

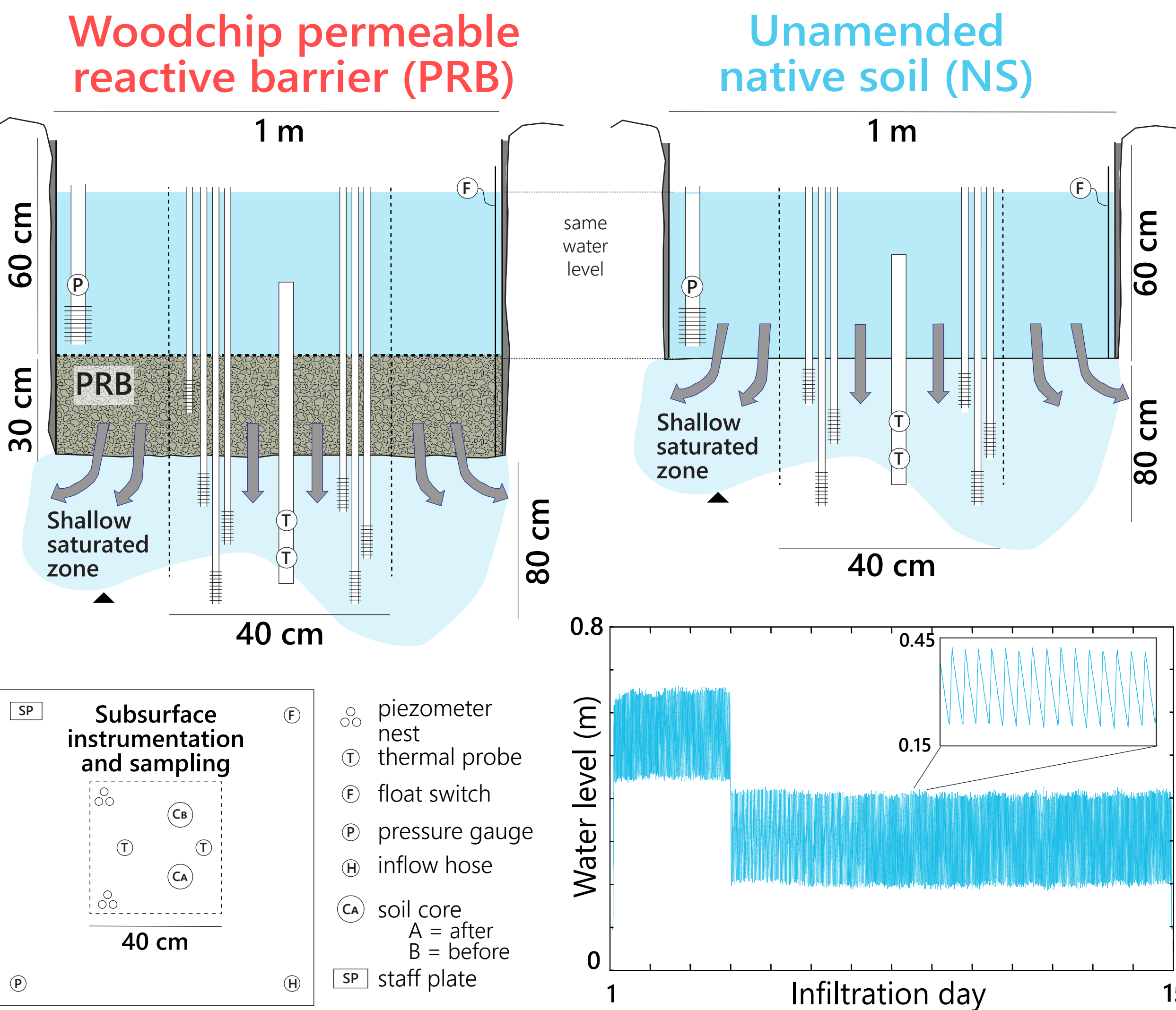
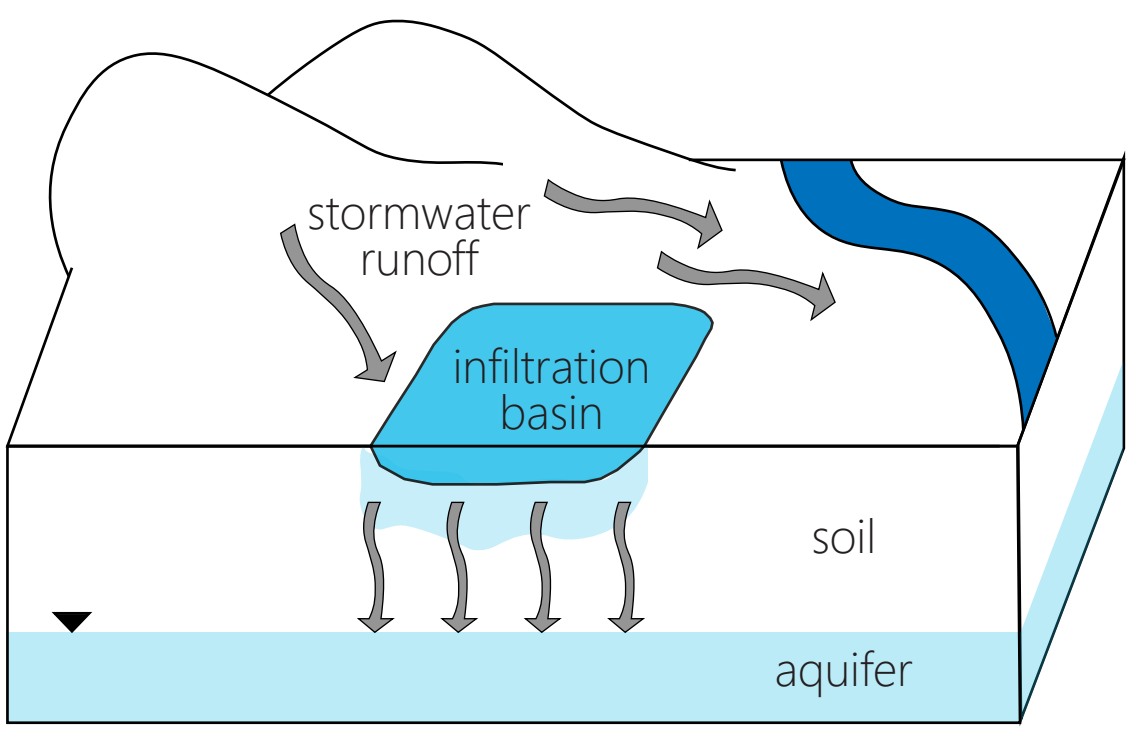
A horizontal permeable reactive barrier stimulates nitrate removal and shifts microbial ecology during rapid infiltration for managed recharge



