Tulibee Refuge Lake Conservation Easement Purchase Targeting: A GIS Analysis

Prepared in partnership with
Leech Lake Area Watershed Foundation

Prepared by
Joseph J. Mueller
Research Assistant
University of Minnesota

2015

CAP Report # 196

This report is available on the CURA website:
http://www.cura.umn.edu/publications/search
The Community Assistantship Program (CAP) is a cross-college, cross-campus University of Minnesota initiative coordinated by the Center for Urban and Regional Affairs (CURA). Funds for CAP were generously provided by the McKnight Foundation and the Blandin Foundation.

This is a publication of the Center for Urban and Regional Affairs (CURA), which connects the resources of the University of Minnesota with the interests and needs of urban communities and the region for the benefit of all. CURA pursues its urban and regional mission by facilitating and supporting connections between state and local governments, neighborhoods, and nonprofit organizations, and relevant resources at the University, including faculty and students from appropriate campuses, colleges, centers or departments. The content of this report is the responsibility of the author and is not necessarily endorsed by the Kris Nelson Community-Based Research Program, CURA or the University of Minnesota.

© 2015 by The Regents of the University of Minnesota.

This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License. To view a copy of this license, visit http://creativecommons.org/licenses/by-nc-sa/3.0/ or send a letter to Creative Commons, 444 Castro Street, Suite 900, Mountain View, California, 94041, USA. Any reproduction, distribution, or derivative use of this work under this license must be accompanied by the following attribution: “© The Regents of the University of Minnesota. Reproduced with permission of the University of Minnesota's Center for Urban and Regional Affairs (CURA).” Any derivative use must also be licensed under the same terms. For permissions beyond the scope of this license, contact the CURA editor.

This publication may be available in alternate formats upon request.

Center for Urban and Regional Affairs (CURA)
University of Minnesota 330 HHH Center
301—19th Avenue South
Minneapolis, Minnesota 55455
Phone: (612) 625-1551
E-mail: cura@umn.edu
Web site: http://www.cura.umn.edu

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.
Tulibee Refuge Lake Conservation Easement Purchase Targeting: A GIS Analysis

By Joseph J. Mueller, MGIS Candidate – University of Minnesota Twin Cities

University of Minnesota – CURA and the Leech Lake Area Watershed Foundation (LLAWF)

GIS Assistance from John Sumption (Sumption Environmental) and Jessica Watts (Cass County GIS)

January 8th, 2015

This project had two primary goals:

1. To develop multiple address tables for a general mailing campaign in northern Minnesota’s Aitkin, Cass, Crow Wing and Hubbard Counties to attempt to locate property owners interested in converting their land under a perpetual conservation easement, and

2. To develop specific maps for the 38 identified Tulibee preserve lakes and their surrounding land, in order to identify specific parcels for possible conservation easement purchase.

The potential land purchase decision method was based on scores calculated through GIS analysis in order to determine the specific targeted parcels with their corresponding addresses to contact the land owners. The project data was acquired from the Leech Lake Area Watershed Foundation (LLAWF) as well as the associated county governments for Aitkin County, Cass County, Crow Wing County and Hubbard County and the Minnesota Department of Natural Resources (DNR). The ESRI ArcMap 10.2 program was utilized for all GIS analysis and map production.

