RESEARCH FACTS

UNIVERSITY OF SASKATCHEWAN
Livestock and Forage Centre of Excellence
LFCE.USASK.CA

IN PROGRESS

Quantifying crop water use and water-use productivity

PROJECT TITLE

Agricultural Water Futures: quantifying crop water use and water-use productivity under future climates

In progress:

Results expected in August 2023

RESEARCHERS

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Background:

The Agricultural Water Futures (AWF) project is a seven-year pan-Canadian project with the overall objective to determine how Canadian agriculture and food production systems can best respond to risk and uncertainty associated with current and future climatic and socio-economic stressors. At present, there is a paucity of precise Canadian data on crop water use and water-use efficiency, and how they vary from local to regional to national scales, under various management systems and through the expected climates (present and future). The proposed project will assist in understanding how Canadian agriculture will change with a changing climate through a combination of field and modelling exercises. The Livestock and Forage Centre of Excellence is a key observatory for the Canadian Prairie portion of the crop water use observation and modelling activities of this project.

Objectives:

- Quantify crop water use and water-use productivity currently and under future climates
- Establish crop model validation datasets
- Develop a novel modelling framework to assess commodity-specific present and future water footprints and risks
- Quantify the spatial variability of crop growth

What They Will Do:

Field studies at the LFCE (in addition to other sites in Saskatchewan) are collecting observations over key crop types (barley, wheat, canola, corn, forages and pulses) including eddy covariance measurements of evapotranspiration, net primary production and various plant biophysical metrics to identify regionally appropriate crop growth parameters for use in modeling future changes. This includes:

- leaf area index, biomass and plant nutrient status sampled bi-weekly,
- yield and harvest index measured at the end of the growing season, and
- soil nutrient status and uptake measured by extracting soil cores prior to seeding and following harvest.

To produce realistic estimates of future crop water use (incorporating the numerous feedbacks to soil and atmosphere), we are coupling a detailed crop-growth model capable of quantifying crop growth parameters (biomass, yield, harvest index, etc.) with an agricultural hydrology model. Model development work uses the collected field data to develop appropriate crop growth, infiltration and evapotranspiration parameter sets, and to refine and validate this agricultural water modelling platform. To interpret the results of the observation and modelling work in the context of the spatial variability in crop growth at the sub-field scale intensive unmanned aerial vehicle field campaigns are being undertaken to spatially quantify crop metrics (crop height, leaf area index, crop health) from lidar, multispectral, thermal infrared and optical imagery.

Implications:

Through the delineation of critical moisture or environmental water risk areas across Canada and an understanding of the drivers of these risks, AWF partners (Agriculture and Agri-food Canada and provincial agencies) can shepherd Canadian farmers to adapt practices in future, in the short- and long-term, to ensure sustainable food supplies.

Knowledge transfer is facilitated by knowledge mobilization teams within the Global Water Futures Research program (funding body). Current approaches are to dissemination knowledge through publishing of results in academic journals, organization of workshops with stakeholders (Ag-Water Research Expo at the USask in May 2019, https://gwf.usask.ca/events/2019/06/agriculture-water-research-expo-.php) and social media engagement (@harder_water, @AWF_Research).

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