

Report as of FY2006 for 2006WI146G: "Identifying High-Infiltration and Groundwater Recharge Areas"

Publications

Project 2006WI146G has resulted in no reported publications as of FY2006.

Report Follows

Annual Progress Report

Reporting Period: 7/1/2006 - 6/30/2007

Submitted By: Jim Hurley

Submitted: 7/2/2007

Project Title

WR06R004: Identifying High-Infiltration and Groundwater Recharge Areas

Project Investigators

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Progress Statement

Our proposal described a plan to produce relative infiltration maps for Dane County, Wisconsin using a weighting-and-rating of several GIS data layers. For example a site with high soil permeability, deep bedrock, and a deep water table could be expected to have a high infiltration rate relative to a site with less permeable soils, shallow bedrock or a shallow water table. Instead of using a weighting-and-rating system, we have decided to develop pedotransfer functions (PTFs), which predict saturated hydraulic conductivity (Ksat) from other soil properties. This approach will allow us to make quantitative comparisons between predicted and measured Ksat values.

We have developed a detailed plan to follow this approach. We will be developing broad-scale pedotransfer functions using the Wisconsin records in the National Cooperative Soil Survey (NCSS) pedon database. These PTFs will allow us to estimate Ksat from basic soil properties (such as texture and bulk density) available for each soil mapping unit in the National Soil Information System (NASIS) database for Dane County. We will be testing these PTFs with locally-collected Ksat measurements. These data will be used to develop fine-scale pedotransfer functions that include topography and land use as predictors of Ksat (in addition to soil properties). The availability of high-resolution digital data sets for these properties (a 10m-resolution county Digital Elevation Model, for example) will allow us to predict Ksat at resolutions finer than the soil mapping unit.

An important research question is whether or not we will be able to collect enough local data to develop models that predict Ksat with greater accuracy than existing models/databases (such as the NASIS database, which includes estimated Ksat values for each soil mapping unit). Since Ksat can vary by orders of magnitude over short distances (due to the presence of macropores, for example), numerous measurements are required to determine a representative value for a given area. We will be testing a new type of infiltrometer in this study- a rectangular steel frame that is 1m long, 0.5 m wide and 0.3m deep. We anticipate that this large sample area will be sufficient to capture more of the fine-scale spatial variability of Ksat, as compared to a smaller instrument, such as the single-ring infiltrometer (10-inch diameter). This should reduce the number of replicates needed to characterize the Ksat of an area.

This summer we will be collecting an initial set of local Ksat measurements. We have selected a watershed that is representative of Dane County in terms of land area percentages in classes of both estimated Ksat and land use. This watershed was sampled intensively in 2004 and 2006 for another project. Complete profile descriptions and chemical analyses of surface soil samples were done for nearly 500 locations. A subset of these (60 points) was selected randomly, stratified into 9 classes (3 for

estimated Ksat and 3 for land use). The number of points in each class is roughly proportional to the land area percentages for that class. For this stratification, Ksat estimates were made using the textural class and bulk density of the surface horizon for the corresponding soil mapping units in the NASIS database. A table of national averages for Ksat in each textural class of both high and low bulk density was used to estimate Ksat. Land uses categories were determined from a GIS data layer developed by the Dane County Regional Planning Commission in 2005.

Impacts

Description Fieldwork for the project only began in May 2007, so results and impacts have not yet been generated. The test infiltrometer described above is a UW innovation. Thus far, it appears to be superior to traditional methods for measuring in-field infiltration. It was vetted with a multi-agency group of infiltration specialists at the recent national conference of the National Cooperative Soil Survey. This group thought it was a useful direction and may eventually incorporate it or similar idea in national soil testing standards.

Committees, Memberships & Panels

Group Name Infiltration working group of the National Cooperative Soil Survey
Description
Start Date
End Date

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Presentations & Public Appearances

Title Identifying High Infiltration and Ground Water Recharge Areas in Dane County, Wisconsin - an Integrated Field/GIS Study.
Presenter(s) Stiles, Cynthia A.
Presentation Type Professional meeting
Event Name National Cooperative Soil Survey Conference.
Event Location Madison, WI.
Event Date 6/6/2007
Target Audience Federal agency
Audience Size 150

Description

Students & Post-Docs Supported

Student Name Kathleen Arrington
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Advisor Name Steve Ventura
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Degree PhD
Graduation Month May
Graduation Year 2009
Department Soil Science
Program Soil Science
Thesis Title Identifying High Infiltration Areas
Thesis Abstract