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Productivity, fertilizer responses and nutrient balances of farming systems in central Tigray, Ethiopia: a multi-perspective view in relation to degradation.

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In many rural livelihoods in sub-Saharan Africa, crop productivity plays an important role since it links with food insecurity, which again is a major constraining factor in livelihood development. Sustainable livelihood development and land degradation are closely connected: lacking sustainability often results in land degradation, whereas the incidence of land degradation frequently frustrates sustainable development. Important forms of land degradation are soil erosion and nutrient depletion, both often being attributed to exhaustive land use practices and both having a direct and major impact on crop productivity. Application of nutrients is an important way to increase productivity. In our study area, central Tigray, development agents recommend the application of fertilizers at high rates in order to boost productivity and to deal with nutrient depletion. In the discussion about the use of fertilizers different perspectives can be taken, in which especially responses and nutrient balances are important issues, linking respectively with socio-economic and agro-ecological livelihood aspects. Ethiopian soils for example are, based on large scale nutrient balances, considered to be depleted, at field scale fertilizer responses are frequently disappointing and achieving sustainable nutrient balances at farm level seems difficult. At a temporal scale however, agricultural systems remained almost unchanged for over 2500 years, suggesting at least some degree of sustainability. With respect to productivity data resulting from on-farm experimentation with natural and artificial fertilizers in 26 sites, we took four perspectives, different in ownership and scale, on nutrient related land degradation and its assumed impact on crop productivity. Taking a farmer perspective we found no significant difference between responses to recommended and current farmer based practices. Taking a more scientific perspective highlighted that, based on the positive correlation between response and soil-P, phosphorus was limiting. A relatively short term farm-level perspective made clear that closing nutrient balances to achieve sustainability is difficult, only the use of manure seemed somewhat satisfactory in this. In case a long term perspective is taken, apparent historical sustainability seems to relate to the combination of relatively low yield levels and mixed farming. Depending on the perspective taken different interventions can be forwarded, all four perspectives however indicate that strengthening the existing mixed farming system provides a promising alternative, allowing the improvement of agro-ecological as well as socio-economic sustainability of involved livelihoods.