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Biophysical Assessment of the Ecological Condition of Wetlands in the Parkland and Grassland Natural Regions of Alberta, Canada

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Abstract : It is estimated that up to 70% of the wetlands in the Parkland and Grassland natural regions of Alberta have been lost due to various land-use activities. These losses include ecosystem function and services they once provided. Those wetlands remaining are often embedded in a matrix of human-modified habitats and despite efforts taken to protect them the effects of land-uses on wetland condition and function remain largely unknown. We used biophysical field data and remotely-sensed human footprint data collected at 322 open-water wetlands by the Alberta Biodiversity Monitoring Institute (ABMI) to evaluate the impact of surrounding land use on the physico-chemistry characteristics and plant functional traits of wetlands. Eight physio-chemistry parameters were assessed: wetland water depth, water temperature, pH, salinity, dissolved oxygen, total phosphorus, total nitrogen, and dissolved organic carbon. Three plant functional traits were evaluated: 1) origin (native and non-native), 2) life history (annual, biennial, and perennial), and 3) habitat requirements (obligate-wetland and obligate-upland). Intensity land-use was quantified within a 250-meter buffer around each wetland. Ninety-nine percent of wetlands in the Grassland and Parkland regions of Alberta have land-use activities in their surroundings, with most being agriculture-related. Total phosphorus in wetlands increased with the cover of surrounding agriculture, while salinity, total nitrogen, and dissolved organic carbon were positively associated with the degree of soft-linear (e.g. pipelines, trails) land-uses. The abundance of non-native and annual/biennial plants increased with the amount of agriculture, while urban-industrial land-use lowered abundance of natives, perennials, and obligate wetland plants. Our study suggests that land-use types surrounding wetlands affect the physicochemical and biological conditions of wetlands. This research suggests that reducing human disturbances through reclamation of wetland buffers may enhance the condition and function of wetlands in agricultural landscapes.

Keywords : wetlands, biophysical assessment, land use, grassland and parkland natural regions
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