

RESEARCH FACTS



UNIVERSITY OF SASKATCHEWAN

Livestock and Forage
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IN PROGRESS

Environmental research at an intensive cattle feeding operation

PROJECT TITLE

Environmental research opportunities presented by the Beef Cattle Research and Teaching Unit, Livestock and Forage Centre of Excellence

In progress:

Results expected in October 2021

RESEARCHER

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Background:

Intensive cattle feeding operations (ICFO) have the potential to negatively impact the environment as a result of high concentrations of animals producing high concentrations of nutrients. Environmental impacts arise mainly from improper containment and handling of runoff and manure. Such problems are usually attributed to issues with penning areas, waste storage lagoons, manure management areas and surface runoff.

Previously, investigations have looked at the risks of contaminants leaching from established ICFO's but this research not only typically focused on isolated areas of the operation but also studied existing commercial or research facilities without the requisite knowledge of the baseline soil and water quality (Betcher et al. 1996, Maule and Fonstad, 2000, McCullough et al. 2001 and Olson et al. 2005). Thus, we still do not understand the combined effects of all aspects of the design and operation of an ICFO on the ecosystem. We will fill this considerable knowledge gap by environmental monitoring at the Livestock and Forage Centre of Excellence from its initial greenfield state through its entire life cycle to develop best management practices designed to mitigate the associated environmental effects.

The environmental program at the Beef Cattle Research and Teaching Unit encompasses multiple components including:

- hydrogeology and hydraulic head monitoring,
- groundwater geochemistry,
- pen surface and infiltration, and
- runoff water characteristics and management.

Objectives:

This research will investigate:

- the hydrogeological characteristics of the site after cattle are introduced to the feedlot,
- the dynamics of the hydrogeology at the feedlot site due to operational activities and seasonal changes,
- the potential for vibrating wire piezometers to be used to estimate pressure changes,
- the quantity and quality of water typically found in runoff containment ponds at ICFOs,
- the amount of the solute transport and moisture fluxes below the cattle feedlot pens,
- the impact that runoff containment ponds have on the adjacent hydrogeology, and
- the seepage rate and quality of runoff water from composting and silage areas.

What They Will Do:

If data regarding the environmental impacts of an ICFO are to be truly useful, baseline data must first be obtained for the environmental parameters in and around the site. The baseline data component of the research will include the installation of environmental monitoring equipment including standpipe piezometers, vibrating wire piezometers, time domain reflectometers, soil moisture probes, runoff catchment weirs, surface water sampling access, meteorological stations and air quality monitoring stations.

The infrastructure will enable studies of the effects of an intensive cattle feeding operation on soil, on groundwater and surface water, on air quality, and on terrestrial and aquatic ecosystems. Over a one-year period, we will obtain baseline data on the pre-existing nutrient levels, the exchangeable water and pore water chemistry, and other characteristics of the soil, surface water and groundwater. The environmental monitoring equipment will then be used to evaluate changes in the soil, surface water, groundwater, air quality, and terrestrial and aquatic ecosystems resulting from ICFO operations, various manure utilization strategies and any mitigation strategies designed to limit environmental impacts.

Implications:

The research team will work closely with Saskatchewan Ministry of Agriculture staff to communicate information from the site during the project in the form of regular meetings, annual reports and upon project completion. Of particular interest will be the final resulting conditions at the site and any predictive capabilities developed.

The team will make presentations to industry upon request.

Design of the instrumentation system at the site and results of research will be submitted to refereed journals for publication. Journal and conference papers will be used to communicate research results to the scientific and regulatory community and industry.

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