SOIL RATING FOR NITRATE (LEACHING INDEX)

INTRODUCTION

This section provides a way to determine the degree to which water percolates below the root zone in certain soils. Percolating water containing dissolved nitrates or other soluble nutrients could be a hazard to ground water. This method is based on a Leaching Index (LI).

For areas with ground water concerns, soil ratings based on the LI should be determined to evaluate the potential for contaminating ground water with soluble nitrates.

LEACHING INDEX

The LI is a qualitative indicator of the potential for nitrates to leach below the root zone and potentially reach ground water. It is defined as the average annual water amount (in inches) predicted to leach below the root zone with the potential of carrying soluble nitrates. The LI uses annual precipitation, rainfall distribution data and hydrologic soil group.

Climatic data was used for weather stations located in the county, where possible. If no weather station data was available for a county, data from and adjacent county was used. The weather data was obtained from the NRCS Parameter-elevation Regressions on Independent Slopes Model (PRISM) climatic data, and reflects weather data collected from 1977 through 2000. The LI uses average annual precipitation, plus the proportion of annual precipitation that falls between October and March (i.e., the non-growing season).

The hydrologic group for each map unit reflects the drainage condition expressed in the map unit description in the SSURGO database. Hydrologic unit ratings are based on the soil profile (maximum depth of 80 inches).

The LI ratings for hydrologic soil groups A, B, C and D have been developed. Soils with dual hydrologic group ratings such as A/D should be evaluated on the basis of the current drainage status. For example, if a soil map unit has a hydrologic group B/D, the LI rating for hydrologic group B should be used if the field has subsurface drainage. If the field is undrained, the LI rating for hydrologic group D should be used.

The LI does not account for irrigation. If irrigation is applied only to supply plant needs, there will be little additional loss below the root zone. The additional loss would be relative to the precipitation events after the soil profile is saturated or nearly saturated after irrigation.

PROCEDURE

1. The ‘[COUNTY]_ToolkitGIS_Template” ArcMap project templates now contain an additional layer named “Potential Nitrate Leaching Risk (mi[FITS]). This layer contains LI rating features for the entire county (Figure 1).

Areas of high potential risk are displayed in red, medium risk in yellow and low risk in green. Cross-hatching indicated areas where potential risk is dependent on drainage status – the background color representing the ‘drained’ rating and the hatch color representing ‘undrained’ status. Planners should determine whether the field is drained or undrained and choose the appropriate LI based on current drainage. Soil map units or surface features without hydrologic group ratings (e.g., pits, urban soils, water, etc.) are listed as “Not Rated” and are shown in grey. Some areas in the state are blank (No Data Available) where the nationally-developed PRISM data does not overlay correctly with the more detailed SSURGO data, or in areas of variable land cover, such as along coastal areas. Planners should use their professional judgment in estimating LI for areas with incomplete data.

Planners can overlay the field boundaries on the LI layer to determine the LI for the field, using their professional judgment to estimate LI based on predominant soil type (Figure 3). NOTE: Some counties have 'breaks' in LI ratings based on transition zones in the PRISM data set. This was a weakness of using a national data set (PRISM) with local (SSURGO) data. Planners should use their professional judgment in estimating LI for areas with this data limitation.

