Landscape features

Impact: Soil erosion

Reference 17

Xiong, M; Sun, R; Chen, L 2018 Effects of soil conservation techniques on water erosion control: A global analysis SCIENCE OF THE TOTAL ENVIRONMENT, 645, 753-760. 10.1016/j.scitotenv.2018.07.124

Background and objective

The benefits of soil conservation techniques (SCTs) vary according to correlations between the natural environment and anthropogenic activities, and their effects on water erosion control at the plot scale have been extensively tested in field runoff plots. However, only a few previous studies have focused on quantifying the effects of various SCTs at the regional scale, and only one type of SCT has been studied at the national, regional and global scales. Therefore, a comprehensive overview and quantification of various SCTs at the global scale is lacking. The objectives of this paper are: 1) to develop a documented global database of field plot data on the use of SCTs; 2) to quantify the effects of different SCT types on water erosion control at the global scale; and 3) to compare the effects of SCTs on water erosion control for different slopes, land uses, continents and climate zones (CZs).

Search strategy and selection criteria

A database of runoff, soil loss and runoff plot measurements acquired from areas where soil conservation techniques were applied was mainly compiled from scientific journal articles, books and Ph.D. dissertations. The authors reviewed the ISI Web of Science, China National Knowledge Infrastructure, and Google Scholar databases to identify articles matching the keywords, soil loss and sediment yield. 1) The article contained at least one runoff or soil loss response variable; 2) each data point was collected during at least a full year, or the reported data could be extrapolated to represent a full year with a sufficient degree of reliability; 3) the same response variables were compared between lands treated with soil conservation techniques (SCTs), hereafter called treated, and those not treated with SCTs (hereafter called control); 4) the treated lands and control lands were exposed to the same environmental conditions; 5) the number of replications was reported; 6) the groups of categories contained more than two data pairs; 7) only runoff and soil loss measurements from bound runoff plots equipped with tanks for collecting runoff and soil loss were used to reduce the influence of measurement uncertainties, and only plots with a minimum length of 5 m were retained because they were considered to be representative.

Data and analysis

To further analyze the efficiencies of soil conservation techniques among different subgroup categories, the heterogeneity of effect sizes was assessed with p-values that describe the variations in effect sizes that can be attributed to differences among the categories of each predictor variable. The overall effect sizes and 95% confidential intervals (CIs) were computed and compared using the program Metafor 2.0.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
121	Cropland and Orchard	1. Buffer strips; 2) Contour bunds, terraces; 3) Hedgerows	No soil conservation techniques	Metric: Soil loss; run-off; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	69%

Results

- Soil loss reduction was greater with than without buffer strips or hedgerows.
- Run-off reduction was great for buffer strips. However, hedgerows were not recognized as powerful tools for reducing runoff.
- For orchards, the benefits of SCTs in term of soil loss reduction increased as the slope increased, and for buffer strips was 38% and 26% for terraces.
- NA
- NA

Factors influencing effect sizes

- NA : NA
- NA : NA
- NA : NA

Conclusion

Buffer strips, terraces and contour bunds were effective in reducing soil erosion and run-off. However, hedgerows were effective in reducing soil erosion but were not effective in reducing run-off.