

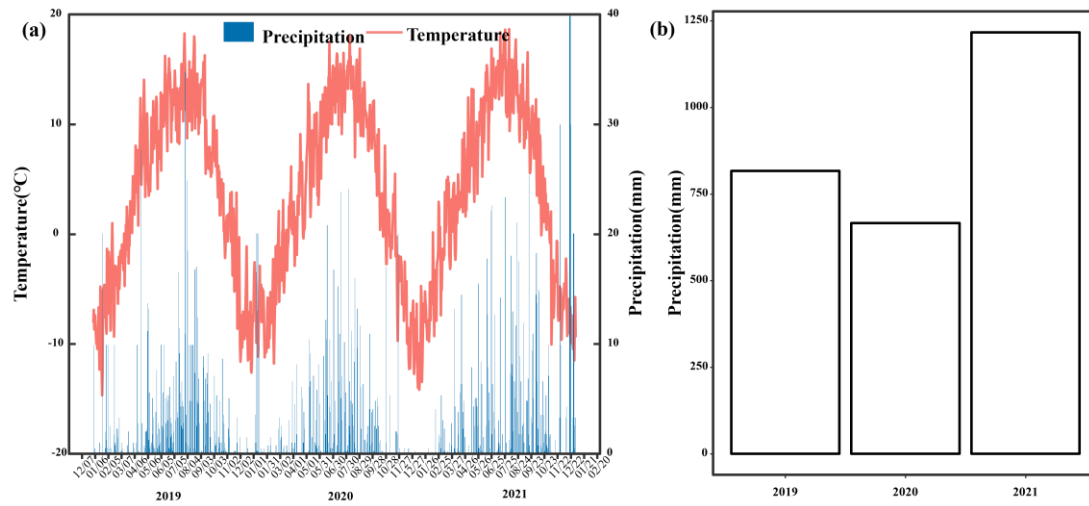


Fig. S1. Climatic conditions in the study area from 2019 to 2021. a) Average daily temperature as well as day-to-day precipitation. b) Cumulative annual precipitation.

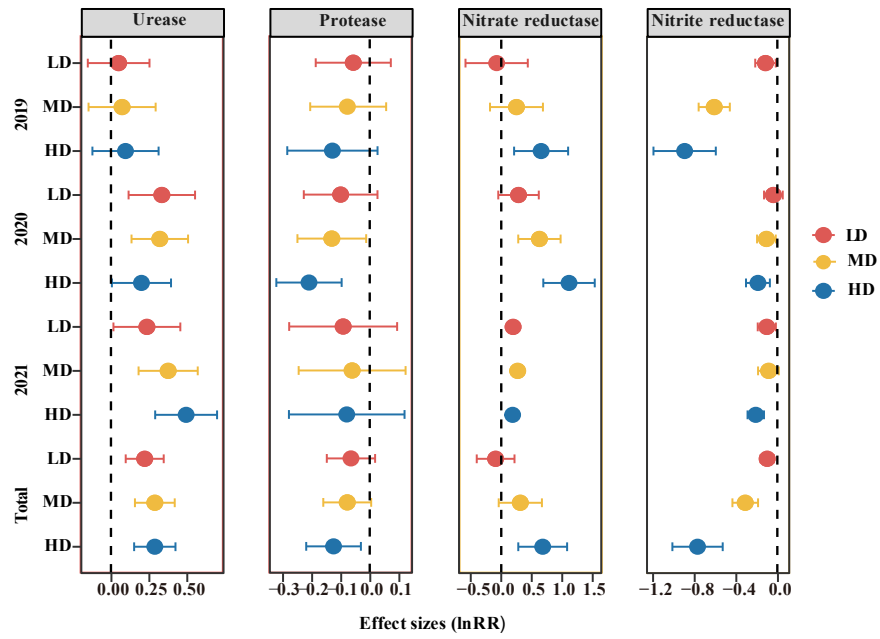


Fig. S2. The interannual effect of soil N-cycling enzyme activity of degraded wetlands on that of undegraded wetlands from 2019 to 2021. urease (URE), protease (PRO), nitrate reductase (NR), and nitrite reductase (NIR). ND, non-degraded; LD, lightly degraded; MD, moderately degraded; HD, heavily degraded.

