THE REGION

MINNESOTA’S 3 BIOMES

GLACIAL LAKE AGASSIZ & THE RED LAKE RIVER

REGIONAL HYDROLOGIC DIVISIONS

GEOGRAPHIC INFORMATION SYSTEMS OVERVIEW

SEGMENT PLAN

RIVER SEGMENTS
MINNESOTA’S 3 BIOMES

Traveling the Red Lake River offers an opportunity to experience the three major biomes of the North American Continent. Each of the three biomes has distinctive plants, animals, and landscapes. The river begins at Lower Red Lake in a coniferous forest near the western edge of the coniferous forest biome. It flows westward out of Lower Red Lake through a landscape of glacial drift and lake plains of pine and spruce with some aspen. As it flows through the deciduous forest biome oak, aspen, and red maple become more common as much of this area is dominated with a wetland condition. The landscape flattens even more as the grassland biome begins. The river winds back and forth through the tall grass prairie, a biome that continues beyond the Minnesota/North Dakota border. Elm and cottonwood trees are found along the banks in this part of the river landscape.

Plant and animal communities are particularly diverse at the points where the two biomes meet each other. The three landscapes have been altered by human activity. Much of the forests have been cleared and much of the land has been drained and cultivated, yet vestiges of the original landscapes and many of the plants, birds, and animals that historically lived there are still present.
Twin Cities Metropolitan Area

RED LAKE RIVER

Mississippi River

Minnesota River

Twin Cities Metropolitan Area

CONIFEROUS FOREST

DECIDUOUS FOREST

PRAIRIE
GLACIAL LAKE AGASSIZ & THE RED LAKE RIVER

Glacial Lake Agassiz played a very important role in creating the landscapes of Northwestern Minnesota, and is the major geologic event that shaped the Red Lake River Corridor environment that is visible today. The global climate changes of the last 2 million years resulted in the advance and retreat of the glaciers in North America. Four great periods of glacial expansion are the Nebraskan, the Kansan, the Illinoisan and the Wisconsin. The last of the Wisconsin ice sheets began melting about 10,000 years ago. In most of Minnesota, surface deposits left behind by the retreating glaciers cover the older, underlying bedrock.

Glacial Lake Agassiz was formed 12,000 years ago when the Des Moines lobe of the Wisconsin ice age flowed south out of Canada. The ice sheet, more than a mile thick, blocked northward flowing rivers. A moraine left by the glacier near Lake Traverse blocked the southward movement of melting glacier waters creating Lake Aggassiz, the largest body of freshwater ever to have existed on the North American continent.

Glacial Lake Agassiz increased and decreased for 5,000 years as the ice sheet advanced and retreated. As it reached its maximum size of 135,000 square miles, or twice the size of North Dakota, approximately 10,000 years ago, Glacial Lake Agassiz drained south, spilling over the moraine and carving the present day Minnesota River Valley. As lake’s outlets eroded to lower and lower levels, the lake became shallower and diminished in size. Each receding water level left behind a beach ridge of sand and gravel formed by centuries of wave action. Eventually the receding glaciers permitted the lake’s melt waters to flow north into the present Hudson Bay.

Sediments accumulated at the bottom of the lake for thousands of years. Most of the old lakebed is covered with poorly drained soils of very fine silts and lacustrine clay of depths up to 150 feet making some of the richest soil on earth. The sandy beach ridges along the shorelines of Lake Aggassiz provide the only change in elevation in an otherwise extremely flat landscape.
EXTENT OF GLACIAL LAKE AGASSIZ

Twin Cities Metropolitan Area

Mississippi River

Minnesota River

RED LAKE RIVER
REGIONAL HYDROLOGIC DIVISIONS
RED RIVER VALLEY / BASIN & THE RED LAKE RIVER WATERSHED

The Red River Valley is located in one of the world’s flattest landscapes in what was once the southeastern portion of the Glacial Lake Agassiz. The Red River of the North meanders through this unusually flat valley at a slow rate with an average slope of one half foot per mile. The Red River of the North forms the border between North Dakota and Minnesota. It flows northward for 550 miles from Breckenridge, MN to Lake Winnipeg, Canada. Because the river is young by geological standards, it has not formed a significant floodplain-valley system which results in the lake plain becoming “the floodplain” during times of high water.” The flat topography, the minimal slope, and the lack of a well-formed floodplain all contribute to the Red River of the North’s frequent flooding from summer rain and spring snow melt.

