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). Anchored point frames were established at each plot and measure at 30 points along the frame each year in July. We used absolute frequencies of Sphagna and vascular plants to examine species and community responses to N treatment. Increasing N input led to led to decreased abundance of S. fuscum and increased abundance of S. angustifolium, S. magellanicum, Andromeda polifolia, Vaccinium oxycoccos, and of vascular plants in general. For dominant shrubs and all vascular species combined, N addition had no effect in the first two years, but frequencies increased with increasing N addition in 2013-2015. Pairwise year comparisons indicated a gradual change in plant species composition as the experiment progressed. Of the 21 pairwise comparisons between nominal N treatments, 18 were significant, indicating a clear influence of N addition on plant community composition. These results suggest that bogs that have persisted under very low ambient N deposition may be especially sensitive to increasing N deposition, in terms of plant species’ relative abundances and plant community composition.