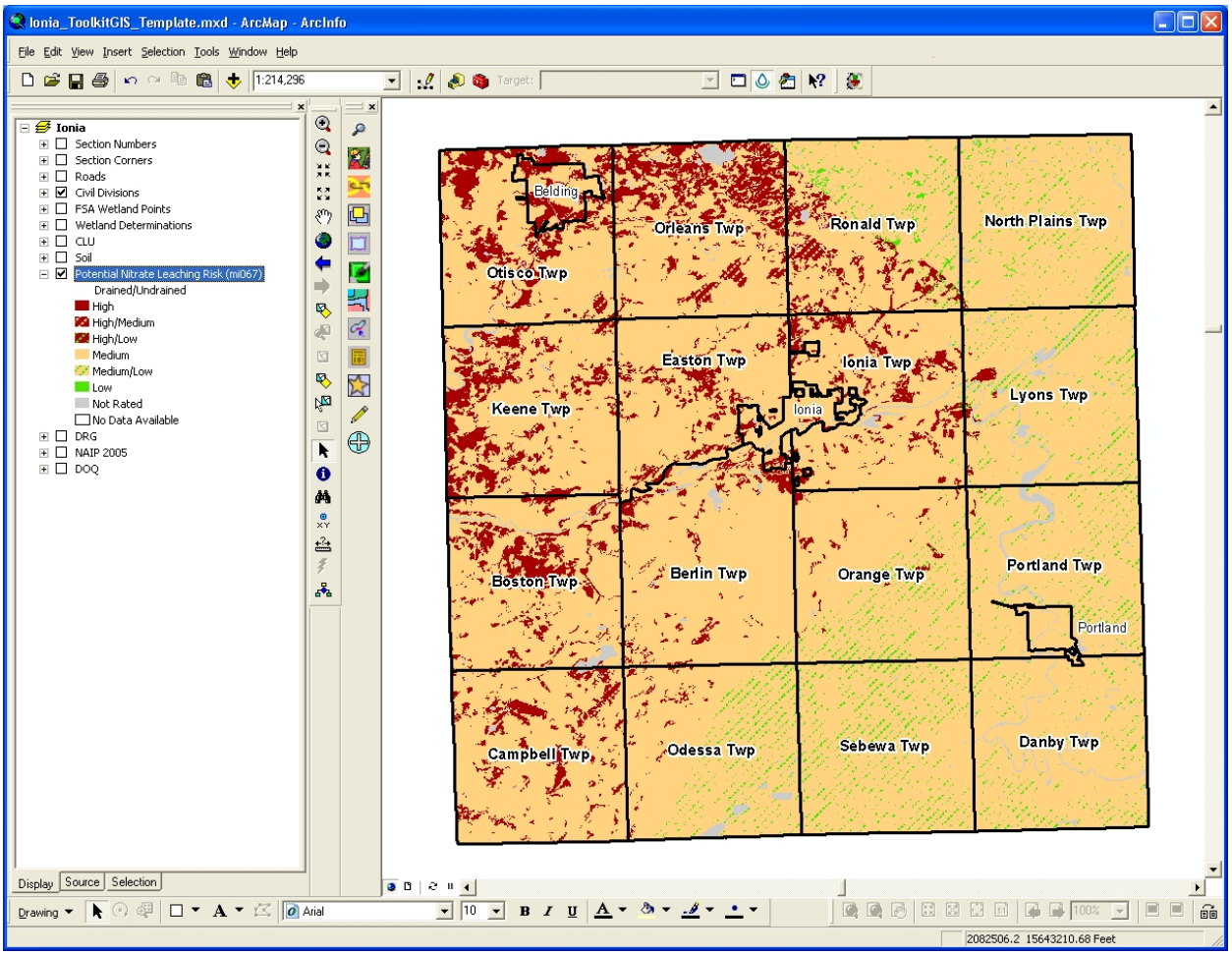

Figure 1. Sample LI display for Ionia County. Potential Nitrate Leaching Risk (Leaching Index) is shown by soil map unit.

Figure 2. Key for Potential Nitrate Leaching Risk (Leaching Index) showing ratings by color. Cross-hatching indicated areas where potential risk is dependent on drainage status – the background color represents the 'drained' rating and the hatch color represents 'undrained' condition. Soils with no hydrologic unit rating are shown as Not Rated in grey. Areas without climatic data are left blank (No Data Available).