The Red River Valley is located in the center of the Red River Basin, which extends from Southeastern South Dakota and West Central Minnesota through Northeastern North Dakota and Northwestern Minnesota to Southern Manitoba. The Minnesota portion of the basin covers approximately 37,100 square miles in Northwestern Minnesota containing all or a part of 21 counties. It is a basin of diverse terrain with flat, agricultural plains, rolling uplands of trees and lakes, and extensive wetlands.

Because it is 5,990 square miles in area, the Red Lake River Watershed is the largest drainage area in the Red River Basin both in flow volume and in size. The watershed is comprised of all of Red Lake County, most of Pennington County, and part of Mahnomen, Polk, Itasca, Marshall, Clearwater, Beltrami, Roseau and Koochiching counties. Historically the watershed was primarily wetlands and prairie. Now one-half of the watershed is tilled agricultural land. Much of it is drained with extensive drainage ditch systems. Deciduous forests, lakes, and wetland networks each cover one-fifth of the watershed. Coniferous forests and lakes cover a very small fraction of the watershed. The major tributaries within the watershed that directly contribute to the Red River are the Grand Marais Creek and the Red Lake River. The Red Lake River flows from the Upper and Lower Red Lakes, two lakes with the largest surface area in Minnesota, both of which are remnants of the Glacial Lake Agassiz.
GEOGRAPHIC INFORMATION SYSTEMS
INITIAL ANALYSIS OVERVIEW

Through the use of GIS technologies hundreds of data layers were analyzed and organized into thematic maps. This layering of information, research, and analysis formed the foundation and tools needed for the planning and design throughout the corridor. By documenting and studying the multiple assets and themes, a holistic approach to the corridor design was developed that responds to the ecological, cultural, historic and economic sustainability issues of the region. A regional resource analysis was made of the Red Lake River watershed, the analysis included the following data layers:

- Bedrock Geology
- Surficial Geology
- Infrastructure
- Elevation
- Hydrology
- Original Vegetation
- National Wetlands Inventory
- Native Plant Communities
- Biodiversity Sites
- Land Use
- Land Cover
- Population Change from 1990 - 2000
- Gap Land Ownership

These layers were used as the basis from which an ecological understanding of this region was derived. The maps produced from these layers include: Hydrology, Geological Association, Land Use, Infrastructure, Original Vegetation, Topography, and Cultural Resources. These thematic maps and a brief description are found in the index pages 164-171.
As part of the Red Lake River Enhancement Project (hereafter RLREP) land use and land use change along the Red Lake River was classified and projected forward, respectively, with the Land Transformation Model (LTM, Pijanowski, 2001). The baseline land use and projections are to be used in conjunction with the development of a master plan for the Red Lake River corridor. Specifically, a comprehensive development plan that details the development of recreational and other resources for the region is the end goal. The land use projections serve as a means to examine urbanization trends along the Red Lake River and gauge the effect of various explanatory variables and the master plan on potential future urbanization.

The study area for the RLREP is a 5 mi corridor centered on the Red Lake River from Red Lake to its confluence with the Red River in East Grand Forks, MN. The corridor is limited to Minnesota only. This area includes Crookston, Thief River Falls, East Grand Forks and part of the Red Lake Reservation.

The objectives of this study are (i) to create a spatially-referenced database that details, among other attributes, vegetation, hydrology, geology, land use, transportation infrastructure, and, ownership for the entire Red Lake River watershed in Minnesota; (ii) to classify land use along the Red Lake River in 1990 and 2000 based on LandSat imagery; (iii) to project change in land use using a 20 and 50 yr time horizon with the LTM; (iv) to analyze LTM outputs to gauge relative importance of various explanatory variables; and (v) to use the completed master plan for the region as a further input in the LTM model and quantify the effect of the master plan on urbanization.

The first objective, i.e., database creation, is complete. In contrast to the other objectives the database is referenced to the entire Red Lake River watershed. This was done to give a larger data context of spatially adjacent areas for the RLREP. The database provides a baseline on the entire watershed for the classification and projection of land use as well as an aid in the construction of the master plan. The database consists of one ArcGIS® map file with ~25 layers and is available at:
http://RedLakeRiverCorridor.org/GIS/RedLakeRiverWatershed.zip

The final objective, i.e., scenario development contingent on the master plan, is under development. The master plan is in the final stages of refinement. Once it is complete the LTM model will be used to gauge the effect of the plan on urbanization. A complete description of the Land Transformation Model is held on pages 168 - 169 of the appendix.
RED LAKE RIVER CORRIDOR URBAN LAND USE IN 2000, 2020, 2050