

High Andean Soil Landscapes Shaped by Interactions between Geomorphology, Vegetation, and Hydrology

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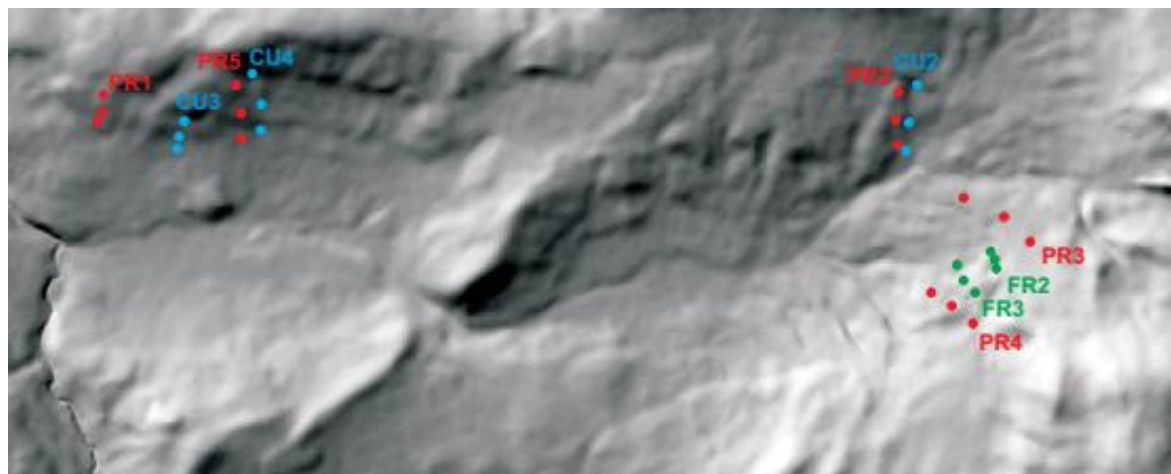
Spatial patterns in rock-derived weathering products across hillslopes and their association with topography and vegetation

Hypotheses :

Weathering extent of the soil mantle differs between (1) vegetation types and (2) topographic positions



