Fire effects on nitrogen cycle in calcareous wetlands of Florida Everglades

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Abstract: Prescribed fire is widely used as a primary restoration technique in various ecosystems and has great influences on nutrient cycles in ecosystem by changing the form, distribution and amount of nutrient as well as by changing species composition. A restored wetland (restored in 2000, high phosphorus) and a native calcareous wetland (reference site, low phosphorus) were burned on 4th May, 2010 in the Hole-in-the-Donut (HID) of Florida Everglades, where farmed marl prairie wetlands have been restored through complete soil removal to reduce nutrient levels. In each site, two 30m by 30m burn and control plots were set and soil properties were measured to evaluate the immediate (2 days), short (1month) and long time (around 1 year) changes of soil nitrogen cycles after the fire. Results showed that after the fire, soil total phosphorus (TP) was 20% to 30% higher in the burn plots compared to the control plots immediately after the fire in both restored and reference sites; and then after 1 year, the TP contents in the burn plots decrease to 10% of the values in the control plots. Accordingly, immediately after the fire, higher extractable nitrate/nitrite (NO_X-N) and ammonia (NH_4-N) were showed in the burn plots compared to the control plots in both restored and reference site. However, the increase of extractable nitrogen was greater in the low-P reference site, in which the extractable nitrogen in the burn plots was 2 times of that in the control plots immediately after the fire; in the high-P restored site, the values were only 20% to 40% higher in the burn plots compared to those in the control plots. These differences would indicate that in the low-P site, more P brought into the system by the fire could potentially facilitate the nitrogen cycle. After a longer time, the response of fire diminished and the extractable NO_X-N and NH_4-N returned to the original status. The effects of fire on nitrogen mineralization and N-related enzyme activities (Leucine-aminopeptidase, LAP and N-acetyl-β-D-glucosaminidase) were different in the restored and reference sites along the time. These results suggest that the fire effects on nitrogen cycle were different with different time scale.