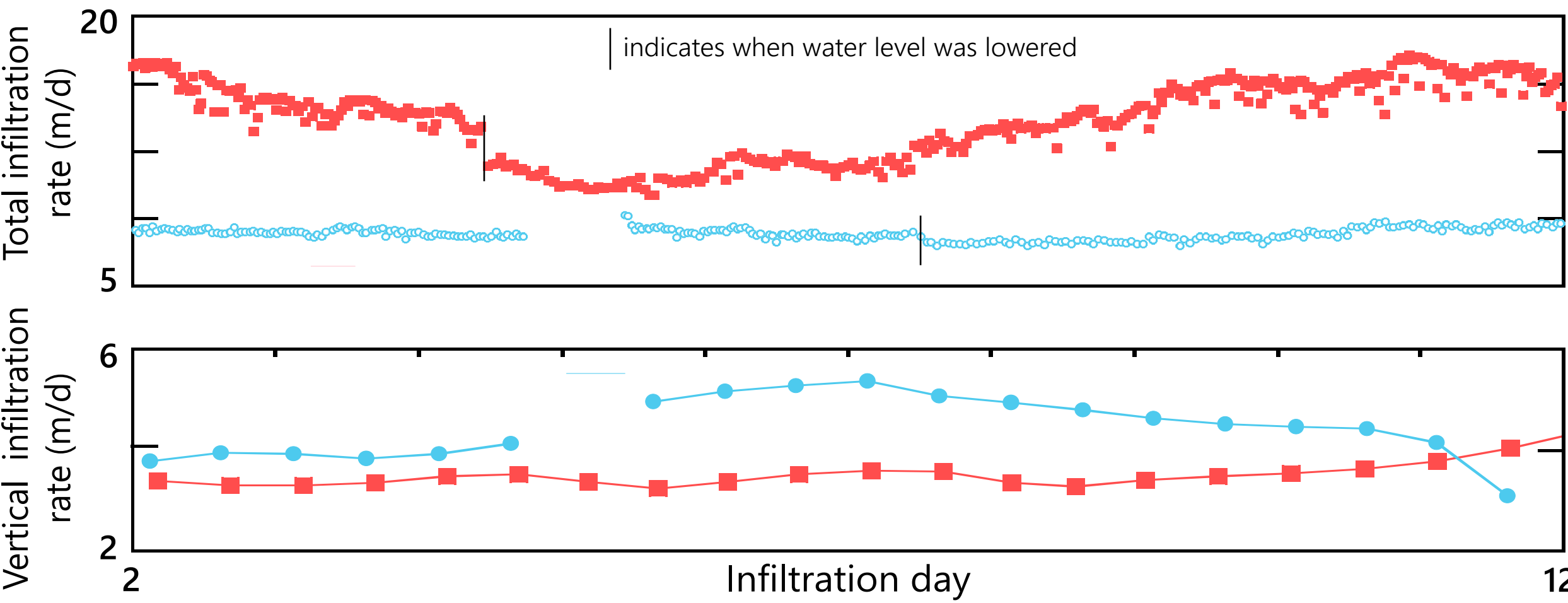
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How can managed recharge improve water supply and quality?

Designing managed recharge projects to improve water quality requires better understanding controls on microbially-mediated nutrient cycling in soil.