Soil sampling: 10 soil catenas from divergent to convergent areas



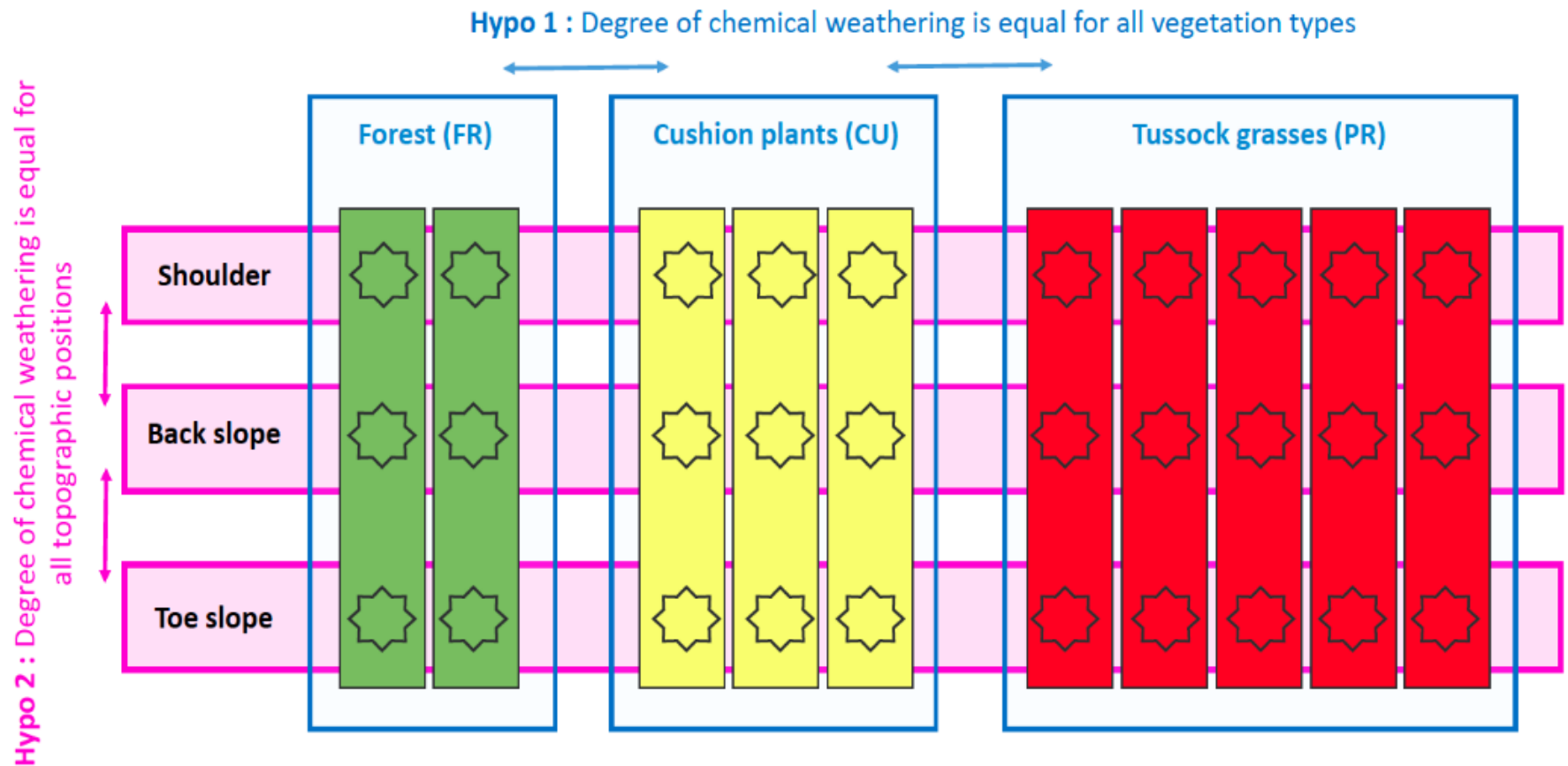
Specie of Tussock grass páramo



Species of Plantago rígida and Uncinia



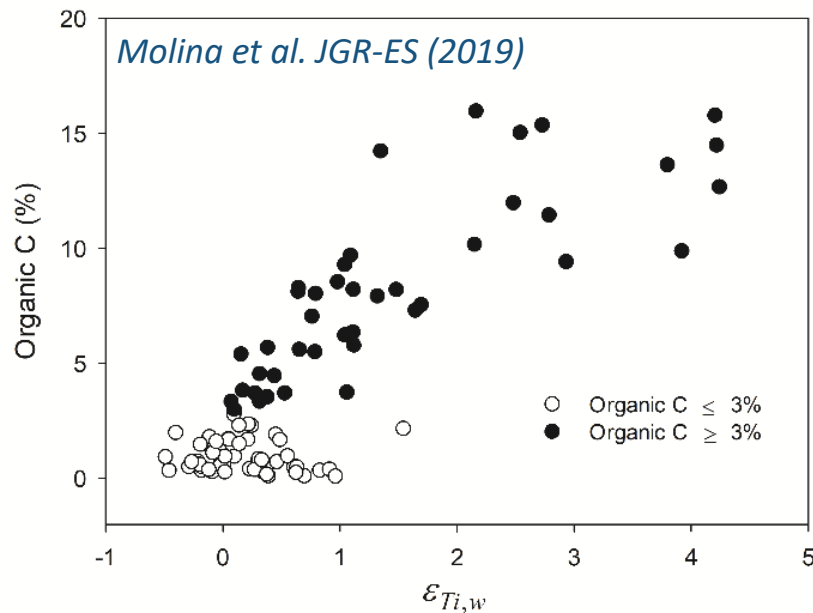
Specie of Polylepis reticulata



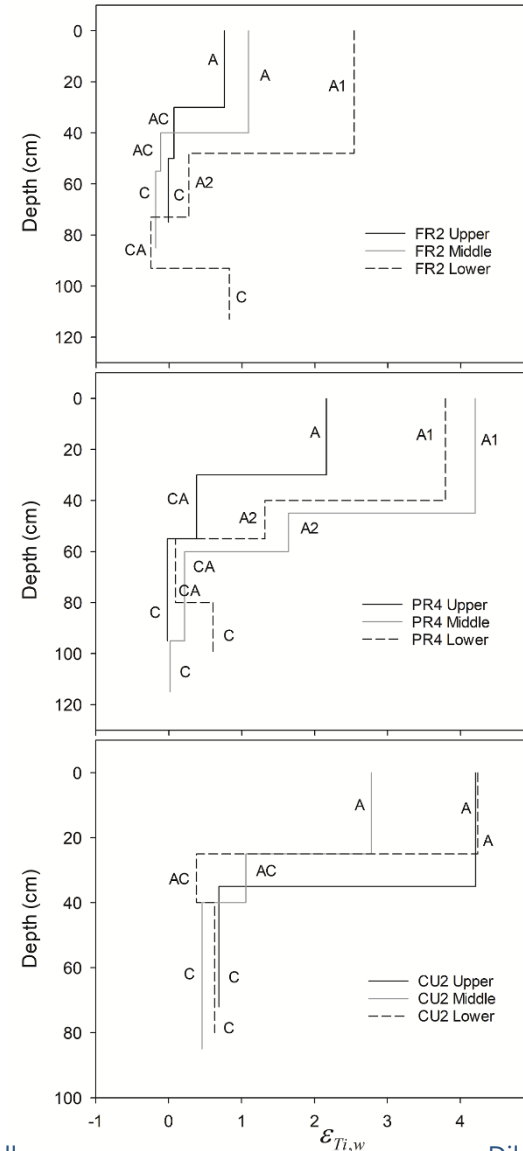
PHYSICAL DEFORMATION OF THE SOIL

Physical deformation or strain

- All A organic-rich horizons have undergone expansion relative to parent material, a factor of ~ 2
- Weathered rock layer, slight expansion $\sim 20\%$



