

Figure S1 Monthly mean N2O fluxes (mean ± SEM, *n* = 4) in Hani peatland in the growing season of 2019. CK, control; P1, P addition with 5 kg P ha-1 yr-1; P2, P addition with 10 kg P ha-1 yr-1; P1W, P1 + warming; P2W, P2 + warming.



Figure S2 Soil enzyme activities under warming (mean ± SEM, *n* = 4), (a) BDG; (b) NAG; (c) PHO; (d) POX. BDG, β-D-glucosidase; NAG, N-acetyl-β-glucosaminidase; PHO, phosphatase; POX, phenol oxidase. Asterisk represents a significant difference, **\*\*\****P* < 0.01; **\*\****P* < 0.05; **\****P* < 0.1; ns, no significant difference.

Table S1 Correlation analysis between biological and abiotic factors under P addition and co-effect of P addition and warming in Hani peatland.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Flux | DOC | TP | TN | TC | SC | VPC | TCov | WTD | C:N | N:P | pH | BDG | NAG | POX | PHO |
| Flux |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| DOC | 0.091 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TP | 0.362 | **0.562\*\*** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TN | 0.201 | 0.246 | **0.768\*\*\*** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TC | -0.045 | -0.254 | 0.146 | 0.269 |  |  |  |  |  |  |  |  |  |  |  |  |
| SC | -0.278 | -0.209 | -0.348 | -0.056 | 0.332 |  |  |  |  |  |  |  |  |  |  |  |
| VPC | 0.355 | **0.452\*\*** | **0.544\*\*** | 0.285 | -0.295 | **-0.606\*\*\*** |  |  |  |  |  |  |  |  |  |  |
| TCov | -0.135 | -0.004 | **-0.475\*\*** | -0.346 | -0.099 | **0.674\*\*\*** | **-0.402\*** |  |  |  |  |  |  |  |  |  |
| WTD | -0.242 | **-0.575\*\*\*** | -0.235 | 0.088 | **0.476\*\*** | 0.135 | **-0.467\*\*** | -0.165 |  |  |  |  |  |  |  |  |
| C:N | -0.195 | -0.318 | **-0.766\*\*\*** | **-0.975\*\*\*** | -0.061 | 0.112 | -0.357 | 0.327 | 0.008 |  |  |  |  |  |  |  |
| N:P | -0.36 | **-0.639\*\*\*** | **-0.927\*\*\*** | **-0.529\*\*** | 0.027 | **0.525\*\*** | **-0.725\*\*\*** | **0.489\*\*** | **0.410\*** | **0.556\*\*** |  |  |  |  |  |  |
| pH | -0.047 | **-0.488\*\*** | -0.37 | 0.077 | 0.078 | 0.142 | -0.072 | -0.2 | 0.299 | -0.082 | **0.435\*** |  |  |  |  |  |
| BDG | **0.432\*** | **0.411\*** | **0.683\*\*\*** | **0.549\*\*** | -0.297 | **-0.529\*\*** | **0.668\*\*\*** | -0.348 | -0.317 | **-0.617\*\*\*** | **-0.701\*\*\*** | -0.229 |  |  |  |  |
| NAG | **0.515\*\*** | **0.394\*** | **0.693\*\*\*** | **0.639\*\*\*** | 0.093 | -0.185 | **0.416\*** | -0.188 | -0.142 | **-0.641\*\*\*** | **-0.618\*\*\*** | 0.027 | **0.705\*\*\*** |  |  |  |
| POX | 0.346 | **0.728\*\*\*** | **0.722\*\*\*** | **0.422\*** | -0.264 | **-0.456\*\*** | **0.638\*\*\*** | -0.25 | **-0.589\*\*\*** | **-0.495\*\*** | **-0.778\*\*\*** | -0.244 | **0.621\*\*\*** | **0.491\*\*** |  |  |
| PHO | -0.227 | **-0.504\*\*** | **-0.476\*\*** | -0.374 | 0.186 | **0.643\*\*\*** | **-0.657\*\*\*** | **0.459\*\*** | 0.208 | **0.431\*** | **0.586\*\*\*** | -0.002 | **-0.624\*\*\*** | **-0.551\*\*** | **-0.509\*\*** |  |

Note: WTD, water table depth; DOC, dissolved organic carbon; TN, total nitrogen; TC, total carbon; TP, total phosphorus; SC, *Sphagnum* cover; VPC, vascular plants cover; TCov, total cover; BDG, β-D-glucosidase; NAG, N-acetyl-β-glucosaminidase; POX, phenol oxidase; PHO, phosphatase. **\*\*\****P* < 0.01, **\*\****P* < 0.05, **\****P* < 0.1.