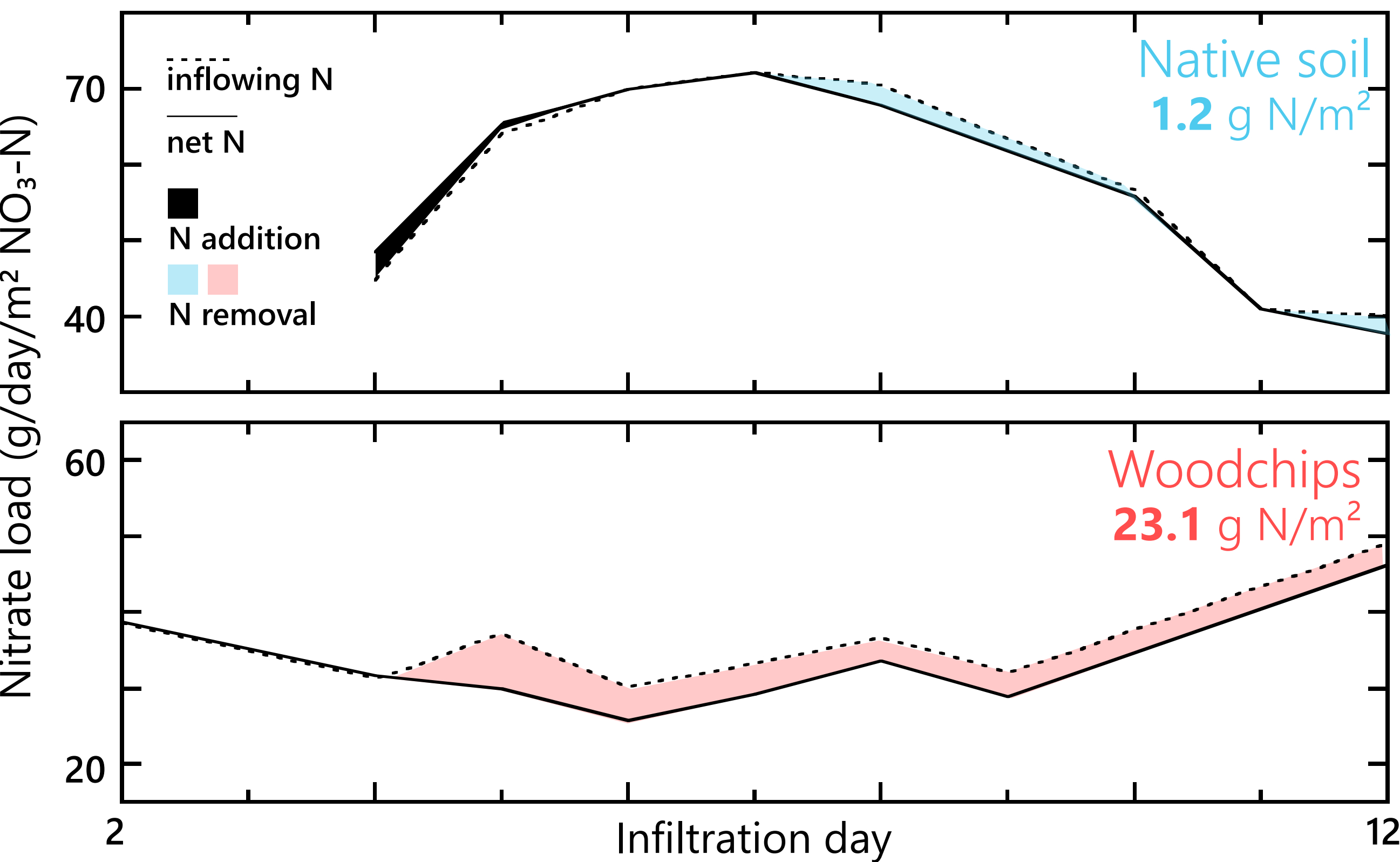
We quantified how a woodchip layer affects soil microbiology and subsurface water quality.



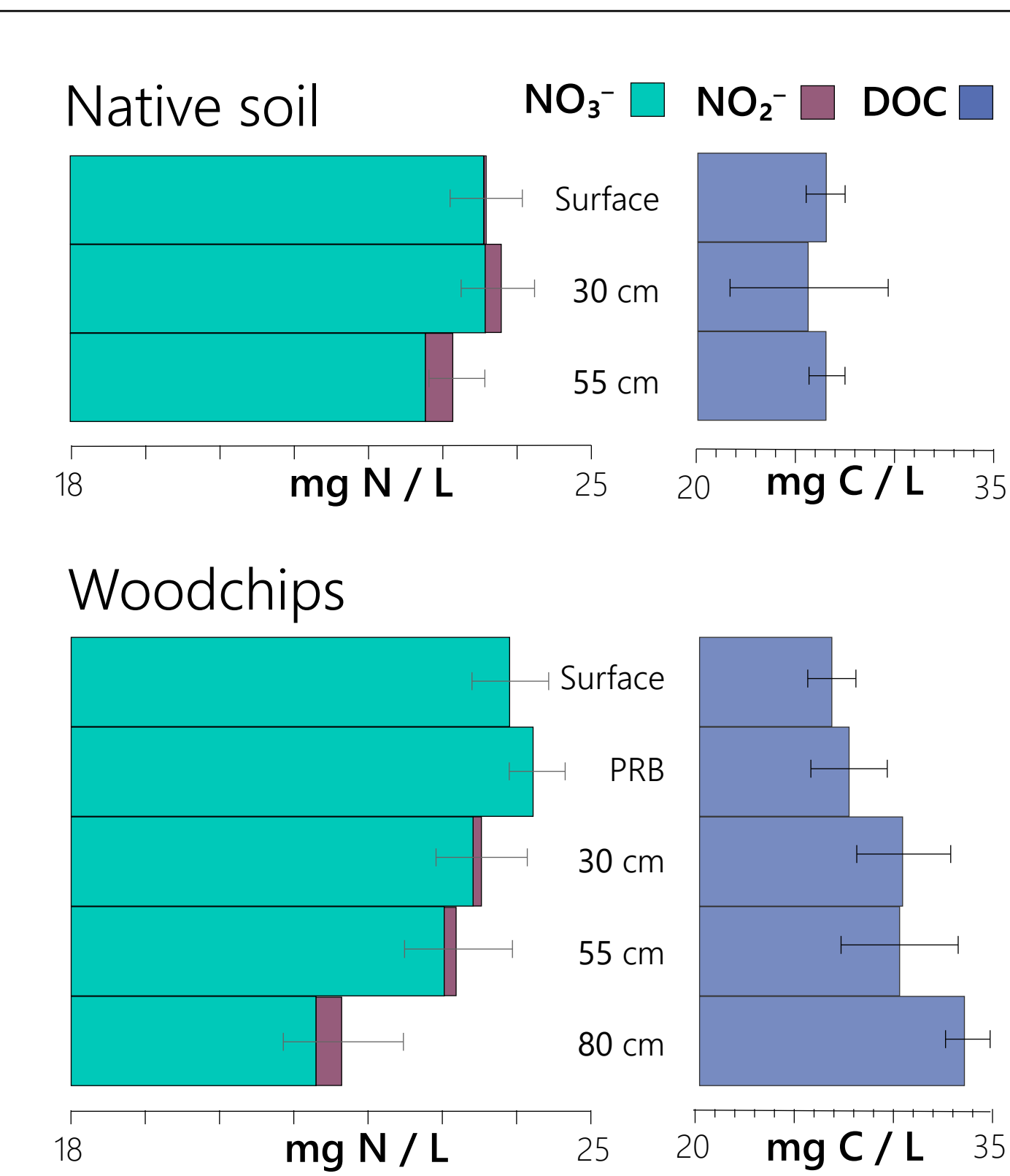
Vertical and total infiltration rates varied between plots and over time during each test.

