

Fig. 1 Patterns of species richness and turnover rate in mine-affected regions along PTEs and elevation gradients in a high-altitude mountainous region of the Tibetan Plateau. Species richness, evenness, and coverage of plants in natural (green) and PTE-polluted habitats (orange). Trend lines were calculated using Generalized Additive Models based on multidimensional scaling (NMDS) of Sørensen dissimilarity matrices. P combine all study sites (triangle for natural habitats and circle for PTE-polluted habitats) of one investigated mine in each climate zone. Background show the elevation contour lines. JYG, metal industry (salt desert); SN, Multimetal mine (desert); XF, chrome chemical factory (grassland); AR, asbestos factory (multimetal mine (grassland); MY, multimetal mine (grassland); XTS, solder iron mountain (dry/cold desert). Support for models including topography, climate, and/or PTEs for explaining changes in species composition of habitats.

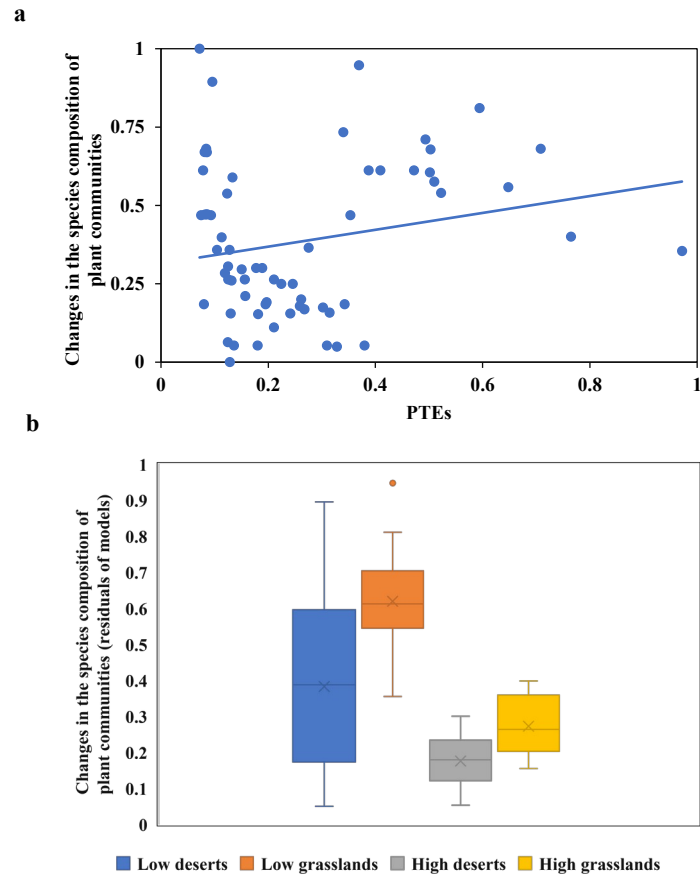


Fig. 2 Effects of PTEs on the species composition of plant communities. Changes in plant communities represent the difference in plant species composition in PTE-polluted ecosystems compared to the predicted species composition of corresponding natural ecosystems (Linear Mixed Effect Model, for all taxa $P < 0.0001$). Box plots show the median (solid line), 25%, and 75% quantiles (boxes); whiskers extend to the minimum and maximum within 1.5 times the interquartile range; more-extreme data values are drawn by individual circles. $n = 64$ study sites for all analyses.

