Quantifying the main sediment sources in agricultural landscapes of Southern Brazil cultivated with conventional and conservation practices

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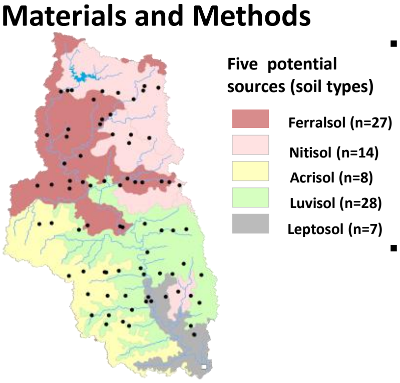
Context

- Agricultural expansion that occurred in the 1960s in Southern Brazil significantly increased soil erosion and sediment supply to the river networks.
- To limit the deleterious impacts of soil erosion, conservation practices including direct sowing were progressively implemented in the 1990s.

- However, there remains a lack of observational data to investigate the impact of these conservation practices on soil erosion and sediment supply.

Materials and Methods



- Sediment sources were investigated in the Guaporé catchment (2032 km²) representative of the cultivated environments of Southern Brazil.
- Sediment samples (n=7) were collected at the outlet between 2012 and 2014 using *in situ* time-integrated suspended sediment samplers.

Sediment fingerprinting

1. Measurement of a panel of potential tracers by ICP-MS and MC-ICP-MS.

2. Examination of the conservative behavior of the elements

➡ Only Na was not conservative

3. Kruskal Wallis test (KW)

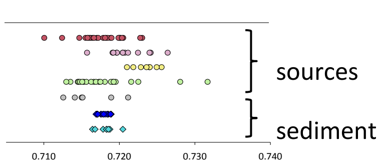
➡ $^{87}Sr/^{86}Sr$, Mg, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Sr, Mo, Ag, Sb, Ba, Tl, Pb (discriminant)

4. Stepwise Discriminant Function Analysis (DFA)

➡ **$^{87}Sr/^{86}Sr$, K, Ti, Co, As, Ba, Pb** provide the best discrimination

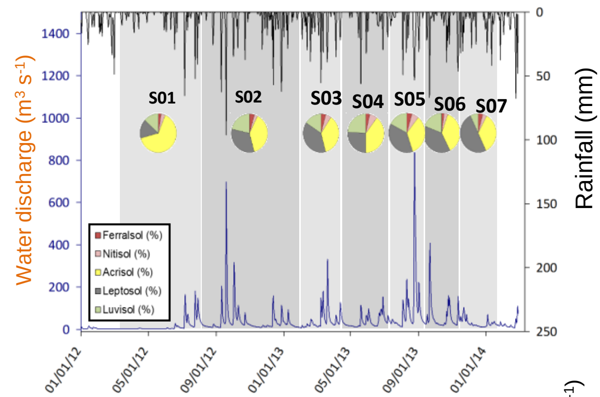
5. Running an un-mixing model to calculate the source contributions

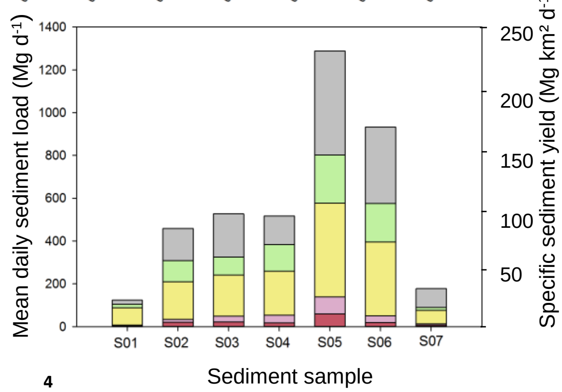
➡ Details are provided in the associated publication

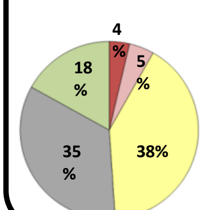


Results

- Sediment samples were modelled to mainly originate from downstream Acrisols (mean 41%, standard deviation (SD) 2%), Leptosols (mean 34%, SD 4%) and Luvisols (mean 17%, SD 4%).
- In contrast, contributions of upstream Ferralsols (mean 4%, SD 2%) and Nitisols (mean 4%, SD 6%) were low.







- Upstream soil contributions remain low (Ferralsols, Nitisols)
- Downstream soil contributions dominate the outlet sediment supply

Conclusions and perspectives

- These results suggest that soils found in lower parts of the catchment, cultivated with conventional agriculture on steep slopes, were the main source of sediment to the river network.
- In contrast, soils found in upper parts of the catchment, cultivated with soybean under direct sowing, were less eroded or deposited before reaching the sediment sampling location at the outlet.
- These findings demonstrate that the management of local and degraded soil sources is important for reducing sediment loads.

Reference

Le Gall, M., et al. (2017). *Land Degradation & Development*; DOI: 10.1002/ldr.2662.