Residence times within the woodchips were 1–2 h.

Woodchips contributed to favorable conditions in underlying soil for enhanced nitrate removal relative to native soil.



Nitrate loads were significantly reduced during rapid infiltration below woodchips, but not native soil.

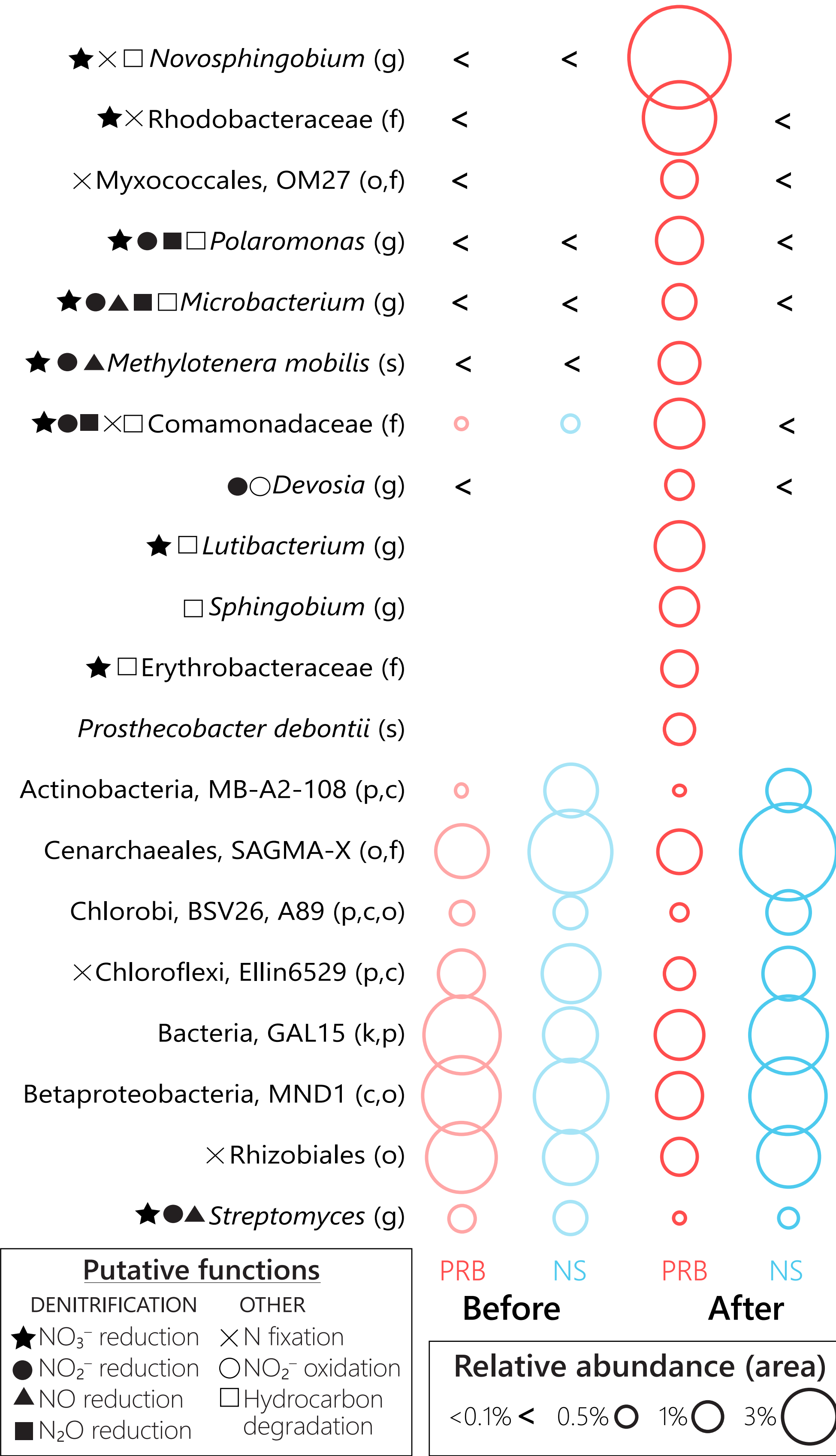
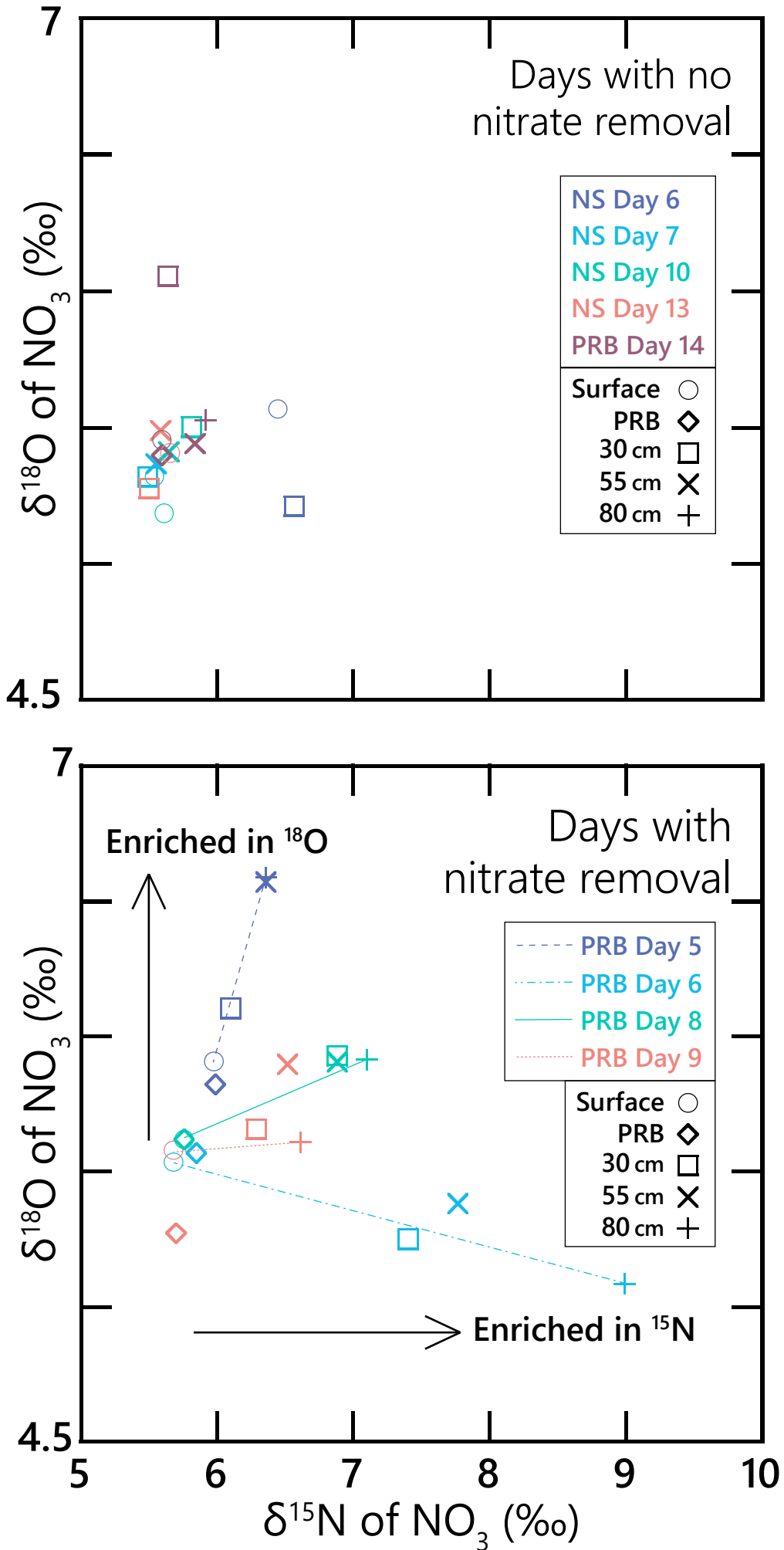


The shallow saturated zone was deeper below woodchips than in native soil.

