

## **Gully afforestation as a historical land management choice: regional insights from SW Ethiopia using 1938-57 aerial photographs**

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Historical aerial photographs can be used to investigate past environmental conditions, resulting in insights on how past societies managed their landscape. Here, we used a series of orthorectified aerial photographs of 1938-40, 1957 and recent satellite images of 2014-16 to explore trends and patterns of woody vegetation cover in the Lake Tana basin of northwestern Ethiopia, and how land cover changes influence gully dynamics. Woody vegetation was mapped using a supervised image classification and gully networks were mapped on-screen from randomly-chosen sites distributed across the study area. Our results reveal that woody vegetation cover has drastically changed over the past 80 years. From an overall cover of about 20% in 1938-40 and 1957, woody vegetation cover dropped to <10% in 2014-16. Areas that were subjected to agricultural intensification saw woody vegetation cover drop dramatically. Paddock trees, woodlots and forests have largely been transformed into cropland. Remarkably, most thalwegs were vegetated in 1938-57. Concomitant to the woody vegetation loss, gully networks expanded over the study period. From 1938-57 to the present, gully density increased from 0.5-1 to 1.9 km km<sup>-2</sup>. The interrelation between both was most remarkable for thalwegs, where the loss of woody vegetation has been paralleled by the development of gully networks and multiplication of gully heads. Our analyses of woody vegetation cover and gully networks indicate a delicate balance of conservation in 1938-1957, a period during which the abundance of vegetation on key topographic positions limited the development of gullies in the anthropogenic landscape. We hypothesize that as part of indigenous knowledge on erosion control, past societies may have allowed spontaneous vegetation regrowth in thalwegs to protect against erosion. Such insights are important additions to current debates on land rehabilitation.