

**Table S1.** Interactions and significance effect of shrub encroachment and soil layer on soil nutrient concentrations, organic carbon storage (CS) and stoichiometry ratios.

Variables	Stages	Layers	Stages×Layers
pH	0.066(0.541)	0.451(0.005)	0.138(0.588)
WC	0.643(0.000)	0.445(0.005)	0.238(0.273)
BD	0.618(0.000)	0.452(0.004)	0.256(0.230)
OC	0.919(0.000)	0.801(0.000)	0.740(0.000)
TN	0.886(0.000)	0.823(0.000)	0.766(0.000)
TP	0.916(0.000)	0.615(0.000)	0.432(0.030)
AN	0.909(0.000)	0.824(0.000)	0.649(0.001)
AP	0.205(0.127)	0.241(0.084)	0.152(0.536)
AK	0.722(0.000)	0.917(0.000)	0.836(0.000)
ACa	0.223(0.103)	0.229(0.096)	0.052(0.907)
AMg	0.113(0.340)	0.726(0.000)	0.241(0.265)
CS	0.422(0.007)	0.028(0.771)	0.177(0.470)
OC:TN	0.647(0.000)	0.159(0.209)	0.130(0.619)
OC:TP	0.450(0.005)	0.522(0.001)	0.241(0.265)
TN:TP	0.559(0.001)	0.522(0.001)	0.328(0.111)
OC:TN:TP	0.481(0.003)	0.164(0.200)	0.207(0.356)
AN:AP	0.312(0.034)	0.059(0.579)	0.068(0.855)
AN:AK	0.845(0.000)	0.577(0.000)	0.538(0.006)
AN:ACa	0.806(0.000)	0.218(0.110)	0.197(0.386)
AN:AMg	0.906(0.000)	0.536(0.001)	0.295(0.157)
AP:AK	0.061(0.566)	0.096(0.404)	0.235(0.280)
AP:ACa	0.334(0.026)	0.013(0.885)	0.199(0.378)
AP:AMg	0.145(0.244)	0.071(0.517)	0.162(0.499)

The numbers outside the brackets were partial eta squared( $\eta^2$ ) which were used to determine the relative importance of each factor or interaction (The greater the value, the greater is the importance), and the numbers inside the brackets were  $p$  value. Yellow background indicates significance ( $p < 0.05$ ). OC represents soil organic carbon, TN represents soil total nitrogen, TP represents soil total phosphorus, AN represents soil available nitrogen, AP represents soil available phosphorus, AK represents soil available potassium, ACa represents soil available calcium, AMg represents soil available magnesium, WC represents soil water content, BD represents soil bulk density, CS represents soil organic carbon storage (CS) storage. OC:TN represents the ratio of soil organic carbon to soil total nitrogen, and so on.