Relationship between strain and organic carbon



Collapse

Dilation or expansion

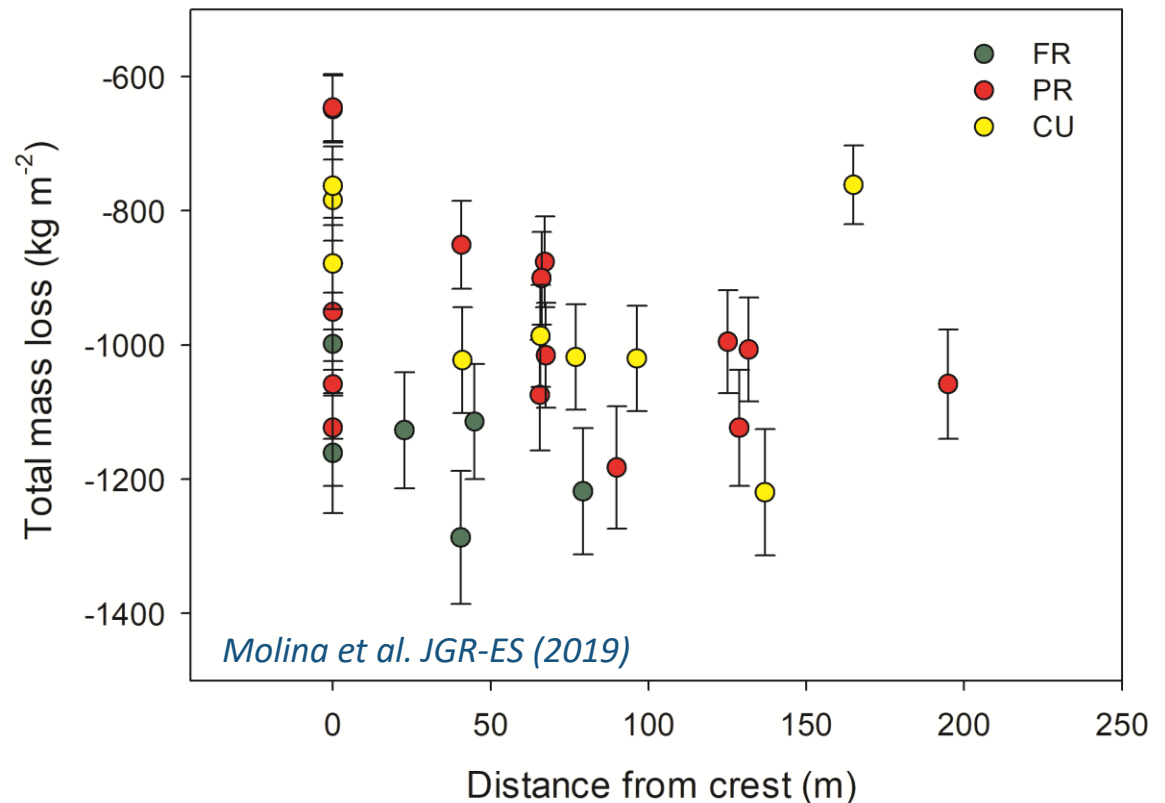


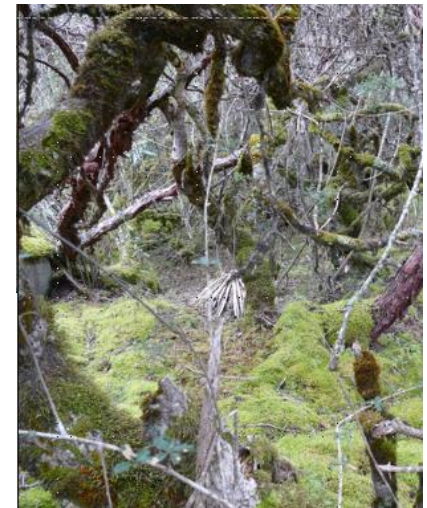
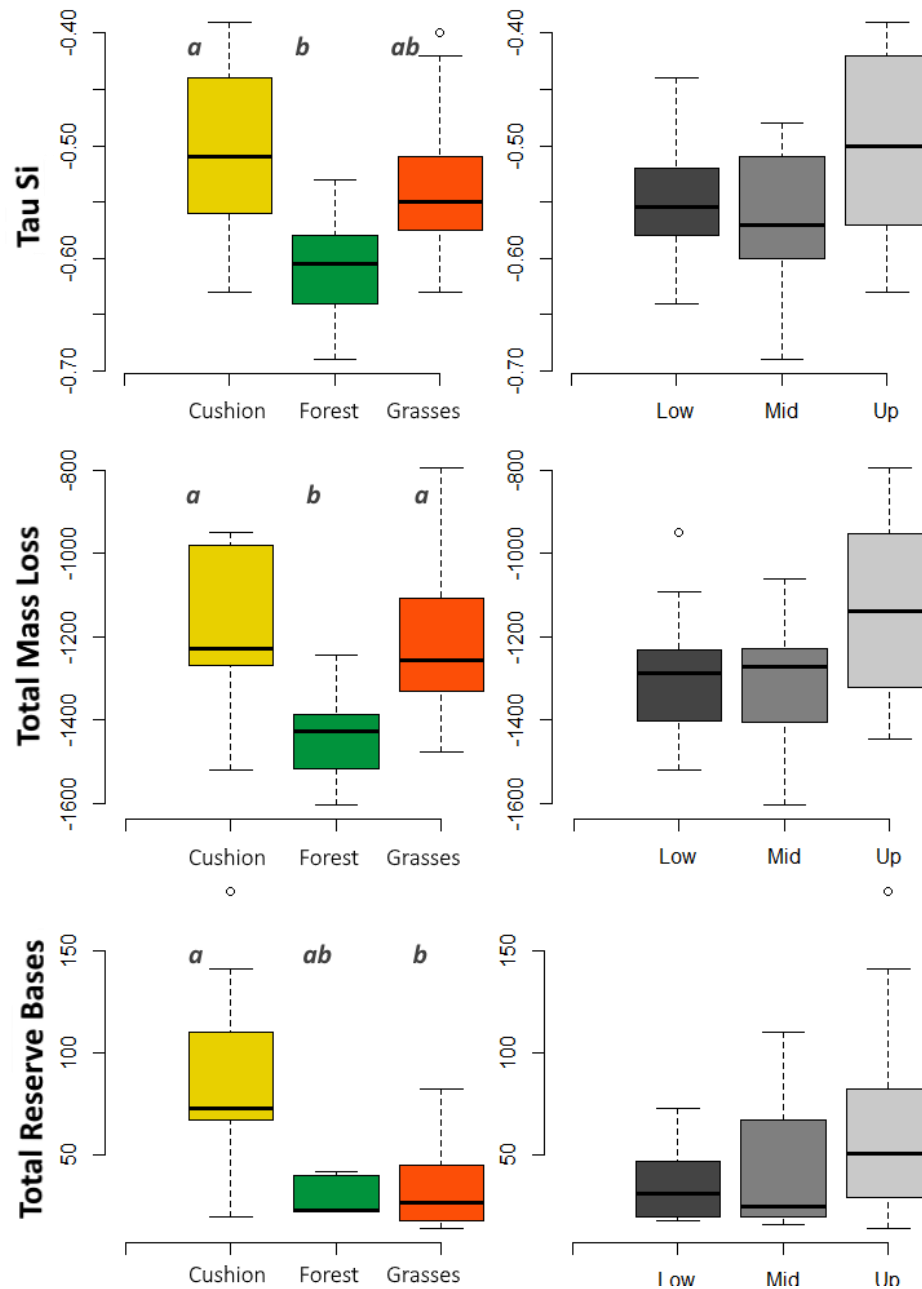
TOTAL WEIGHT LOSSES BY CHEMICAL WEATHERING

Total mass loss by chemical weathering per unit area

$$\delta_{total} = \sum_{h=1}^n \rho_p z_h \left(\sum_{j=1}^m \tau_{j,w} C_{j,p} \right)$$

(Porder et al., 2007)





Molina, A., Vanacker, V., Corre, M. D., & Veldkamp, E. (2019). Patterns in soil chemical weathering related to topographic gradients and vegetation structure in a high Andean tropical ecosystem. *Journal of Geophysical Research: Earth Surface*, 124. <https://doi.org/10.1029/2018JF004856>



1. Young postglacial soils developed on andesitic parent material with intense weathering and strong depletion of base cations
2. Organic carbon storage and accumulation
3. Spatial pattern in rock-derived nutrients associated with vegetation distribution
4. Total mass losses by weathering in forests : 19% and 22% higher than grassland and cushion forming plants
5. Subsurface hydrology creating differences in water residence times



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