The project was conducted to assist the protection of 38 Tulibee refuge lakes, identified by the Leech Lake Area Watershed Foundation. Tulibee is a fish species which comprises the food-chain foundation for many northern Minnesota game fish, e.g., Northern Pike and Walleye. Tulibee fish are extremely sensitive to changes in water temperature, suspended particle loads, and pollution. By protecting the land around the identified habitat lakes, the goal is to preserve the water that flows into each identified lake, protecting water quality and the Tulibee’s environment. Hopefully, with the added protection, Tulibee fish will continue to thrive and survive in a rapidly changing climate and an increasingly developed Minnesota while at the same time continuing to provide the foundation for the game fish of northern Minnesota.
The project’s first goal to develop general address tables for parcels larger than 10 acres, fell within one of the large-minor watersheds (HUC-8) which intersected with an identified Tulibee refuge lake and was either (a) within 50 feet of a lakeshore or (b) greater than 50 feet from a lakeshore. Parcels that were adjacent, or close to public, lands were also included in this analysis with the goal of creating protected environmental corridors for wildlife. This analysis was initiated by acquiring data from the various described entities discussed above. From the DNR Data Deli, GIS data of various State and Federal lands was downloaded for usage. The State and Federal lands shapefiles were merged together to create a unified protected-public lands feature class. From the lake shapefile from the county, the identified Tulibee lakes were selected and exported as a new feature class. Next the Select by Attribute function was utilized to select features from the minor watersheds where the source layer was of the county_lakes_selection feature class that are within a distance of the source layer feature by 10 feet. This selected all the relevant HUC-8 watersheds. These were then exported as a new feature class. The next step was to clip the parcel layer from the county to the newly made watershed selection feature class. From the clip output, the table was opened and the parcels greater than 10 acres were selected. Then after clicking on the button to see only the selected features in the table, under the table options the ‘Export’ option was clicked on. Export only selected features was chosen, and the table was exported to a specific file geodatabase called ‘Tables’. The table was then brought into the map. In the tool search tab, I searched for the tool ‘Table to Excel’. This brought up that tool, which was used to export the solo selected features table to an (.xls) Microsoft Excel file. Once the export completed, I opened the Excel document and removed unnecessary columns, leaving only the ObjectID, Address1, Address2, Address3, Address4 and Parcel Number. Then one final step was to use the ‘Remove Duplicate Data’ function to remove repeating address entries, so only unique addresses to contact remained. This was then saved and emailed to the LLWAF. This process was repeated for each lake in each county.

The project’s second goal was to develop 38 maps and address tables for the immediate area around each of the identified Tulibee refuge lakes in order for the LLAWF to target specific parcels for possible conservation easement purchase. The targeting would be based on scores generated for various categories that would then be totaled. The categories with their point values and ranges were provided by the LLAWF and included points based on acreage, shoreline footage, development potential, percent developed and whether wetlands were present on the parcel. Wetland data came from the DNR. In order to create a feature class with parcel and wetland data together, the best method discovered was to use the geoprocessing tool ‘Union’ to combine the parcel and wetland feature
classes. Once this was done, the feature class ParcelWetland_Union1 was created, which had all of the parcel physical, contact and value information as well as wetland data. The next step was to open the table for this new feature class and create several new fields (all of them in the ‘double’ format):
ParAcres, WetAcres, Total Acres, DevPoten, PercDevPot, DevPotPts, PercDevPotPts, AcrePts, WetPresentPts, AdjPubProd and InitialTotalPts. I then started an edit session and utilized the field calculator to fill in each column. For ParAcres and WetAcres it was a simple transfer of data from other columns in the same table. TotalAcres was ParAcres + WetAcres. DevPoten was calculated by doing ParAcres – WetAcres. PercDevPot was calculated by doing ParAcres/TotalAcres as an approximation. The point values were entered by using select by attribute to find values in the given range, and then use the field calculator to assign the correct amount of points for that range of values. WetAcre points were assigned if WetAcres>0. For AdjPubPro, the select by location function was again used to find any parcels that fell within or adjacent to protected land areas. These areas were given a set amount of points. In any of the point fields created, <NULL> field entries were recalculated to equal 0. Once that was done, all of the point (...Pts) columns were added together to calculated the InitialTotalPts. After saving edits and exiting the edits session, the map document was saved to be safe. The next step was to enter the symbology properties for ParcelWetland_Union1. Going to ‘categories’ and choosing InitialTotalPts as the field to be mapped. A suitable color ramp of green to red was chosen, and the color’s flipped so that red showed the highest values. In the legend description area, the values were changed to show “Tier 5 – Lowest Conservation Priority” to “Tier 1 – Highest Conservation Priority”. To make sure all the records were being used, Jenks statistical method was used and the sample changed to 1,000,000 records. Next shore footage was calculated following the following methodology:

I first selected all parcels that were within 50 feet of a lake, then exported them to create a new shapefile (Lake_Properties). From that new shapefile, I then deleted all polygons that were row (in Cass they are coded 99-999-9999 in the parcel number field), and then selected all the water polygons from that new shapefile (they are coded as 0 in ownership with the DNR# in the parcel field) and exported those into a new shapefile called LakeFrontageLakes. Once exported, I also deleted these from the Lake_Properties shapefile also.

I then used the Geoprocessing>Buffer tool to create a buffer of the LakeFrontageLakes polygon (10 feet/Outside only) and named it LakeFrontageLakes_BufferOutside (creative aren’t I ?), then I used the Geoprocessing>Intersect tool to break that buffer along the parcel lines (Input = Lake_Properties and LakeFrontageLakes_BufferOutside) to create the shapefile LakeFrontageCalculated.

Within that shapefile I created two fields...Perimeter and FrontFeet. I used calculate Geometry option to calculate the perimeter in feet, then calced the FrontFeet field to equal ([Perimeter]-20)/2.

- Jess Watts, Cass County GIS Department.
The points for lake frontage were then competed using the field calculator. LakeFrontageCalculated feature class was then joined to ParcelWetland_Union1 feature class. A new field was created called TransferPts where the field calculator was used to transfer the points from the original LakeFrontageCalcualted FootagePts field. The join was then removed, and a new field created in ParcelWetland_Union1 called TotalPts. This was then calculated in the field calculator with InitialTotalPts + TransferPts. The edit was saved and closed and the map was then saved and refreshed.

I then went to the label properties for the feature class, and changed it so all labels were done the same way, with the field of parcel number used as the labeling field with a font of 12 Aerial Bold. I changed the placement properties so to be horizontal only with duplicates removed. Once I clicked ok, I then went back into the table and exported all parcels with scores lower than Tier 1 or Tier 2. Parcels with acres less than 3 were also exported. I then deleted those parcels from the ParcelWetland_Union1 feature class that were less than 3 or lower in score than Tier 2. Next I activated the labels for the feature class, and converted the labels to annotation so I could move them around for ease of reading. I then entered an editing session and deleted the annotations that were for public-lands. Finally I added a title, information box (with name, date, projection, foundation information) and legend and exported the map. The LLAWF requested no north-arrow or scale-bar. Once the map was exported to a PDF, I selected all parcels within the extent of the map that fell within the Tier 1 or Tier 2 scores. These records were then exported to a new table, which was then used as the input for the ‘Table to Excel’ tool. Finally, the Excel document was opened and unnecessary records removed so that only ObjectID, ParcelNum, Address1, Address2, Address3, Adress4, ParValue and TotalPts fields were present. Repeating addresses were not removed from the table by request for the LLAWF. These steps were followed for all lakes, and the LLAWF provided with all maps and address tables.
CWCH - Conservation Parcel Prioritization: Pleasant Lake, Cass County

Joseph Mueller
1/6/2015
NAD83-MN Central State Plane
U of M - CURA
Leech Lake Area Watershed Conservation
CWCH - Conservation Parcel Prioritization: Big Trout Lake, Crow Wing County

Joseph Mueller
1/8/15
UTM 15N
U of M - CURA
Leech Lake Area
Watershed Conservation Foundation
CWCH - Conservation Parcel Prioritization: Big Sandy Lake, Aitkin County

Parcels Less than 3 Acres

Public Lands

Tier 5 - Lowest Conservation Priority

Tier 4

Tier 3

Tier 2

Tier 1 - Highest Conservation Priority

Parcels Less than 3 Acres

Joseph Mueller
1/5/15
NAD83-HARN
U of M - CURA
Leech Lake Area Watershed Conservation Foundation