

Table S1 Basic chemical properties in soil aggregate of the study sites (mean \pm SE).

| Erosion position | Aggregate size (mm) | OC (g kg ⁻¹) | TN (g kg ⁻¹) | Fef (g kg ⁻¹) | Fea (g kg ⁻¹) |
|------------------|---------------------|--------------------------|--------------------------|---------------------------|---------------------------|
| UC | <0.053 | 27.11 \pm 0.52 | 0.67 \pm 0.01 | 31.55 \pm 0.15 | 2.91 \pm 0.04 |
| | 0.053-0.25 | 15.02 \pm 0.27 | 0.29 \pm 0.00 | 31.63 \pm 0.15 | 2.34 \pm 0.04 |
| | 0.25-2 | 8.73 \pm 0.17 | 0.28 \pm 0.02 | 10.26 \pm 0.28 | 3.48 \pm 0.01 |
| | 2-5 | 6.77 \pm 0.09 | 0.27 \pm 0.00 | 6.70 \pm 0.17 | 3.14 \pm 0.10 |
| CW | <0.053 | 3.11 \pm 0.11 | 0.06 \pm 0.00 | 24.37 \pm 0.35 | 1.59 \pm 0.02 |
| | 0.053-0.25 | 2.66 \pm 0.08 | 0.01 \pm 0.01 | 24.06 \pm 0.07 | 5.70 \pm 0.16 |
| | 0.25-2 | 1.82 \pm 0.05 | 0.06 \pm 0.01 | 26.18 \pm 0.11 | 3.05 \pm 0.04 |
| | 2-5 | 0.98 \pm 0.10 | 0.04 \pm 0.00 | 15.81 \pm 0.11 | 2.08 \pm 0.04 |
| CD | <0.053 | 2.22 \pm 0.05 | 0.18 \pm 0.00 | 23.88 \pm 0.30 | 1.16 \pm 0.02 |
| | 0.053-0.25 | 3.23 \pm 0.05 | 0.02 \pm 0.00 | 24.64 \pm 0.10 | 1.34 \pm 0.06 |
| | 0.25-2 | 0.33 \pm 0.02 | 0.01 \pm 0.00 | 4.07 \pm 0.06 | 0.42 \pm 0.01 |
| | 2-5 | 0.42 \pm 0.05 | 0.02 \pm 0.00 | 2.62 \pm 0.02 | 0.48 \pm 0.02 |
| SC | <0.053 | 1.21 \pm 0.12 | 0.08 \pm 0.00 | 21.04 \pm 0.50 | 1.19 \pm 0.04 |
| | 0.053-0.25 | 1.30 \pm 0.03 | 0.02 \pm 0.00 | 24.57 \pm 0.14 | 2.74 \pm 0.04 |
| | 0.25-2 | 0.33 \pm 0.01 | 0.02 \pm 0.01 | 4.63 \pm 0.02 | 0.64 \pm 0.02 |
| | 2-5 | 0.23 \pm 0.01 | 0.01 \pm 0.00 | 2.76 \pm 0.02 | 0.45 \pm 0.01 |
| AF | <0.053 | 1.53 \pm 0.01 | 0.04 \pm 0.00 | 24.15 \pm 0.11 | 4.43 \pm 0.02 |
| | 0.053-0.25 | 2.76 \pm 0.12 | 0.02 \pm 0.00 | 24.34 \pm 0.17 | 1.27 \pm 0.03 |
| | 0.25-2 | 2.33 \pm 0.08 | 0.09 \pm 0.00 | 23.25 \pm 0.16 | 1.80 \pm 0.02 |
| | 2-5 | 1.89 \pm 0.05 | 0.06 \pm 0.00 | 19.01 \pm 0.06 | 3.69 \pm 0.08 |

UC, upper catchment; CW, collapsing wall; CD, colluvial deposit; SC, scour channel; AF, alluvial fan; SE is the standard

error. BD, bulk density; CP, capillary porosity; OC, organic C; TN, total N; Fef, free iron; Fea, amorphous iron oxide.

