The Farm-P Reduction Planner (Farm-PREP): An Integrated Tool for Optimizing Field Practices to Achieve Farm-Scale Nutrient Reductions

STONE ENVIRONMENTAL

Services / Products
Web-Based Application & Tool Development
User Interface / User Experience Design
Agricultural Stewardship
Producer Conservation
Farm-Field Nutrient Management
Agricultural Policy Environmental eXtender (APEX) Model Customization & Integration
Watershed and Water Quality Planning
TMDL Implementation Support

Markets
Agriculture
Farmers
Crop Consultants
Conservation Districts

Project Location
Montpelier, Vermont

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2018

Project Owner
Stone Environmental

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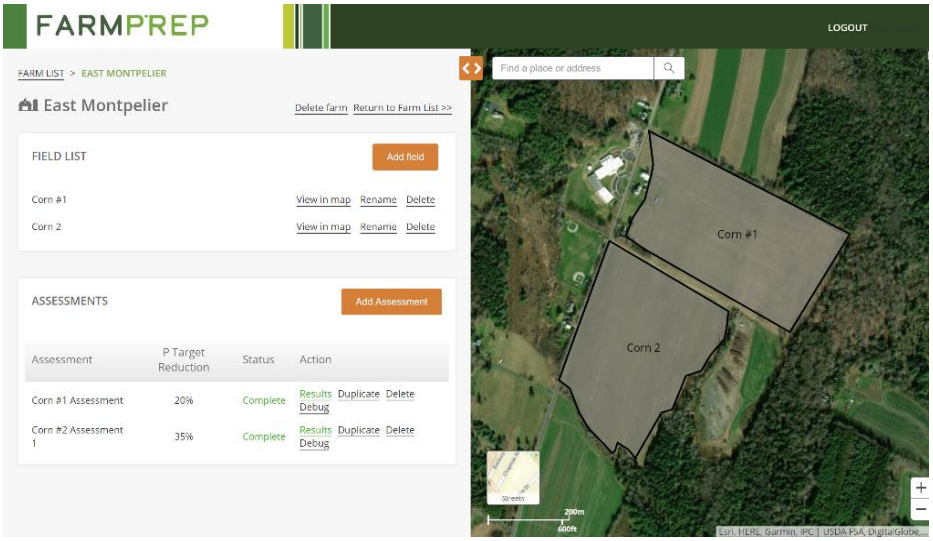

Farm-PREP's web-based user interface provides a streamlined and user-friendly interface to APEX, allowing farmers, crop consultants, and other stakeholders to easily identify options for field-level practices that meet water quality objectives and identify solutions that meet their farm's operational needs and preferences.

THE Farm Phosphorus Reduction Planner (Farm-PREP) is an integrated web-based application Stone developed to help farmers, technical crop consultants, and stakeholders easily evaluate the impacts of field-level best management practices on farm scale phosphorus (P) loss reductions and identify modifications to their field operations to help achieve water quality improvement targets on the watershed-scale.

Farm-PREP brings the power of the USDA Natural Resource Conservation Service's farm-scale water quality model, the Agricultural Policy Environmental eXtender model (APEX), to a much broader audience through a streamlined and user-friendly user interface allowing for evaluation of thousands of farm management scenarios. The tool integrates agronomic and hydrologic science, numerical modeling, and web-based application development that is packed with science and engineering on the back-end, yet elegant and intuitive on the user-facing front end.

The APEX model is a physically-based agronomic and water quality model designed for simulations at the field to farm/small watershed scale. The Farm-PREP user interface provides the first streamlined, user friendly interface to APEX, making it accessible to farmers, crop consultants, and others. The streamlined, user-friendly application simulates possible reductions of phosphorus farm field runoff by analyzing alternative conservation practices applied across individual farms to help farmers and crop management consultants find targeted solutions related to their farm fields and cropping practices and determine how those reductions compare to targets established in the Lake Champlain Basin P TMDL.

Stone's development of the Farm-PREP tool and integration with the APEX model allows for virtually thousands of possible use cases. Stone worked closely with the

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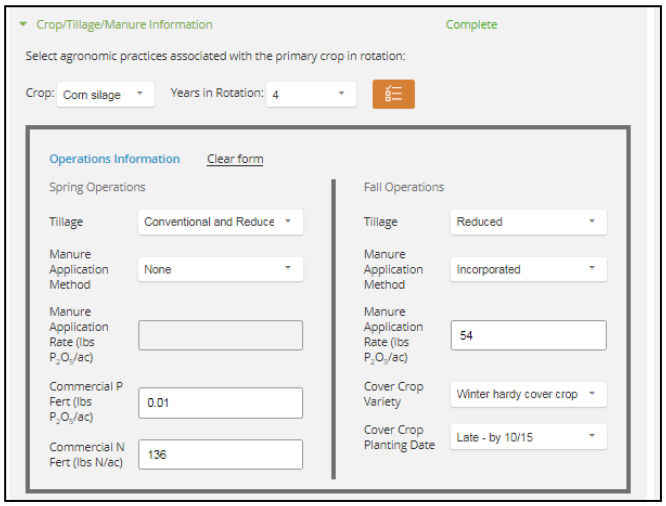
University of Vermont agricultural scientists, local crop consultants, and stakeholders on the development of APEX model inputs to represent thousands of possible field practice combinations representative of Vermont dairy operations. These model inputs were then built into a relational database and accessed by the Farm-PREP tool based on user input. Using the tool, Stone tested APEX model simulations and evaluated the model predictions for a broad range of agricultural practices and field conditions.

Numerical modeling and optimization methods were developed to enable the execution of thousands of APEX model simulations for each farm to identify management solutions that met a target for reducing phosphorus losses. The modeling and optimization approach utilized distributed cloud computing in a dynamic framework that could accommodate increasingly complex analyses associated with increasing farm size and number of concurrent users. Farm-PREP's web-based user interface with a logical work-flow designed to allow efficient inputs of the most critical farm information required to conduct the modeling analysis. The information provided by the tool offers farmers multiple options for field-level practices that meet water quality objectives and allows the farmer to make decisions on solutions that also meet their farm's operational needs and preferences.



Users provide current crop rotations and agronomic practices, and Farm-PREP generates model simulations of multiple combinations of field practices to arrive at a farm-level plan that meets pre-determined farm phosphorous reduction targets.

Using FarmPREP, farmers and crop management consultants can evaluate the impact of a number of agricultural strategies and practices, including: evaluate the impacts of alternative fertilization, irrigation, and tillage strategies on crop yield and nutrient/soil budgets; assess potential improvements in water quality leaving a farm after the installation of vegetative buffers or grass waterways; investigate the impacts of alternative herd management on pasture land sustainability; and assess the environmental quality impacts of numerous other best management practices. FarmPREP simplifies the user input to obtain results that help guide farmers to best farm field management.

The Farm-PREP tool is currently being expanded throughout the state of Vermont and is being enhanced to include additional field-level management practices and consideration of alternative nutrient management technologies. The implementation of this tool will lead to a substantially more quantitative and targeted approach to implementing improvements in farm agronomic practices that meet water quality objectives required to satisfy the Lake Champlain TMDL.

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