

# LAND-USE EFFECTS ON DEPRESSION-FOCUSSED GROUNDWATER RECHARGE IN THE PRAIRIES: WATER BALANCE APPROACH



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## ABSTRACT

Groundwater recharge in the Canadian prairies is driven by snowmelt runoff accumulation in local depressions, which slowly infiltrates as soil thaws over the spring. The effects of land use on this process are poorly understood. As a main objective of this work, a water balance based-approach was used to estimate differences in groundwater recharge between cropland and grassland sites. A paired plot site was instrumented near Rosebud, Alberta with a grazed grassland and wheat-barley-canola rotation crop field. A meteorological station was installed at both sites with standard sensors and an eddy covariance system to measure evapotranspiration. The amount of snow, and ensuing runoff and accumulation in depressions, was monitored. Subsequent infiltration was monitored using soil moisture sensors. These results were compared with a long-running study site near Calgary, Alberta with similar cropland-grassland dynamics, which showed increased runoff in the cropland compared to both a native grass and alfalfa field. The increased runoff is likely due to the less developed macropore network and higher moisture content in the croplands over the course of the year. The fewer, wetter, shallower macropores are more likely to be filled with ice, reducing soil infiltrability and enhancing runoff to topographic depressions. The macropores in the grasslands, with deep-rooted perennial grasses and drier soils, do not become completely blocked near the surface. The grassland snowmelt water is initially able to infiltrate, and is eventually taken up by the grasses, unable to recharge the groundwater below. The combination of macropore density and ice-filled pores leads to greater runoff in the cropland sites, compared to more direct infiltration in the well-developed, dry macropore networks of the grasslands. Due to increased runoff, croplands have greater amounts of groundwater recharge compared to the grasslands. Findings of this research may have useful implications on groundwater recharge assessments in the Canadian prairies.