Table S2 Loading factors of parameters on the first Principal Components (PC1 and PC2) of principal component analysis (PCA) applied to physicochemical parameters and labile C fractions of soils subject to erosion positions.

| Parameters | Principal component | |
|---------------------------------|---------------------|--------|
| | PC1 | PC2 |
| BD | -0.082 | -0.268 |
| CP | -0.117 | 0.024 |
| Sand | -0.102 | -0.391 |
| Silt | -0.109 | 0.385 |
| Clay | 0.280 | 0.160 |
| Fef | 0.301 | -0.041 |
| Fea | -0.014 | -0.187 |
| SOC | 0.303 | 0.037 |
| TN | 0.303 | 0.033 |
| LOC | 0.303 | 0.034 |
| MLOC | 0.302 | 0.051 |
| HLOC | 0.302 | 0.043 |
| NLOC | 0.303 | 0.035 |
| Labile-C | -0.059 | 0.405 |
| Passive-C | 0.059 | -0.405 |
| CPI | 0.303 | 0.037 |
| L | -0.159 | 0.333 |
| LI | -0.159 | 0.333 |
| CPMI | 0.300 | 0.065 |
| Eigenvalue | 10.829 | 5.787 |
| Contributionrate (%) | 56.992 | 30.458 |
| Cumulative contributionrate (%) | 56.992 | 87.450 |

BD, bulk density; CP, capillary porosity; Fef, free iron; Fea, amorphous iron oxide; SOC, organic carbon in bulk soil; TN, total nitrogen in bulk soil; LOC, less-labile organic C; MLOC, moderately-labile organic C; HLOC, high-labile organic C; NLOC, non-labile organic C; CPI, soil C pool index; L, soil C pool lability; LI, soil C pool lability index; CPMI, C pool management index.

Table S3 Comprehensive scores of labile C stability with different erosion positions.

| Erosion positions | F1 | | F2 | | Comprehensive score | Comprehensive ranking |
|-------------------|--------|---------|--------|---------|---------------------|-----------------------|
| | Score | Ranking | Score | Ranking | | |
| UC | 1.779 | 1 | 0.162 | 2 | 1.215 | 1 |
| CW | -0.332 | 2 | -0.331 | 3 | -0.331 | 3 |
| CD | -0.368 | 3 | -0.935 | 5 | -0.565 | 5 |
| SC | -0.473 | 4 | -0.539 | 4 | -0.496 | 4 |
| AF | -0.606 | 5 | 1.643 | 1 | 0.178 | 2 |

UC, upper catchment; CW, collapsing wall; CD, colluvial deposit; SC, scour channel; AF, alluvial fan.

Table S4 Loading factors of parameters on the first Principal Components (PC1 and PC2) of principal component analysis (PCA) applied to physicochemical parameters, aggregate stability and erodibility of soils subject to erosion positions.

| Parameters | Principal component |
|------------|---------------------|
|------------|---------------------|

| | PC1 | PC2 |
|---------------------------------|--------|--------|
| BD | 0.136 | -0.213 |
| CP | -0.077 | -0.168 |
| Sand | 0.207 | -0.326 |
| Silt | -0.309 | 0.058 |
| Clay | 0.035 | 0.434 |
| Fef | 0.177 | 0.354 |
| Fea | 0.118 | -0.148 |
| SOC | 0.126 | 0.400 |
| TN | 0.128 | 0.395 |
| PSA1 | 0.311 | -0.034 |
| PSA2 | 0.243 | -0.156 |
| PSA3 | -0.311 | 0.041 |
| PSA4 | -0.308 | 0.062 |
| MWD | 0.311 | -0.040 |
| GMD | 0.309 | -0.010 |
| WSA | 0.310 | -0.051 |
| K | -0.305 | 0.039 |
| St | 0.175 | 0.360 |
| Eigenvalue | 10.269 | 5.222 |
| Contributionrate (%) | 57.052 | 29.014 |
| Cumulative contributionrate (%) | 57.052 | 86.066 |

BD, bulk density; CP, capillary porosity; Fef, free iron; Fea, amorphous iron oxide; SOC, organic carbon in bulk soil; TN, total nitrogen in bulk soil; Aggregate stability indexes: PSA1-4, the proportion of the total aggregates in LMA (2-5 mm), SMA (0.25-2 mm), MIA (0.053-0.25 mm) and SCA (< 0.053 mm); MWD, mean weight diameter; GMD, geometric mean diameter; WSA, the percentage content of > 0.25 mm water-stable aggregate; St, structural stability index; K, soil erodibility factor.