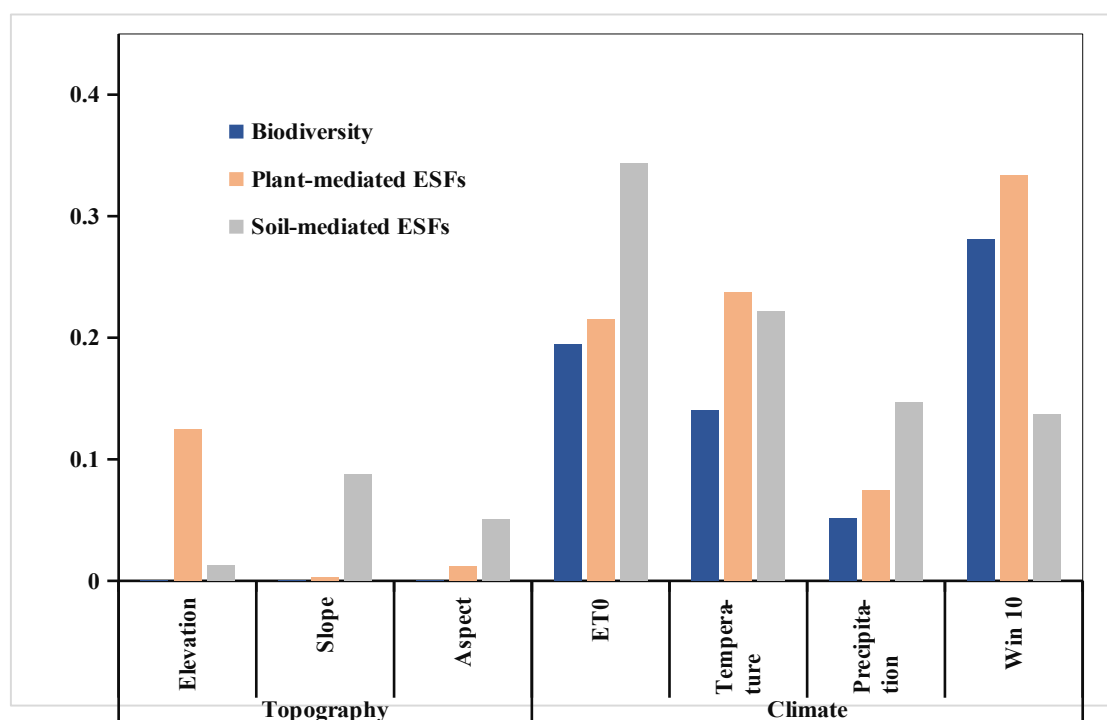
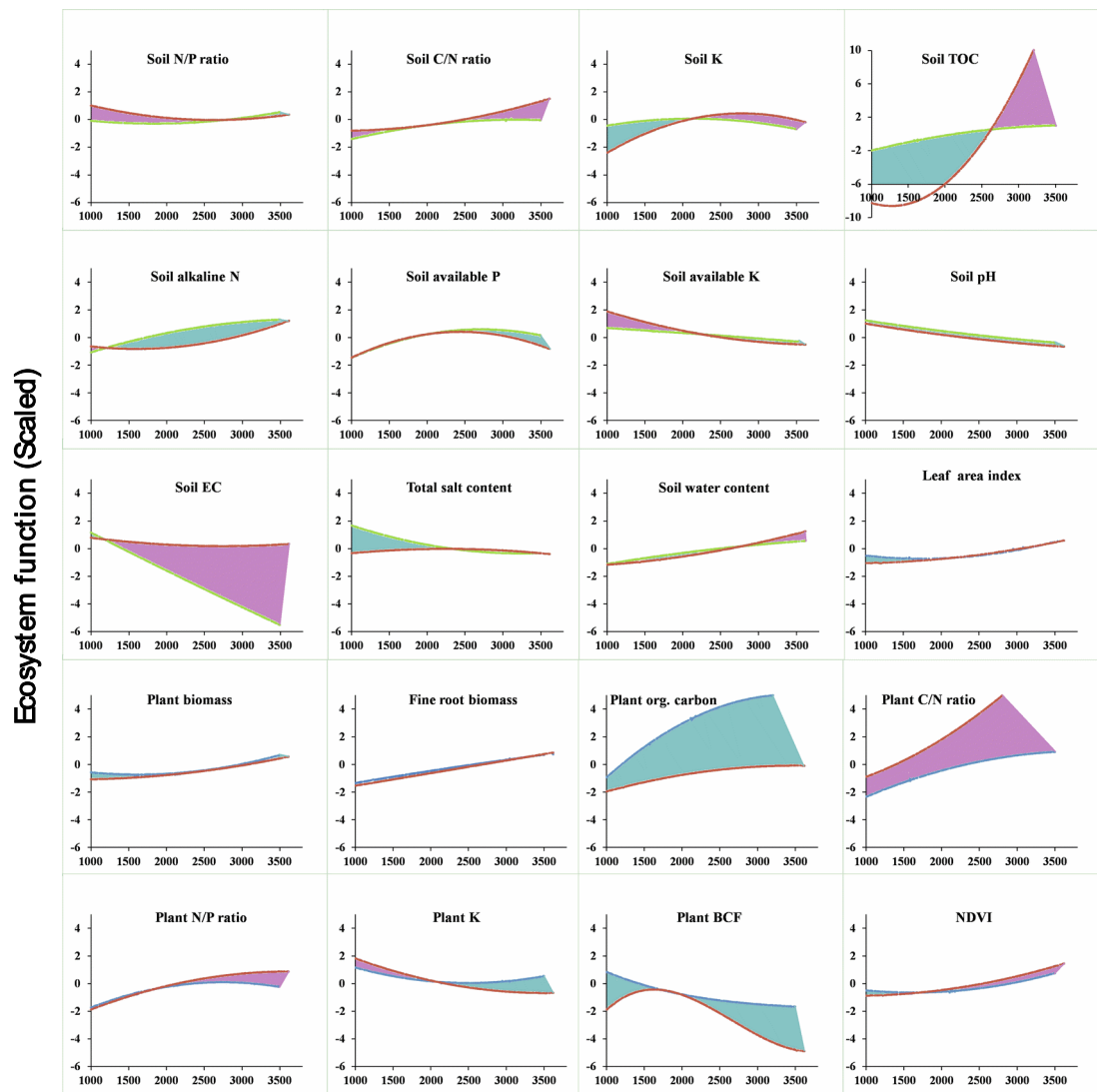


