

# **Computer-assisted Nutrient Management Planning: One Way to Cope with New Rules, Regulations, the Increasing Cost of Commercial Fertilizer, and the Increasing Value of Manure**

Brad C. Joern, Philip J. Hess, and Brad Eisenhauer  
Department of Agronomy, Purdue University, West Lafayette, IN

## **Introduction**

Comprehensive nutrient management plans (CNMPs) have been part of USDA-NRCS cost-sharing programs for nearly a decade. The recently released EPA CAFO rule also has a nutrient management plan (NMP) requirement for their NPDES permit program. We anticipate that NMPs will eventually be required for all crop and livestock producers. NMPs are complex, computation-intensive documents, so software tools that can ease the computational burden for the planner will speed up the planning process significantly. In this paper we share the progress we have made with computer-assisted NMP development and outline our current thoughts on how best to prepare NMPs and CNMPs.

## **Software Overview**

*University of Missouri Clipper:* The University of Missouri Center for Applied Research and Environmental Systems (CARES) has developed a Web-based application planner one can use to select and download all of the site-specific spatial and tabular data needed to generate CNMPs and NMPs. This Web-based application serves as a “one stop shopping” site for all planners in all states, eliminating the need for planners to search for similar single-state sources of information.

*MapWindow GIS with MMP Tools:* MapWindow GIS is a free software tool that does not require any external GIS program. We have added an MMP Tools plug-in to MapWindow GIS, so planners can generate all of the required maps and spatial information currently required in CNMPs and NMPs.

*Purdue University's Manure Management Planner (MMP):* MMP is the only software tool supported nationally by NRCS to help technical service providers (TSPs) develop CNMPs that meet NRCS program requirements. MMP also is specifically mentioned in the new EPA CAFO rule as a tool that can be used to develop NMPs that meet USEPA CAFO Rule permit requirements. MMP is currently programmed for use in 34 states to help agricultural professionals develop CNMPs and NMPs. The planner enters information about the operation's fields, crops, storage, livestock, and application equipment. MMP helps the user allocate commercial fertilizers and livestock manures (where, when, and how much) on a monthly basis for the length of the plan (1-10 years) using state-specific fertilizer recommendations and manure nutrient availability algorithms. This allocation process helps determine if the current operation has sufficient crop acreage, seasonal land availability, manure storage capacity, and application equipment to manage the manure produced in an environmentally responsible manner. MMP also generates draft NMPs that satisfy both NRCS and EPA NMP requirements. With minimal additional inputs, the planner can generate a state-specific NMP that has a consistent national format template.

## **Streamlining the Plan Development Process**

We have made several significant advances to further simplify and automate NMP development. We use the term connectivity to describe our general approach to seamlessly link all of the tools used in NMP development. Connectivity helps to standardize the steps and the data sources that planners use to create NMPs. By standardizing the steps, data sources, and software used to create plans, we hope to eventually develop a process for archiving plans so that they can be re-created at a later date, if necessary. We have a great deal of work to do before we optimize the planning process, but we have made progress.

We believe that using the University of Missouri Clipper application is an excellent first step in standardizing the planning process. The Clipper allows planners to zoom in to their areas of interest using tools just like Google Earth. Once they have located the area of interest, they simply draw a box around the area and download a .zip file that includes the aerial photograph, the digitized soil boundaries, and the tabular soils, climate, and crop managements needed to run Universal Soil Loss Equation, version 2 (RUSLE2). If a topographic map of the area is available that will be included in the .zip file as well.

A wide variety of GIS options are available to planners. We initially developed the MMP plug-in for the MapWindow GIS so we would have a tool available for training purposes. As we became more involved in developing this tool, we found several shortcomings in existing GIS applications that we felt we had to address to optimize the nutrient management planning process. Some of these shortcomings include the ability to draw (1) sensitive features like wells, streams, and ponds, (2) state-specific manure application setbacks, and (3) conservation practices like animal walkways, grassed waterways, and terraces. Another major shortcoming in many GIS tools is that they do not have a way to export the data to MMP. We have solved these GIS tool challenges by developing our own MapWindow-based tool that is specifically developed to work with the University of Missouri Clipper application and MMP. Our MapWindow-based GIS is directly linked to the national manure application setbacks database being developed by the University of Missouri and NRCS.

We have linked MMP to the NRCS Revised Universal Soil Loss Equation, version 2 (RUSLE2) for all 34 supported states and we have programmed state-specific risk assessment tools (most of these are phosphorus indexes, PIs) in 21 states. Both RUSLE2 and state risk assessment tools must be used to develop NRCS CNMPs and EPA permit NMPs. We also have worked with NRCS and EPA to develop the national CNMP/NMP template so that an NRCS CNMP can be used to meet national EPA permit NMP requirements.

