. Of the 121 MCDs that had a change in the amount of farmland, 116 MCDs had some type of lose, including three townships (Blue Lake, Lyon, and Higgins) that lost 100% of their agricultural land.


Photo Courtesy of AWRI

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 5 km^2. 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. 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 Muskegon River Watershed.

Lastly, four MCDs in the Muskegon River Watershed 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, confided feeding, and other agricultural lands. The mean gain for these four MCDs was only 0.5 km^2.

Urban Landuse

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 121 of the 123 MCDs in the Muskegon River Watershed. There was a net gain of 307.6 km^2 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

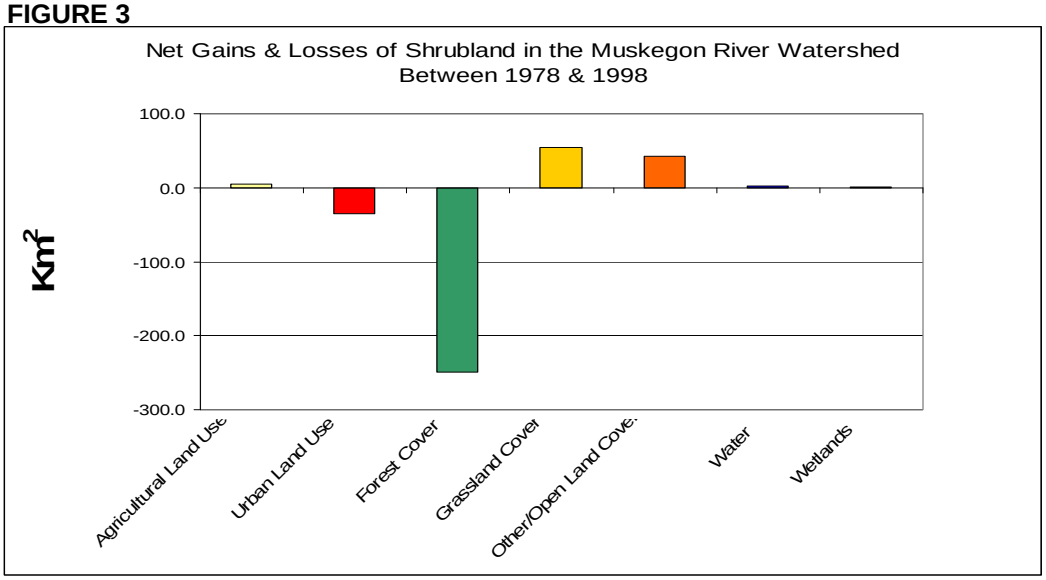
1 sq. mile = 640 acres

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 Muskegon River Watershed. Between the years of 1978 and 1998, shrubland had a net loss of 272.1 km^2. The largest amount of land that shrublands lost was transferred to forest. Forest cover took over approximately 250 km^2 of shrubland in the entire Muskegon River Watershed. Urban land cover developed 38.0 km^2 of shrubland in the years between 1978 and 1998, while during the same time only 3.5 km^2 of urban land was converted back to shrubland. The Muskegon River Watershed also experienced 27.2 km^2 of agricultural land transitioned into shrublands. This gain in shrubland is nearly nullified by the 21.6 km^2 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 96 km^2 of shrubland in the Muskegon River Watershed. Wetlands and water were also transformed into shrubland, but the total amount of land was less than 5 km^2, which is probably and error in the classification process. Review FIG. 3 below for an overview of shrubland cover change in the Muskegon River Watershed 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 Muskegon River Watershed 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.

FIGURE 3



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 Muskegon River Watershed there was a net gain of forest totaling 153 km^2. Within the drainage basin of the Muskegon River, 82 MCD had a gain of forested areas while 40 MCDs experienced a loss. White Cloud was the only MCDs that had neither a gain nor loss of forest. 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

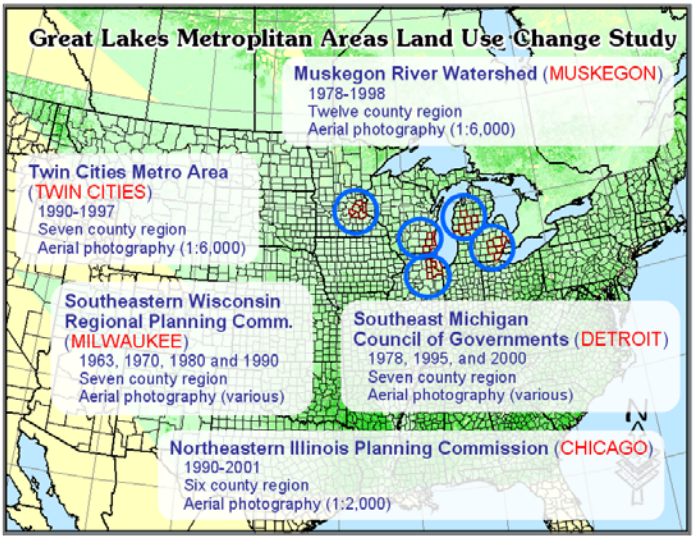
Research being conducted at Purdue University on rates and patterns of land use change in the Great Lakes Basin (see fig) has revealed that the ratio of urban expansion to population increase is about average in the MRW compared to other areas in Michigan, Wisconsin, Minnesota, Indiana and Illinois.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

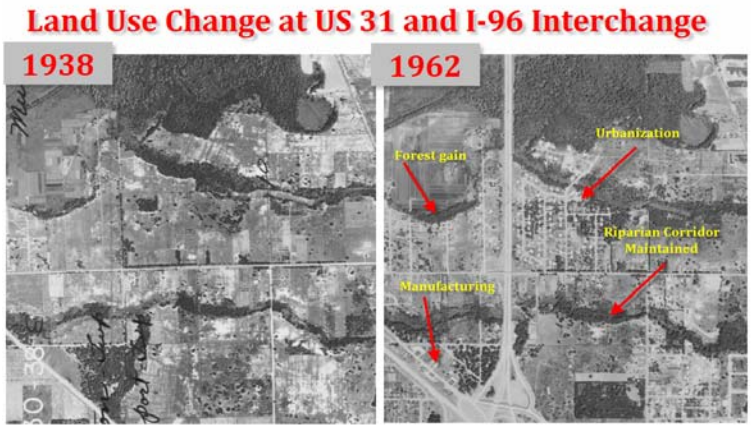
Another result of land use change is that land uses are becoming more scattered (i.e., fragmented) across the watershed.

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 greatest than any in any of the sites examined in the Purdue study (there was over a tripling of urban land use patches during the 1978 to 1998 time period, far more than the other areas).



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 3-9 sq mi) of black and white snapshots of landscapes. The study has used these to calibrate and validate the backcast model. Below is a aerial photo sequence from the archive.



The Bottom Line...

To quickly summarize the land use/cover study done on the Muskegon River Watershed there was a gain in the amount of urban shrubland, wetlands, and forest; while there was a loss in the amount of agriculture and shrubland. The gain of urban land is an alarming trend, since its total is twice as much area as the forest, which had the second largest gain of area. This may suggest that urban sprawl is becoming more of a problem in the watershed.

The rate of land use change in the watershed is about average for a Great Lakes watershed although the amount of urban fragmentation is some of the greatest in the basin. The proportion of original (circa 1978) agriculture lost was the largest of any region examined in a separate Purdue study.

On a positive note, one may be encouraged by the increase in the area of wetlands and forest through out the drainage basin.