Land use/cover change in the north Ethiopian highlands: integration of satellite imagery and terrestrial photography

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Erosive rains, steep slopes and human land use have caused severe land degradation in the Ethiopian highlands. Since the 1970s, land rehabilitation programs have been established.

In order to characterize and quantify the transformations in the northern Ethiopian highlands, a study was carried out in an 8884 km² study area (1300 – 4000 m a.s.l.) in eastern Tigray.

Land use and cover maps were obtained using Landsat imagery (1972, 1984-86 and 2000), historical ground-based photographs (1974-5) and fieldwork (2008). In order to assess the use of the historical ground-based photographs, the 1972 Landsat images were classified using two different methods, i.e. conventional change detection (image differencing) and ground truthing (using the historical photographs of 1974-5).

The use of ground-based photographs seems very promising, as the classification accuracy based on this method was better (Kappa coefficient 0.54) than the classification accuracy of the method based on image differencing (Kappa coefficient 0.46).

Major land use and cover changes between 1972 and 2000 are (1) a gradual but significant decline in bare ground (from 32% to 8%), (2) a significant increase of bushland (25% to 43%) and total forest area (including Eucalyptus plantations, 2.6% to 6.3%) and (3) creation of numerous lakes and ponds.

The dominant change trajectory is a gradual or recent vegetation increase (27% of the study area). These changes can be linked to changes in the land tenure system, population increase and introduction of land rehabilitation initiatives, complemented by growing land holders' awareness.