Agroforestry and water retention

Reference 4

Sun, D; Yang, H; Guan, DX; Yang, M; Wu, JB; Yuan, FH; Jin, CJ; Wang, AZ; Zhang, YS. 2018 The effects of land use change on soil infiltration capacity in China: A meta-analysis. Science of the total enviroment, 626, 1394-1401. doi: 10.1016/j.scitotenv.2018.01.104

Background and objective

Land use changes can cause a significant change in soil physical properties and thus affected soil infiltration rates. Reasonable land use patterns could ameliorate the soil infiltration capacity through altering soil physical and chemical properties, which ultimately influenced soil water redistribution processes. The objective of this meta-analysis was to identify the soil infiltration capacity under different land use types. Additionally, to quantify soil property conversions accompany with land use type changes and demonstrate the relationship between soil properties and soil infiltration capacity.

Search strategy and selection criteria

Collected data on soil infiltration rate from peer-reviewed papers published in both Chinese and English language journals from 1999 to 2016. Papers in Chinese were collected from the China National Knowledge Infrastructure (CNKI) database and those in English from ISI-Web of Science and Google Scholar. 1)studies had to report at least one of variables including soil initial infiltration rate and steady infiltration rate before and after land use change; 2) means and sample sizes had to be reported; 3) any studies lacking replication was not considered; 4) land use change could be represented by two different land use types, as long as they locate in adjacent sites.

Data and analysis

A fixed-effects model option was employed in Metawin 2.1 for calculation of grouped effect sizes except in instances where the results of homogeneity test were statistically significant ($P < 0.05$), in which case a random effects model was used. Confidence intervals (CIs) on the weighted effect size were generated using bootstrapping (9999 iterations). Publication bias was quantified by Egger's regression test. Trim-and-fill analysis was also conducted to test the robustness of these results which existed publication bias.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
42	Land use change between grassland, cropland, forest and agroforestry in China.	Agroforestry	Cropland, forest (natural forest, secondary forest and plantation forest, coniferous forest, broadleaf and mix forest).	Logarithm of ratio of soil (both initial and steady) infiltration rate in agroforestry to soil infiltration rate in other land uses.	88%

Results

- Soil initial and steady infiltration rates of agroforestry were 70.28% and 84.17% higher than that of cropland, respectively.
- Both soil initial and steady infiltration rates were not significantly altered when forest (all types) converted to agroforestry, as their 95% confidence intervals covering the value of zero.
- From forest plantation to agroforestry, soil initial and steady infiltration rates were both significantly increased by 110.92% and 35.85%, respectively.
- NA
- NA

Factors influencing effect sizes

Soil bulk density and total porosity of cropland were both significantly decreased when it converted to agroforestry. The decrease of soil bulk density and increase of organic matter content led to the increase of soil infiltration rates. No significant alteration happened on soil infiltration rates when broadleaf forests were converted to agroforestry.

Conclusion

1)Conversion from cropland to agroforestry is in favor of improving soil infiltration rate. 2) Establishing agroforestry does not significantly alter soil infiltration rate of forest except that condition of increasing soil infiltration rate for forest plantations.