# Erosion Prediction: A New Piece for Precision Farming?

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Precision farming is all about using geo-referenced data to turn field averages into smaller pieces for precise, bit-by-bit management. It's about variable rate planting prescriptions, precisely applying variable rates of fertilizer, and planters that can switch seed hybrids on the go.

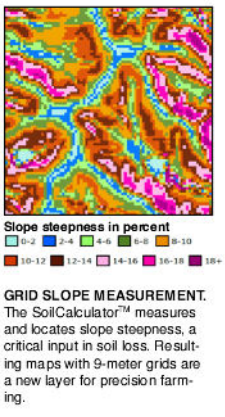
Soil prediction models, on the other hand, have been based on averages. Until now.

A computer program called the SoilCalculator has been developed by Agren, Inc. of Carroll, Iowa, that for the first time predicts erosion in 9-meter by 9-meter grids. It uses LiDAR elevation data to define slope length and steepness, two critical elements in soil loss prediction. Since it's geo-referenced, the SoilCalculator can also produce soil loss grid maps much like those produced from yield monitors, the difference being these maps show predicted soil loss across a field.

GRID SLOPE MEASUREMENT: The SoilCalculator measures and locates slope steepness, a critical input in soil loss. Resulting maps with 9-meter grids are a new layer for precision farming.

**More accurate**

The basis for soil loss predictions is the Revised Universal Soil Loss Equation, version 2, commonly called RUSLE2. "Traditional RUSLE applications require a conservationist to use judgment to define the dominant slope length and steepness of a soil type in a field," says Seth Dabney, research leader and soil erosion expert with the Agricultural Research Service in Oxford, Mississippi. Dabney has researched and tweaked the equation for many years.

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"RUSLE2 allows you to break the dominant slopes into segments where topography changes rather than predicting the same erosion rate for an entire field, but in practice that's rarely done," Dabney says. "Another issue is that it's very difficult to train people to judge how long slope segments are -- where does the slope begin and end? So there's a lot of variation in that judgment, and resulting variation in predicted erosion as a result," Dabney says.

The LiDAR elevation data in the SoilCalculator takes the guesswork out of soil length and steepness, and shows predicted erosion on more slope segments. "The more accurate slope data on a smaller grid gives a more realistic picture and understanding of what's happening in the field," explains Dabney.

ARS has a research interface for RUSLE2, but results are a matrix of numbers, continues Dabney. "So we welcome companies who take our open source, public domain data and put it into their

interface or application that make it more accessible and useable by conservationists, crop consultants, and farmers," he says.

**Used it to make a point**

Greg Reisz, owner of an integrated, full service precision ag company with both crop advisor and farmer clients in Iowa, Illinois, Minnesota, and beyond, became interested in the SoilCalculator as he worked with one particular client.

"I deal with a lot of growers, who have a lot of different ways to produce a crop. There are multi-generations, and various degrees of commitment to soil conservation," Reisz says. "To me, soil is part of your equity. I wanted to make a point in one particular instance where I'd been consulting for more than 15 years. The owner wanted the grower to continue to disk a sloping field, but I knew it was causing erosion and nutrient loss, and costing the tenant money.

"I felt we should at least be contouring that field, and it should be no-tilled," Reisz says. "I could benchmark yields with neighbors to compare yields, and the SoilCalculator was a way to compare soil losses with the different planting and tillage systems."

**A piece of the puzzle**

"Severe soil erosion over time can cause a yield drag," Reisz says. "There's a correlation -- not 100%, but it's something we can benchmark against." Reisz developed a cloud-based software program called E4 Crop Intelligence, which helps growers with their entire precision agriculture program.

"Soil erosion is a piece of the crop production puzzle -- another indicator if you will," notes Reisz. "I did a test on five fields with four different farmers on areas I knew were losing soil. The power of the data here, like all data, lies in how accurate it is, and LiDAR data makes this tool useful. I think it is especially helpful on fields that we don't have much information on, where the owners and operators are concerned about soil erosion."

Reisz would like to see the standalone program more automated and adapted so it could be embedded in his software. "This tool could help guide fertilizer rates, variable corn hybrid planting, change in crop rotation, and a number of management decisions," Reisz says.

That's how Tom Buman, president of Agren, sees the future use of the tool. "It's another layer in precision agriculture, that helps tell you how erosion fits into your bottom line," Buman says. "It tells you where your soil is degrading, and also relates to P and K loss in the field."

Adding soil conditioning index and ephemeral erosion models

Dabney says a soil conditioning index that indicates organic matter increases and decreases will be available soon. "We're also adding an ephemeral erosion indicator, to predict how much soil loss is coming from a field in those channels of concentrated runoff," he says. Ephemeral gully erosion, which can be significant, especially in the amount of sediment produced from field, has not been accounted for in sheet and rill erosion predictions in the past.

"When we combine those three models, we'll have a much better picture of the effects of total soil loss in a field. And we will welcome those privately developed applications to deliver the models. The most attractive option in the future is a cloud application with processors that access RUSLE2 models."

Another feature Agren is testing is the ability to determine how much erosion has occurred in a field the past year, based on that year's rainfall.

"RUSLE2 erosion predictions are based on historic rainfall, so it gives you average soil erosion predictions over time. What we hope to do now is tap into rainfall events data layers over a year and run the SoilCalculator with those amounts," Buman says.

"So, in addition to predicting how much soil loss you may get in the future with a particular management system on different slopes of the field, you'll also be able to pinpoint where and how much erosion you actually had on those slopes from the current year."

The SoilCalculator can be used anywhere LiDAR elevations are available -- that's currently in most states from Nebraska to the East Coast. Agren is currently set up with data loaded to run the calculator in Iowa, and plans to expand use to areas where critical demand justifies the cost.

*Betts writes from Johnston, Iowa.*