Development of the oil sands has led to increasing atmospheric N deposition, with values as high as 17 kg N ha-1 yr-1; regional background levels <2 kg N ha-1 yr-1. To examine responses to N deposition, over five years, we experimentally applied N (as NH4NO3) to a poor fen near Mariana Lake, Alberta, at rates of 0, 5, 10, 15, 20, and 25 kg N ha-1 yr-1, plus controls (no water or N addition). Between June and August of each year, we measured N2-fixation using the acetylene reduction technique between 2012 and 2015Averaged across all measurement dates, whether described by a linear or segmented regression, N2-fixation rates decreased with increasing N addition. N2-fixation rates were not different between the water addition only treatments and the control treatments (p = 0.44). While increasing N deposition may not substantively change total inputs of new N to bogs, the form of new N inputs shifts to inorganic N in deposition, rather than organic N produced by the microorganisms that are fixing N2.