Abstract:

Classification of lake clarity, a key indicator of water quality, using Landsat satellite imagery has proven to be an accurate and economical method to monitor the condition of lakes in Minnesota. The University of Minnesota's Remote Sensing and Geospatial Analysis Laboratory, with support from the Minnesota Pollution Control Agency (MPCA), Legislative and Citizens Commission on Minnesota Resources, and the National Aeronautics and Space Administration, has developed the capability for using satellite remote sensing to classify the clarity of over 10,500 Minnesota lakes.

This GIS data set includes water clarity measurements assembled from Landsat imagery, primarily Thematic Mapper and Enhanced Thematic Mapper Plus, for Minnesota lakes larger than eight hectares in surface area contains data on more than 10,500 lakes at five-year intervals over the period 1985-2005 that are documented in Olmanson et al. 2008 and two subsequent assessments for 1975 and 2008. Background information and additional documentation for the Water Clarity data can be accessed at www.water.umn.edu. The 1975 assessment was conducted using the older Landsat Multi-Spectral Scanner (MSS) imagery and should be used with caution since it may not be as reliable as the other datasets. The reliability of the 1985-2005 data was evaluated by examining the precision of repeated measurements on individual lakes within short time periods using data from adjacent overlapping Landsat paths and by comparing water clarity computed from Landsat data to field-collected Secchi depth data. The agreement between satellite data and field measurements of Secchi depth within Landsat paths was strong (average R^2 of 0.83 and range 0.71-0.96). Relationships between late summer Landsat and field-measured Secchi depth for the combined statewide data similarly were strong (r^2 of 0.77-0.80 for individual time periods and r^2 = 0.78 for the entire database).

The 1985-2005 database was analyzed statistically for spatial distributions, temporal trends, and relationships with both in-lake and watershed factors that potentially affect lake clarity. The water clarity at the state level has been relatively stable; 4.6% of lakes had increased clarity and 6.2% decreases from 1985 to 2005. However, there are strong geographic patterns with lower clarity in the south and higher clarity in the north. Deeper lakes tend to have higher clarity and are more stable than shallow lakes. Lakes in forested areas have higher clarity, while agricultural and urban land uses are associated with lower clarity (Olmanson et al. 2013).

Purpose:

The data set was created as part of the Minnesota Pollution Control Agency's Environmental Data Access System, which allows for public access to surface water monitoring data.

ATTRIBUTE FIELD DETAIL:

unmlknum: Updated 2010 UMN lake number and the only unique ID for all 12,193 polygons

umnlknum_o: The original UMN lake number from polygon layer created in 2000

dowlknum_1: umnlknum centerpoint linked to the dow lake number from December 2010 DNR lake polygons - this is the number to link to other DNR data - Note there may be multiple polygons with the same dowlknum since the umnlknum polygons are at a finer scale for some lakes

RNAME_1: Name of the waterbody associated with the lake polygon.

PWI_CLASS: Public Waters Inventory (PWI) class as defined by Bulletin No. 25 - An Inventory of Minnesota Lakes
http://www.dnr.state.mn.us/waters/watermgmt_section/pwi/bulletin25.html

AREA_BASIN: Lake area in acres from Bulletin No. 25 - An Inventory of Minnesota Lakes

WETTYPE: Public waters wetlands type 3, type 4, and type 5 wetlands (as defined in U.S. Fish and Wildlife Service Circular No. 39, 1971 edition)

X_UTM: Map coordinate from Bulletin No. 25 - An Inventory of Minnesota Lakes

Y_UTM: Map coordinate from Bulletin No. 25 - An Inventory of Minnesota Lakes

PolyAcres: Polygon area in acres calculated from the lake polygon.

1985MIN: e.g. Minimum water clarity in meters for that lake for the 1985 time period. These were calculated from all Landsat images used to estimate water clarity for that time period. Zeros are no data and need to be removed if calculating any statistics.

1985MAX: e.g. Maximum water clarity in meters for that lake for the 1985 time period. These were calculated from all Landsat images used to estimate water clarity for that time period. Zeros are no data and need to be removed if calculating any statistics.

1985MEAN: e.g. Mean water clarity in meters for that lake for the 1985 time period. These were calculated from all Landsat images used to estimate water clarity for that time period. Zeros are no data and need to be removed if calculating any statistics.

MIN2008: Minimum water clarity in meters for that lake for the 2008 time period. These were calculated from all Landsat images used to estimate water clarity for that time period. Zeros are no data and need to be removed if calculating any statistics.

MAX2008: Maximum water clarity in meters for that lake for the 2008 time period. These were calculated from all Landsat images used to estimate water clarity for that time period. Zeros are no data and need to be removed if calculating any statistics.

SDM2008: Mean water clarity in meters for that lake for the 2008 time period. These were calculated from all Landsat images used to estimate water clarity for that time period. Zeros are no data and need to be removed if calculating any statistics.

CITATIONS:

Olmanson, L.G., Bauer, M.E., and Brezonik, P.L. 2013. Geospatial and Temporal Analysis of a 20-Year Record of Landsat-Based Water Clarity in Minnesota's 10,000 Lakes. *Journal of the American Water Resources Association.* 1-14. DOI: 10.1111/jawr.12138

Olmanson, L.G., Bauer, M.E., and Brezonik, P.L. 2008. A 20-year Landsat water clarity census of Minnesota's 10,000 lakes. *Remote Sensing of Environment.* 112(11):4086-4097.

DISTRIBUTION DISCLAIMER:

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