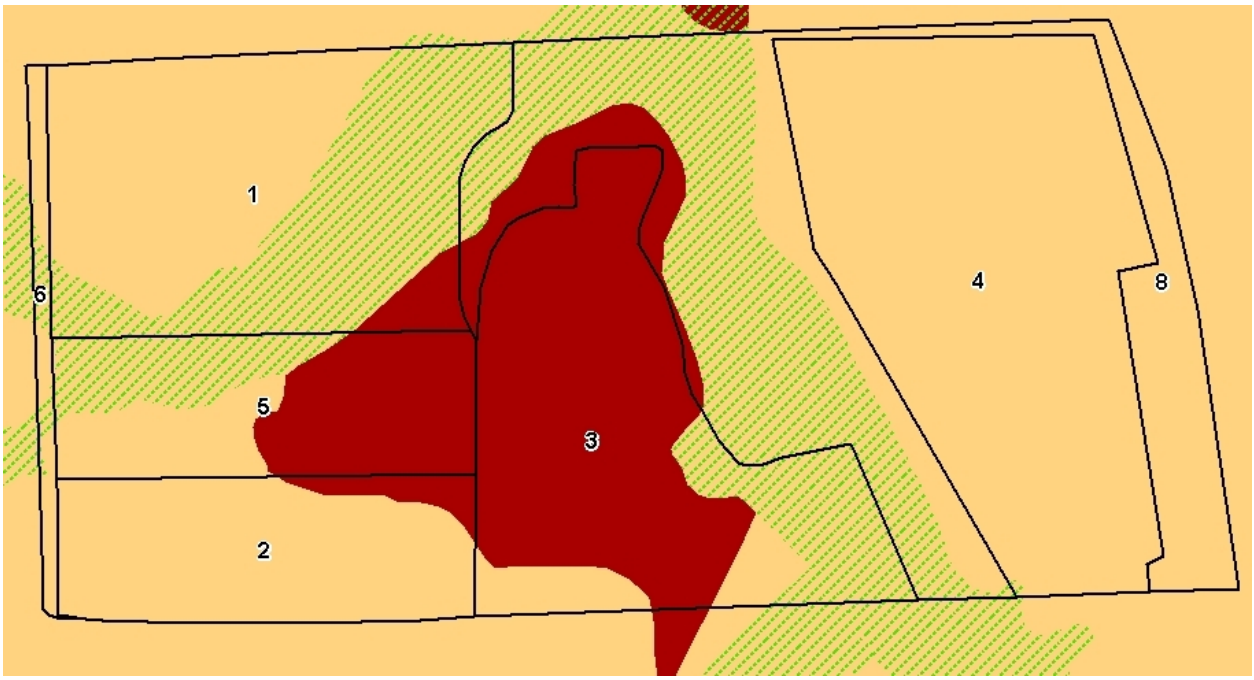

Figure 3. Sample fields with Potential Nitrate Leaching Risk (Leaching Index) shown. Field 3 would have a predominant LI of High. Field 1 would have a Medium risk rating if drained or Low risk rating if undrained.

2. The **LI Rating Maps** were developed for use if the geospatial data is not available. These state maps can be found in the FOTG, Section II, Water Quality and Quantity. When using the state maps, follow these steps to determine the LI of the predominant soil for a field or planning unit:

1. Find the soil's hydrologic group. Hydrologic groups are located in each county's soil survey or SSURGO database.

2. Locate the LI Rating for each that group.

3. From the map, based on the soil location in the state, determine the risk of leaching.

The LI component of the Manure Application Risk Index (MARI) can also be used to determine LI for a field. See Michigan Technical Note #37, "Using the Michigan MARI Excel Spreadsheet for Nitrogen Leaching Index Inventory and Evaluation", found in Section I of the FOTG.

GUIDELINES FOR RECOMMENDATIONS

A LI 0 – 2 inches has a **low-risk rating** and would probably not contribute to nitrate leaching below the root zone.

A LI 3 – 9 inches has a **medium-risk rating** and may contribute to nitrate leaching below the root zone. A nutrient management plan for nitrogen is needed.

A LI 10+ inches has a **high-risk rating** and there is a high probability of nitrate leaching below the root zone. A nutrient management plan for nitrogen should be developed, including a nutrient budget plus other management and conservation practices to reduce nitrate leaching.

Consult the current version of the Nutrient Management (590) practice standard for guidance on nitrogen management.

REFERENCES

Williams, J.R. and D. E. Kissel. 1991.'Water Percolation: An Indicator of N Leaching Potential', *in* Managing Nitrogen for Groundwater Quality and Farm Profitability, R. F. Follett, D. R. Keeney, R.M. Kruse, Editors. Soil Science Society of America, Inc., Madison WI

"The NRCS PRISM Climate Mapping Project" http://www.prism./oregonstate.edu/docs/przfact.html