### **Step-By-Step Plan Development Process**

In this section we describe our current thoughts on how to develop CNMPs/NMPs using the University of Missouri Clipper application, MapWindow GIS with MMP Tools, and MMP. Because the details for each step in the process are documented in the user guides for our MapWindow GIS with MMP Tools (Using MapWindow GIS with MMP Tools) and MMP (Getting Started with Manure Management Planner), we will only outline the process here. Please visit the MMP Web site <http://www.agry.purdue.edu/mmp> for links to all of these tools and our user guides.

Our current thoughts on the steps that should be used to create a CNMP or NMP are:

- (1) Acquire GIS base data with University of Missouri Clipper

- (2) Draw GIS linework
- (3) Develop nutrient management plan in MMP
- (4) Export draft conservation plan from GIS and MMP
- (5) Bring draft conservation plan into Toolkit and finalize it
- (6) Generate CNMP/NMP with MMP
- (7) Archive CNMP
- (8) Implement CNMP

*Step 1: Acquire GIS base data with University of Missouri Clipper*

The Clipper Web site is <http://projects.cares.missouri.edu/snmp/nrcsdata/aoilist.asp> and using this tool is similar to using Google Earth. The .zip file is automatically created with a filename selected by the planner.

*Step 2: Draw GIS linework with MapWindow GIS with MMP Tools*

MapWindow GIS with MMP Tools will automatically unzip the Clipper download file, open, and display all data layers. It also will supply MMP with the RUSLE2 databases when the data are exported to create an MMP file. The planner must remember where they saved the Clipper .zip file! MapWindow GIS with MMP Tools can then be used to:

- (1) Draw and identify fields on an aerial photo of the farm.
- (2) Calculate the acreage of each field.
- (3) Display and identify soil types.
- (4) Draw sensitive features and add manure application setbacks, and then calculate spreadable acreage for each field.
- (5) Draw conservation practices.
- (6) Draw travel lanes from fields to storage.
- (7) Optionally, if you have an operation that was laid out with SNMP GIS (version 1.1 for ArcView 3.x), you can import its layers and data rather than drawing everything again.
- (8) Export field names, acreages and soils to an MMP plan ([www.agry.purdue.edu/mmp](http://www.agry.purdue.edu/mmp)).
- (9) Print or export a map of the fields suitable for use in a comprehensive nutrient management plan (CNMP) or other nutrient management plan.

*Step 3: Develop nutrient management plan in MMP*

Soil test, crops, RUSLE2, animals, storage, manure analyses, and equipment information are added in MMP while the rest of the field information will automatically be populated by the GIS if drawn (for example, application setbacks, buffer strips, and distance to water). The bulk of the planning is done during the allocation process. Planners often must change tillage practices in the RUSLE2 crop management editor to decrease erosion and stay within acceptable risk assessment tool limits.

*Step 4: Export draft conservation plan from GIS and MMP*

We hope to minimize planner dependencies on NRCS field office staff as they begin the plan development process, so information from MapWindow GIS with MMP Tools and MMP (including the RUSLE2 managements that you select or create) are used to automatically generate a draft conservation plan.

*Step 5: Bring draft conservation plan into Toolkit and finalize it*

Until an automated process, currently under development with NRCS and at least two private vendors, is developed, the planner must bring the draft conservation plan to the NRCS field office so any new practices can be scheduled. This may be done electronically, but a personal visit to the field office may be more effective.

*Step 6: Generate CNMP/NMP with MMP*

MMP will automatically generate a draft CNMP/NMP document that contains all of the calculated data tables required by NRCS CNMPs and EPA permit NMPs using the national template that we developed with NRCS and EPA. Some additional information or forms may be required to satisfy individual state requirements.

*Step 7: Archive CNMP*

We are currently working with NRCS and EPA to develop the specific files and file structure needed for long term plan archiving and possible plan recreation. Once these specific requirements are finalized, we will automate the archiving process.

*Step 8: Implement CNMP*

Obviously, implementing and documenting the proper implementation of a plan is the most important activity in the planning process. Unfortunately, we still have not received funding from either NRCS or EPA to specifically address this issue. We hope that this will change in the very near future.

## **Final Thoughts**

We realize that this process is not perfect, but we have come a long way from developing plans with a calculator and spreadsheets. We hope that planners will save time and improve the consistency and accuracy of the plans they develop by using these tools to streamline the CNMP and NMP development process. While many consultants view NMP development as strictly a livestock producer-oriented activity, we believe that developing NMPs for crop producers (that may or may not use manure as a nutrient resource) is a valuable activity for both consultants and producers.

Remember that some of the most significant advances we have made in our software and the plan development process are a direct result of user feedback. Please contact us with questions or ideas to further improve the CNMP and NMP development process.