Table S5 Comprehensive scores of labile C stability with different erosion positions.

| Erosion positions | F1 | | F2 | | Comprehensive score | Comprehensive ranking |
|-------------------|-------|---------|-------|---------|---------------------|-----------------------|
| | Score | Ranking | Score | Ranking | | |
| UC | 0.724 | 1 | 1.634 | 1 | 1.031 | 1 |

| | | | | | | |
|----|--------|---|--------|---|--------|---|
| CW | 0.119 | 4 | -0.595 | 3 | -0.121 | 4 |
| CD | 0.503 | 2 | -0.660 | 4 | 0.111 | 2 |
| SC | 0.399 | 3 | -0.673 | 5 | 0.038 | 3 |
| AF | -1.746 | 5 | 0.293 | 2 | -1.059 | 5 |

UC, upper catchment; CW, collapsing wall; CD, colluvial deposit; SC, scour channel; AF, alluvial fan.

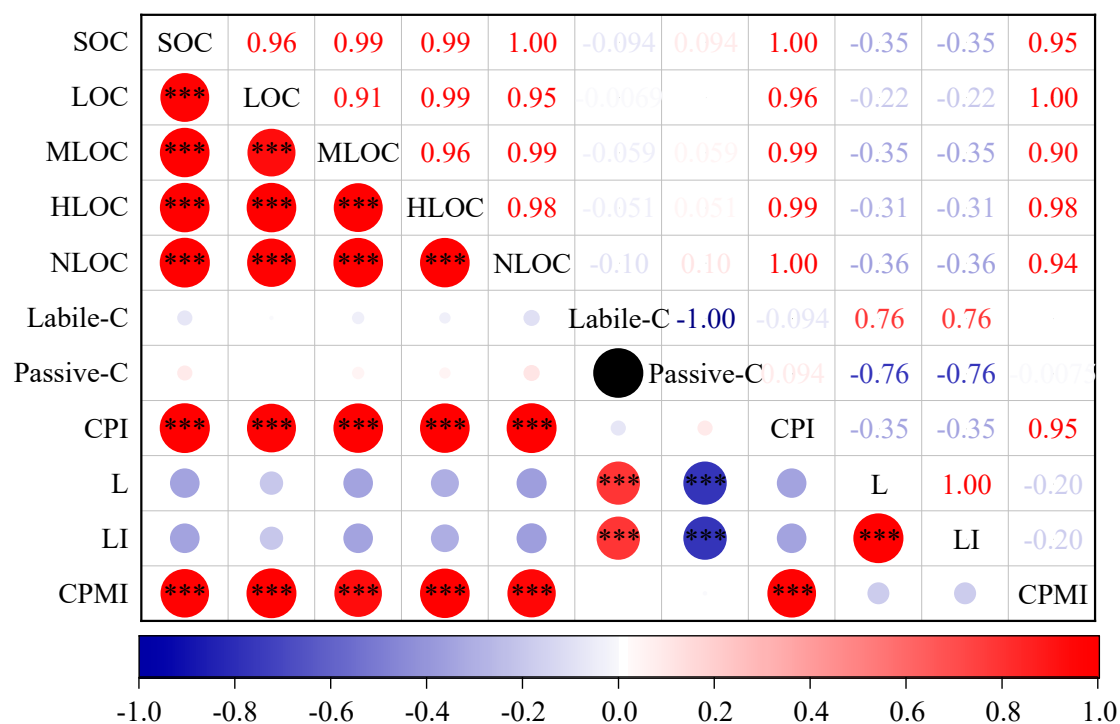


Figure S1 Pearson's correlation coefficients among soil organic C, labile C fractions and C pool management index under different soil erosion positions. SOC, soil organic C; LOC, less-labile organic C; MLOC, moderately-labile organic C; HLOC, high-labile organic C; NLOC, non-labile organic C; CPI, soil C pool index; L, soil C pool lability; LI, soil C pool lability index; CPMI, C pool management index. The *, ** and *** indicate significant correlation at $P < 0.05$, $P < 0.01$ and $P < 0.001$, respectively.