

## Crop water footprints and virtual water flows: A comprehensive evaluation of crop water use in Saskatchewan

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SPG Contributions	Project Status	Duration/Timeline of Project (Year to Year)	Total Project Cost
\$115,000.00	Completed	January 2016 – June 2018	\$115,000.00

### Project Description

To evaluate the water footprints (WFs) for crops in Saskatchewan; to evaluate virtual water flows (VWFs) related to crop transfer in Saskatchewan; to assess strategies for water footprint reduction and water-saving benefits of virtual water flows.

The water footprint (WF) of crop production is a user friendly means to analyze the consumption of the water resource in agricultural production systems. This study assessed the inter-annual variability of the total WF of three types of main crops: cereal (spring wheat and barley), oilseed (canola and sunflower), and pulse (lentils and chickpeas), both from a yield and protein perspective, and determined the major factors influencing the WFs in the province of Saskatchewan.

### Outcome

Over the period of 1965 to 2014, the annual precipitation in Saskatchewan fluctuated greatly, but increased slightly with time. The yield-based WF ranged between 1.08 and 1.80 m<sup>3</sup> kg<sup>-1</sup> for spring wheat, 0.90 and 1.38 m<sup>3</sup> kg<sup>-1</sup> for barley, 1.71 and 2.58 m<sup>3</sup> kg<sup>-1</sup> for canola, 1.94 and 4.28 m<sup>3</sup> kg<sup>-1</sup> for sunflower, 1.47 and 2.37 m<sup>3</sup> kg<sup>-1</sup> for lentils, and 1.39 and 1.79 m<sup>3</sup> kg<sup>-1</sup> for chickpeas. In contrast, the protein yield-based WF ranged between 7.69 and 10.44 m<sup>3</sup> kg<sup>-1</sup> for spring wheat, 8.27 and 16.47 m<sup>3</sup> kg<sup>-1</sup> for barley, 3.79 and 7.75 m<sup>3</sup> kg<sup>-1</sup> for canola, 4.86 and 11.17 m<sup>3</sup> kg<sup>-1</sup> for sunflower, 5.09 and 7.42 m<sup>3</sup> kg<sup>-1</sup> for lentils, and 5.51 and 10.69 m<sup>3</sup> kg<sup>-1</sup> for chickpeas. All WFs of crops generally decreased with time, which was likely driven by scientific and technological advances. Pulse crops had a higher grain yield-based WF, but a lower protein yield based WF than cereal crops. Under conditions of improved protein consumption and healthy living in the future, pulse crops may be a preferred crop.

### Research Objective

#### OBJECTIVE 1

To evaluate the water footprints (WFs) for crops in Saskatchewan.

#### OBJECTIVE 2

To evaluate virtual water flows (VWFs) related to crop transfer in Saskatchewan.

#### OBJECTIVE 3

To assess strategies for water footprint reduction and water-saving benefits of virtual water flows.