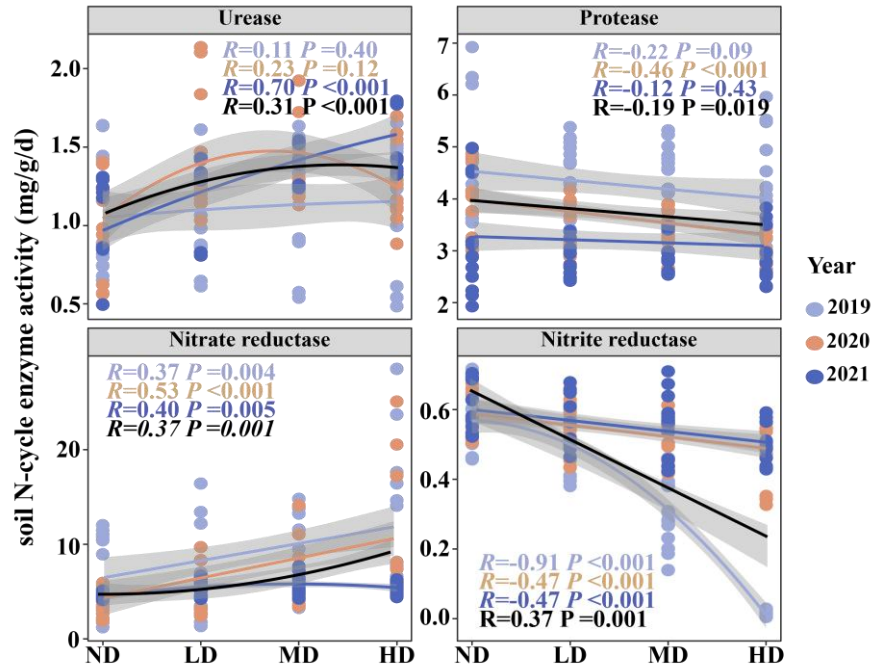


Fig. S3. Response of soil N-cycle enzyme activity to wet meadow degradation from 2019 to 2021. The three colored lines represent the fitted lines for 2019, 2020, and 2021, and black represents the total fit. ND, non-degraded; LD, lightly degraded; MD, moderately degraded; HD, heavily degraded.

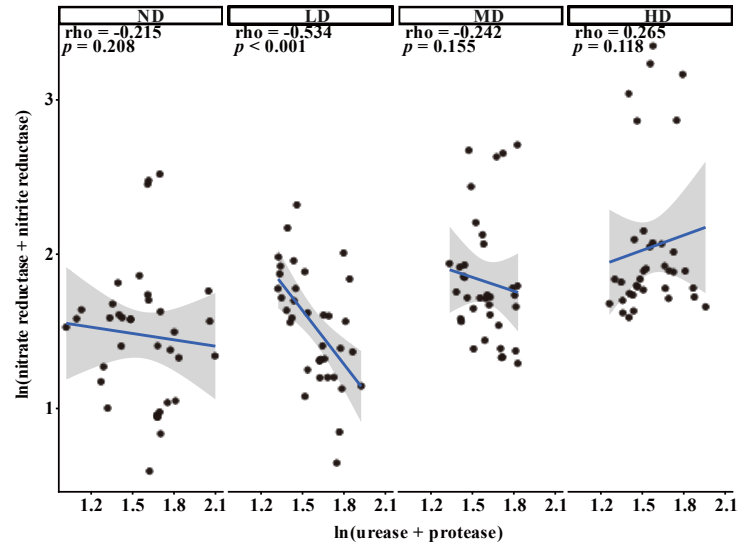


Figure S4. Relationships between $\ln(\text{urease} + \text{protease})$ and $\ln(\text{nitrate reductase} + \text{nitrite reductase})$ across different wetland degradation levels. Panels represent non-degraded (ND), lightly degraded (LD), moderately degraded (MD), and heavily degraded (HD) wetlands. The fitted lines indicate the relationships between nitrogen-mineralizing and nitrogen-reducing enzyme activities within each degradation stage.

Table S1. Vegetation characteristics of the four wetland degradation stages in the study area.

Degradation degree	Dominant species	Coverage (%)	Height (cm)	Aboveground biomass (g cm ⁻²)
ND	<i>Kobresia tibetica</i> ; <i>Potentilla anserin</i> ; <i>Poa annua</i>	96.25±5.32 a	16.71±2.98 a	355.90±174.64 a
LD	<i>Carex meyeriana</i> ; <i>Artemisia frigida</i> ; <i>Oxy tropis</i>	86.34±7.36 b	13.02±2.24 b	293.02±143.93 b
MD	<i>Kobresia humilis</i> ; <i>Artemisia subulata</i>	45.33±13.34 c	7.43±0.97 c	185.73±134.90 c
HD	Almost no vegetation is on the surface, and more than 90% of the surface is bare.			

Note: ND, non-degraded; LD, lightly degraded; MD, moderately degraded; HD, heavily degraded. The different letters above the table represent significant differences among the treatments at $P<0.05$. Value = mean ± SE.