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Adding another dimension: Temporal development of the spatial distribution of soil and crop properties in slow-forming terrace systems

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- Slow forming terraces decreased their slope by more than 50% in two decades and thus serve the purpose of soil conservation.
- Initial strong spatial heterogeneity of soil chemical parameters (macronutrients, SOM and pH) significantly decreased after 17 years using [chicken manure](#).
- Initial spatial heterogeneity in crop productivity was equalized after 17 years.

Abstract

The cultivation of marginal land in the Andes makes it one of the hot-spots of soil erosion. Since the 1980s an alternative soil conservation method denominated “slow-forming terraces” has been introduced to the area, since it is not labour or cost intensive and therefore more likely to be applied by the small-holder farmers. Research investigating the short-term effect on soil properties and crop productivity in these terrace systems showed reason for concern regarding the sustainability of the method, since there were position-dependent drops in crop productivity and related soil properties especially on shallow soils. Here, we investigate in the same terrace systems the temporal change of the observed properties 21 years after establishment. The terraces are managed by subsistence farmers and thus provide a valuable insight: if the spatial heterogeneity disappears, this renders slow-forming terraces agronomically sustainable in the long-term. Our results show a significant improvement of soil properties in general and furthermore to most extent a disappearance of the spatial heterogeneity in plant properties. These findings outline that the initial disadvantages of this soil conservation practice can be overcome in the long-term making slow-forming terraces a valuable measure for soil conservation and a sustainable system for small-holder subsistence farming. A support in farm planning, informing about both short- and long-term agronomic effects, while also considering social, economic and cultural/traditional aspects, could increase the adoption and maintenance of conservation measures and also symbiotically increase family income.

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KEY WORDS

Soil conservation; Andes; Erosion; Contour hedgerow systems; Ecuador

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