



## **Zoogeochemistry: bird grazing enhances wetland methane emissions**

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Recent experimental evidence supports the idea that wild animals can exert strong controls over key processes in the carbon cycle. Herbivores grazing in wetlands may be especially strong actors because the vegetation they consume is closely related to production, oxidation and emission of methane. Wetland plants provide carbon substrate fueling methane production, facilitate the oxygenation of root soils for methane oxidation, and also provide an efficient methane efflux pathway. Because the effects of plants on methane are bidirectional, it is difficult to predict how herbivory will change net methane emissions from wetlands. In order to assess the relationship between wetland herbivores and methane, we conducted a two-year field experiment utilizing exclosures to manipulate the presence or absence of grazing ducks and swans. We found that waterfowl grazing greatly increased methane emissions by 230% compared to paired exclosure plots. Porewater concentrations of dissolved methane in grazed plots were also significantly higher, indicating that a lack of oxygen delivery to soils limited the capacity for grazed soils to oxidize accumulated methane. This interpretation was further supported by differences in the availability of extractable nitrate and nitrous oxide emissions, indicating that grazed plots soils lacked the capacity for the aerobic process of nitrification. We found that intensive grazing on dormant plant roots during the winter prevented plants from emerging quickly during the early growing season and developing an oxidized rhizosphere, which led to the changes we observed in methane and other biogeochemical parameters. This finding provides experimental evidence that wild herbivorous birds may play an unrecognized role in the regulation of wetland carbon cycling.