Enhanced Saskatchewan Soil Data for Sustainable Land Management

Angela Bedard-Haughn, Darwin Anderson, Ralph Deters, Jeff Schoenau, Ken Van Rees, University of Saskatchewan; Darrel Cerkowniak, Henry deGooijer, Brian McConkey, AAFC; Don Campbell, Western Sales, Rosetown SK; Tim Nerbas, NRG Farms Limited, Waseca SK

Project Code: ADF2015-0286
Final Report: February 2018

Sustainable land management decisions and advancements in precision agriculture technologies need to be based on reliable information about soils and land capability. Researchers at the University of Saskatchewan, in collaboration with AAFC and industry, initiated a two-year project to design and develop a new enhanced data framework to store and access Saskatchewan soil information accessible by an innovative computer application. SKSIS provides the foundation for land management tools that provide decision support in making field-specific recommendations. SKSIS is available for both desktop and mobile users wanting to identify soil properties at a specific location, with the mobile access app using smartphone GPS technology to establish user location. SKSIS was officially launched in 2018. sksis.usask.ca

Sustainable land management decisions and advances in precision agriculture technologies need to be based on reliable information about soils and land capability. For many years, Agriculture and Agri-Food Canada (AAFC), together with its provincial partners, invested heavily in soil survey, particularly from 1950 to 1995, with the results being compiled into AAFC's Canadian Soil Information System (CanSIS). However with the future of CanSIS and updates uncertain, combined with the increasing demand for improved access to high-quality Saskatchewan soil data, a new framework was required.

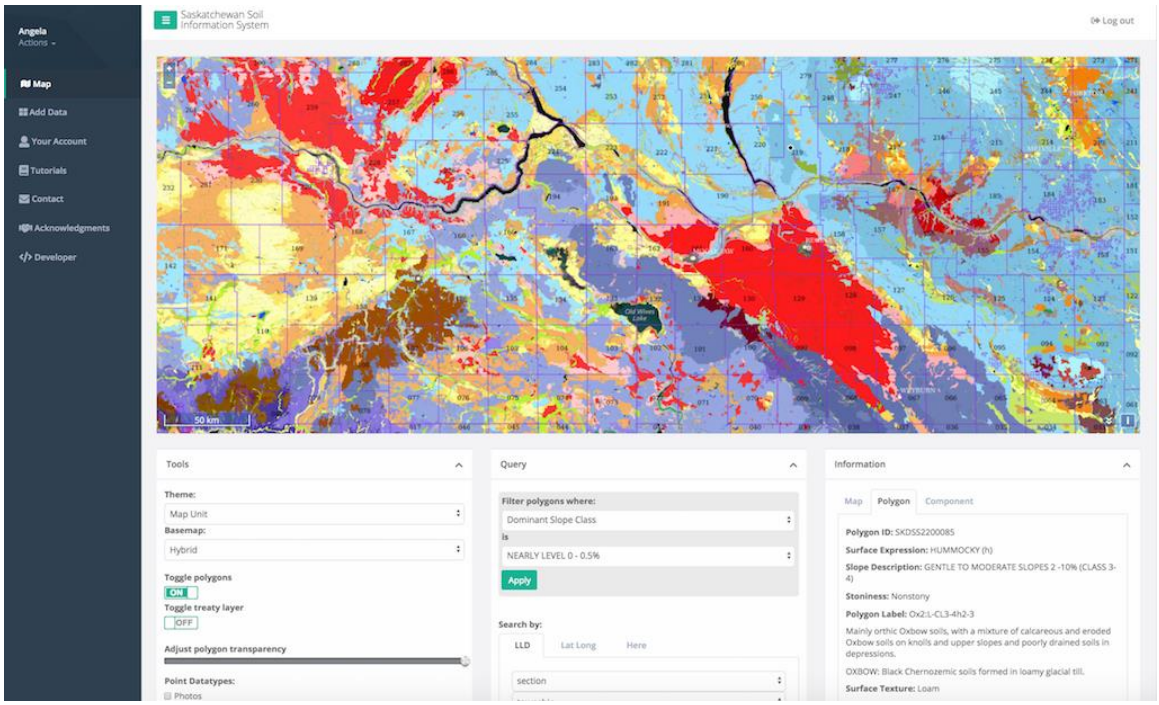
Researchers at the University of Saskatchewan, together in collaboration with AAFC and industry, initiated a two-year project in 2016 to design and develop a new enhanced data framework to store and access Saskatchewan soil information: the Saskatchewan Soil Information System (SKSIS). Researchers also wanted to explore ways to refine and apply this soil information, including digital soil mapping at a resolution and scale useful for precision management and developing applications that allow producers to upload and integrate their own field-scale data to inform nutrient-management decisions. The project was designed around three main objectives that interrelate and build upon each other.

The first objective was to make the existing Saskatchewan soils information, collected through a number of preceding decades, available to everyone as an online resource, and to preserve the data in the event that other archives are eventually unmaintained. Existing datasets from CanSIS were accessed and imported into a database management system (DBMS). A fully digital framework and application to store and access Saskatchewan soil

information were developed. This new SKSIS data framework provides full access to all existing Saskatchewan soil information for a diverse group of users and stakeholders.

The second objective was to enhance the resolution of existing soil data and to develop a digital soil mapping (DSM) technique that is optimized for Prairie soils and landscapes. Saskatchewan's existing soil information was at the scale of 1:100,000, which limits its potential to inform field-scale decisions (e.g. precision applications). These applications require information at a finer scale of 1:5000 or better and are compatible with the data collected by producers (e.g. via combine yield monitors) and agronomists. Three sites in Western Saskatchewan were used for testing DSM methods: Central Butte, Rosetown and Waseca. This mapping was based upon a 5-meter grid digital elevation model (DEM) obtained from data collected with a fixed wing drone and sophisticated software package. The DSM algorithms were then able to use a limited number of sample points (30- 40 per site) to produce 5-m grid rasters of five soil properties for the fields. All soil properties were successfully mapped with high prediction accuracy and verified by the individual land owners/operators, showing the ability of the DSM to produce layers of spatially enhanced soil information at the field scale.

Researchers then developed a proof-of-concept app in Objective 3 to demonstrate the use of the enhanced resolution soils information to produce an application usable at a farm-field scale. The DSM results from Objective 2 were analyzed and combined with expert knowledge on soil capability to build an app that would use the mapped soil properties within the fields to identify areas that had differing ability for crop production under dry, moderate and wet levels of expected annual moisture. The SKSIS app was evaluated by beta-test users and their feedback incorporated into the final app.



The SKSIS project provides the foundation for land management and decision support tools for making field-specific recommendations. SKSIS is available for both desktop and mobile users, to identify soil properties at a specific location, with the mobile access app using smartphone GPS technology to establish user location. SKSIS includes additional functionality, such as supporting the uploading of photos, documents, and simple text 'observations', and other personalized components such as the ability to change base maps to allow users to associate soil information with landmarks they are familiar with, like highways or farm yards. The site in its current form can be used to better understand variability in the field and inform nutrient planning; when used in concert with variable rate equipment or other precision ag technologies, it is great value for those looking to better understand why their yield is more variable in some locations than others, rather than relying on yield maps alone.

SKSIS (*sksis.usask.ca*) was officially launched in 2018 and funding for Phase 2 research has been approved to continue to build on this initiative, enhancing its usability and accessibility for a wider audience and providing greater refinement of the soils information via new digital soil mapping technologies and decision support systems.