Effects of Chinese Deforestation and Reforestation Policies on Sediment Sourcing in Yunnan, China

Details

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Abstract

Widespread deforestation from the 1960s through 1980s, blamed for catastrophic flooding in the lower Yangtze in 1998, prompted bans on logging and agriculture on steep slopes in western China. However, despite reports of extensive erosion resulting from the deforestation, sediment yield data show no corresponding increase during this time. Prior work suggested that if the deforestation increased erosion, the sediment is stored in floodplains, terraces, and alluvial fans throughout the region. In order to test this hypothesis, we sampled in-channel and overbank sediments at 38 locations, 19 of which are co-located with Chinese hydrology stations with at least five years of daily sediment yield data. Sediments were analyzed for meteoric and in situ 10-Be, unsupported 210-Pb, and 137-Cs. Unsupported 210-Pb activity is uniformly low throughout the study area and 137-Cs was found only in a few high-altitude, low-relief watersheds. Modern sediment yields, determined from Chinese data, are higher than long term in situ 10-Be-derived erosion rates in all but four watersheds, where we hypothesize sediment is being stored in alluvial features and agricultural terraces or that stochastic events such as landslides were not captured in the sediment yield data. Overall there is no relationship between topographic or climatic metrics, including slope, relief, or mean annual rainfall for any of the four isotopes except for a weak but statistically significant negative relationship between in situ 10-Be derived erosion rate and rainfall. Although paired in-channel and overbank samples are statistically indistinguishable for meteoric and in situ 10-Be, the overbank samples have lower unsupported 210-Pb activity, suggesting deeper sediment sourcing during the monsoon. In summary, in addition to suggesting differences between wet- and dry-season sediment sources, preliminary results support previous hypotheses regarding increased contemporary erosion and low hillslope-channel connectivity.

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