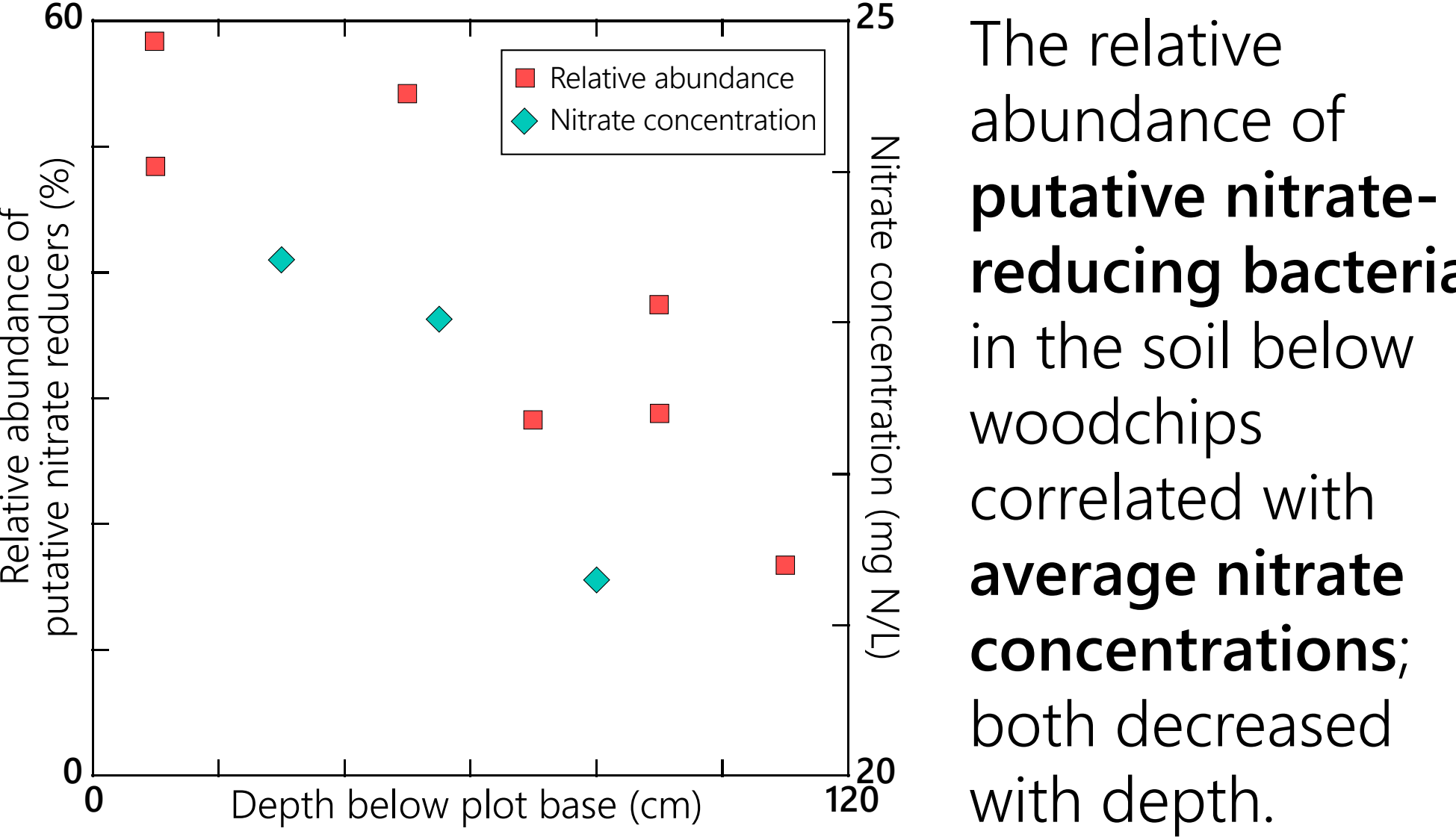
Nitrate decreased and DOC increased below woodchips more so than in native soil.

Nitrate removal did not occur within the woodchips, but in the soil >0.5 m below.