Fig. 3 Effect of topography and climate on ecosystem functions and natural habitat elevation gradient. Bar height shows the mean. Error bars show the standard errors of absolute effect strength values for each type of ecosystem function and climate variable. Original data are shown in Extended Data Table 3. ESFs, ecosystem functions; ET0, mean annual evapotranspiration.



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37 **Fig. 4 Indicators of ecosystem function change with elevation**
 38 **transport** Predictions of ecosystem functions in natural (brown) and
 39 polluted habitats (orange) for the soil-, and plant- mediated ecosystem functions.
 40 Predictions (lines) are based on the best generalized additive models (GAMs) of
 41 ecosystem functions on elevation and PTE transport. The green (higher predicted
 42 values for PTE-polluted habitats) and purple polygons (lower predicted values for
 43 PTE-polluted habitats) fill the space between the two predictions for ecosystem
 44 functions in natural and PTE-polluted habitats.

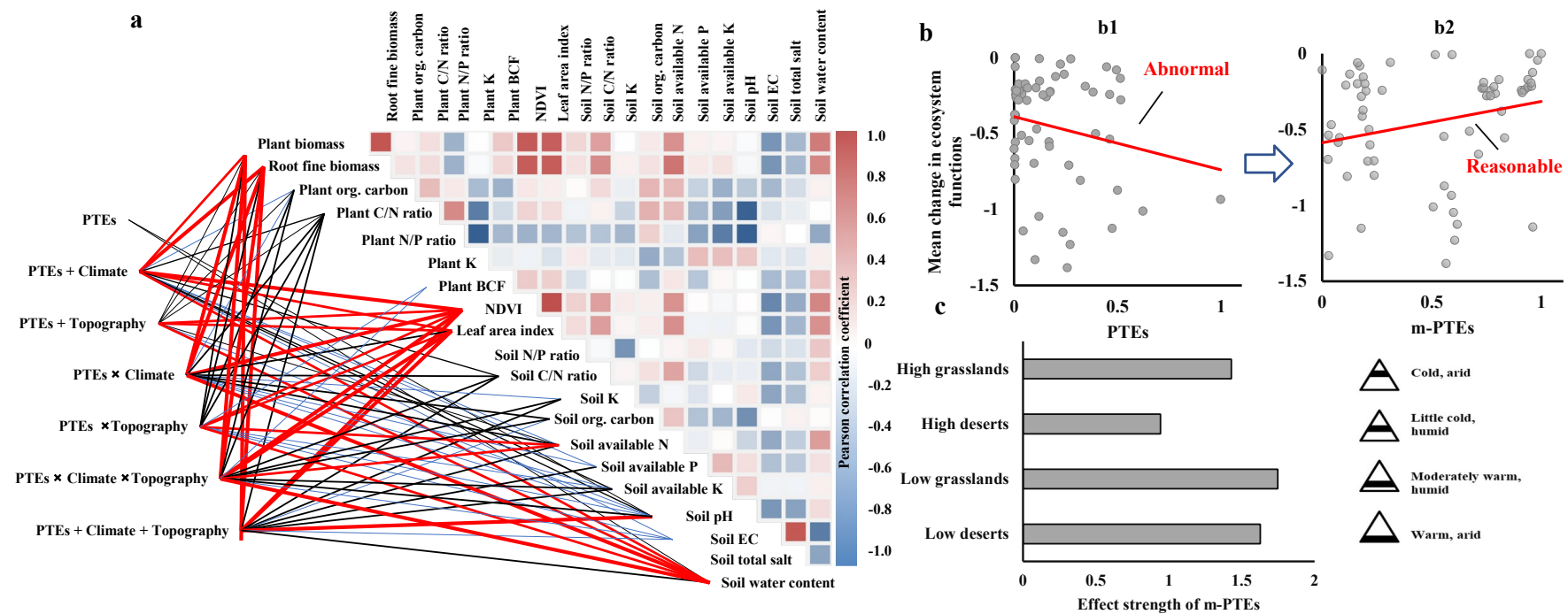
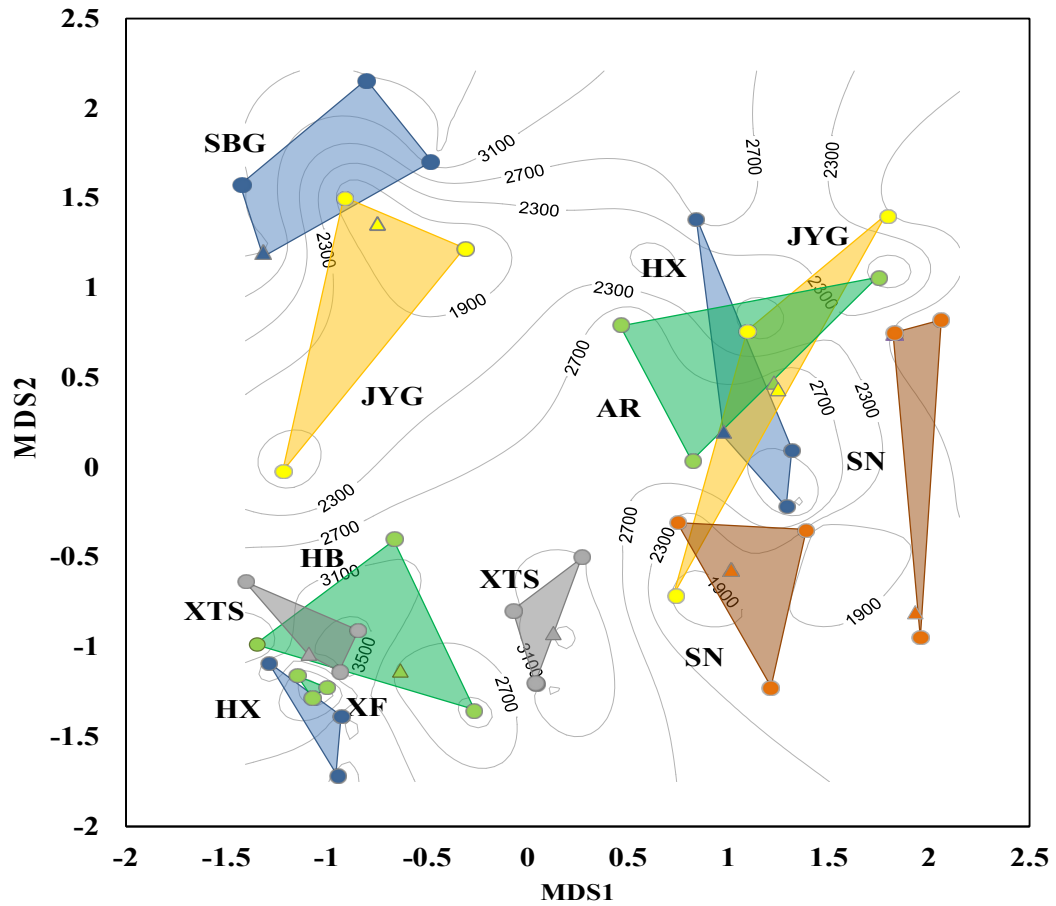


Fig. 5 Effects of PTEs, climate, and topography on ecosystem function in a high-altitude mountainous region of the Tibetan Plateau.

a, Left, support for seven topography, climate, and/or PTEs models of 20 ecosystem functions. Line strength is plotted as a relationship to the statistical support of individual models (high model R^2 value = thick lines); the best model per ecosystem function is indicated in red. Right, a visualization of a Pearson correlation matrix of all ecosystem functions. **b**, the average change in ecosystem functions (compared to predictions for natural habitats, log-transformed) decreased with PTE-intensity (**b1**), and increased with m-PTE intensity (linear model, $P < 0.01$, **b2**). **c**, the effect strength of m-PTEs on the mean change in ecosystem functions (grey bars). The triangle on the right side of the panel schematically represents the elevational position of studied sites in Qilian Mountains.



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55 **Fig. 6 Effects of PTEs, topography, and climate on the multivariate index of**
 56 **multifunctionality in ecosystem multifunctionality across**
 57 **sites (dots) in natural (triangle) and PTE-polluted habitats (circle) plots.**
 58 **PTE-polluted habitats and one natural habitat were selected for different elevation**
 59 **levels and vegetation zones (low-elevation deserts, low-elevation grasslands, high-**
 60 **elevation deserts, and high-elevation grasslands) of the Qilian Mountain**
 61 **position in ordination space illustrates the functional characteristics of sites**
 62 **relation to other sites; sites closer to one another have more-similar ecosystem**
 63 **multifunctionality. Lines in the background show elevation contour line.**