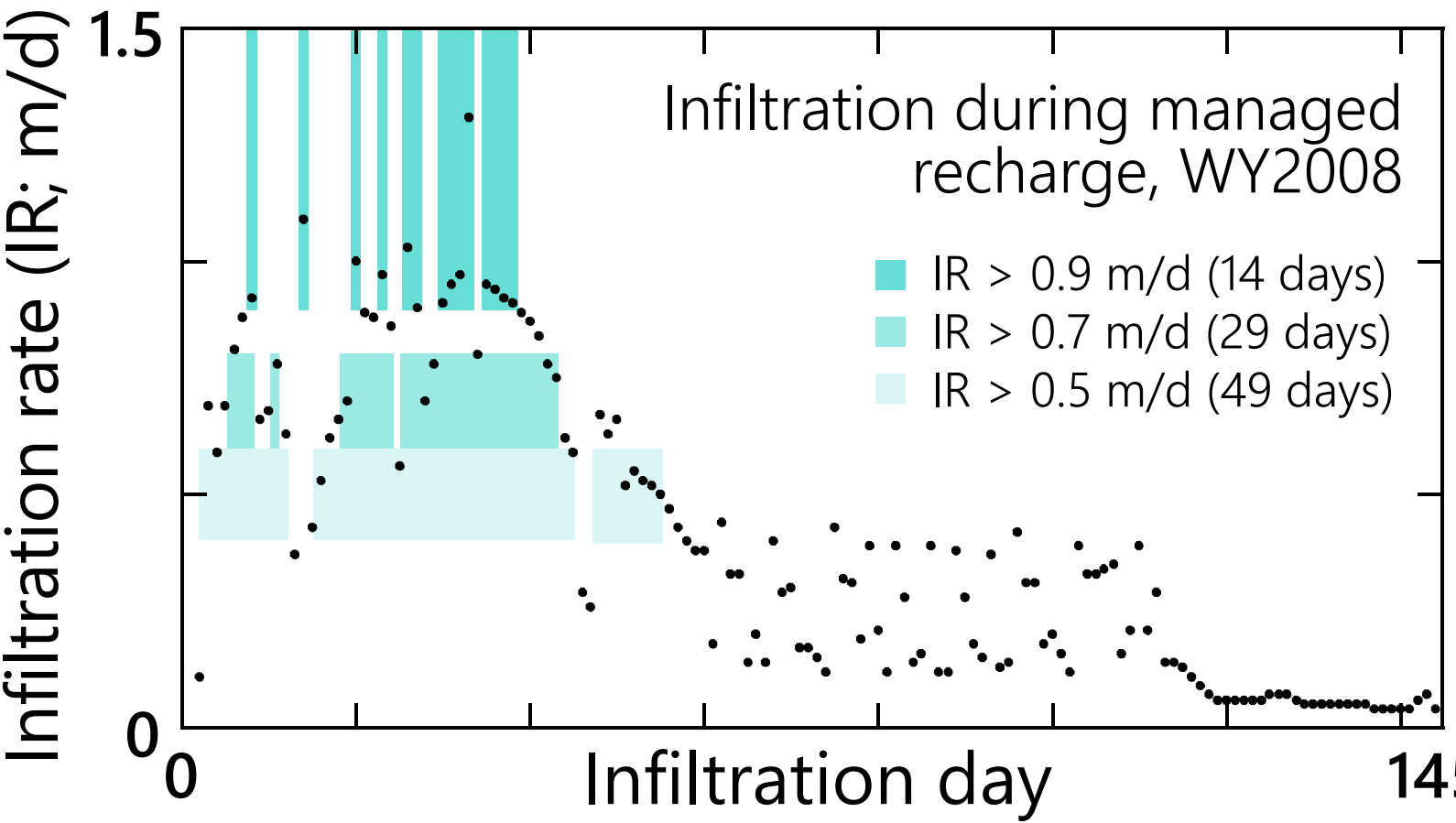
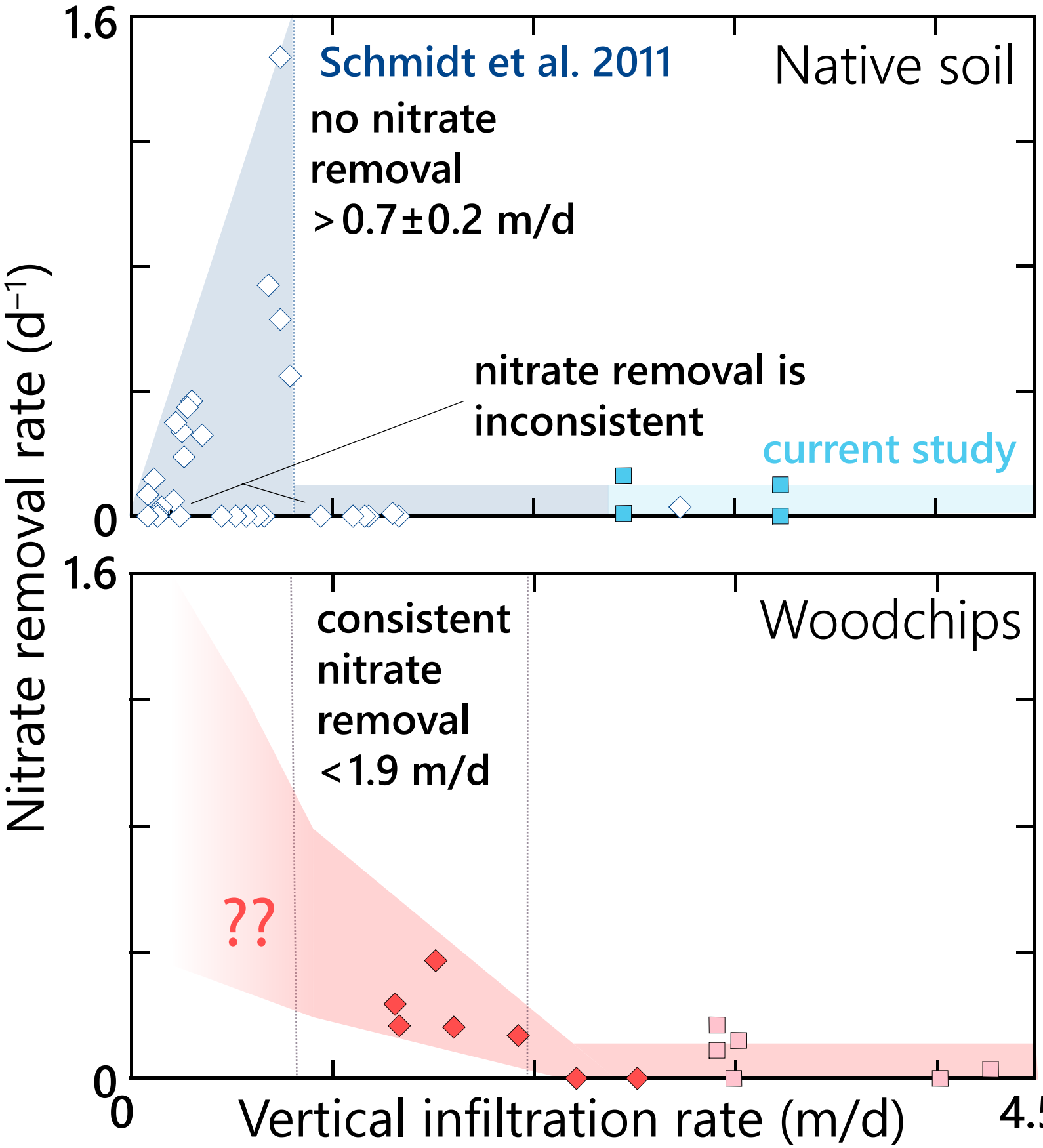
Residual nitrate in infiltrating water below woodchips was enriched in $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$, consistent with denitrification during rapid infiltration.



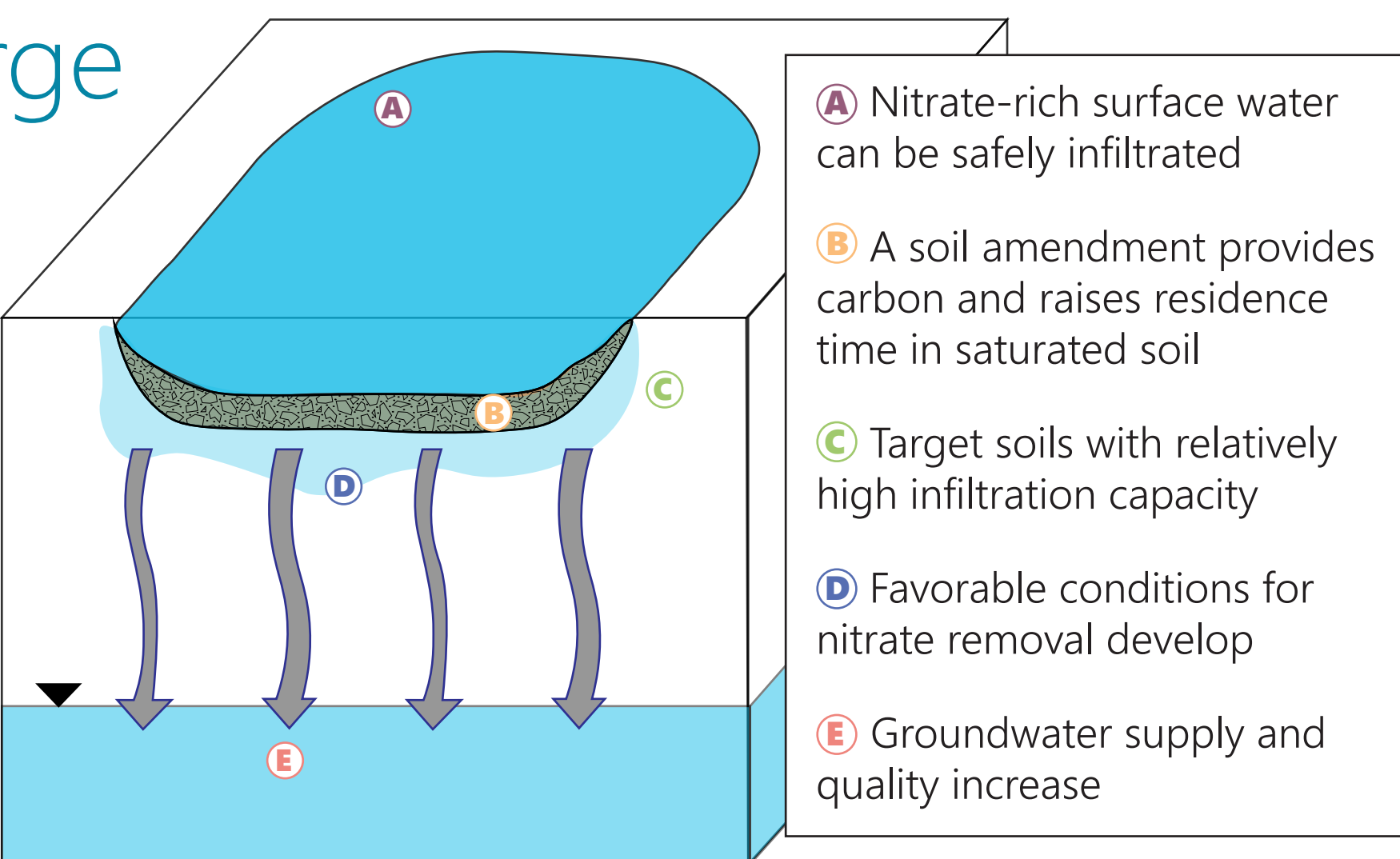
Denitrifying microbes had greater relative abundances after infiltration through woodchips, but not native soil.



The relative abundance of putative nitrate-reducing bacteria in the soil below woodchips correlated with average nitrate concentrations; both decreased with depth.



Managed recharge can facilitate water quality improvement while rapidly infiltrating surface water.



Woodchips may provide the most benefit during rapid infiltration, which is common during managed recharge.

In native soil, inconsistent nitrate removal occurred below 0.7 m/d. In soil below woodchips, consistent nitrate removal occurred up to 1.9 m/d.

Further work is needed to explore the impact of soil amendments over a wider range of infiltration rates, across different soil types, and at different scales.

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