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Climate change projections of terrestrial primary productivity over the Hindu Kush Himalayan forests

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SUPPLEMENTARY INFORMATION

1. Comparison in the climatic outputs of LPJ-GUESS

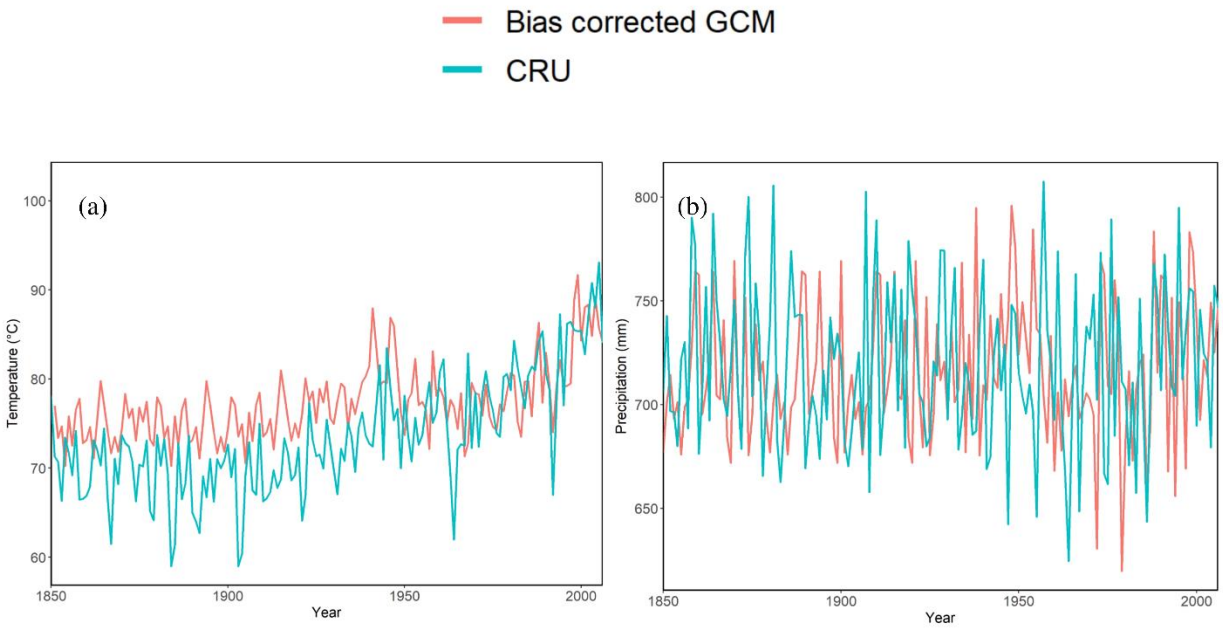

Figure S1 Time series of a) temperature as simulated by LPJ-GUESS in CRU and bias-corrected simulations from 1851-2006 b) Precipitation simulated by LPJ-GUESS in CRU and bias-corrected simulations from 1851-2006

2. Spatial Evaluation of patterns of GPP and NPP from 2000-2010

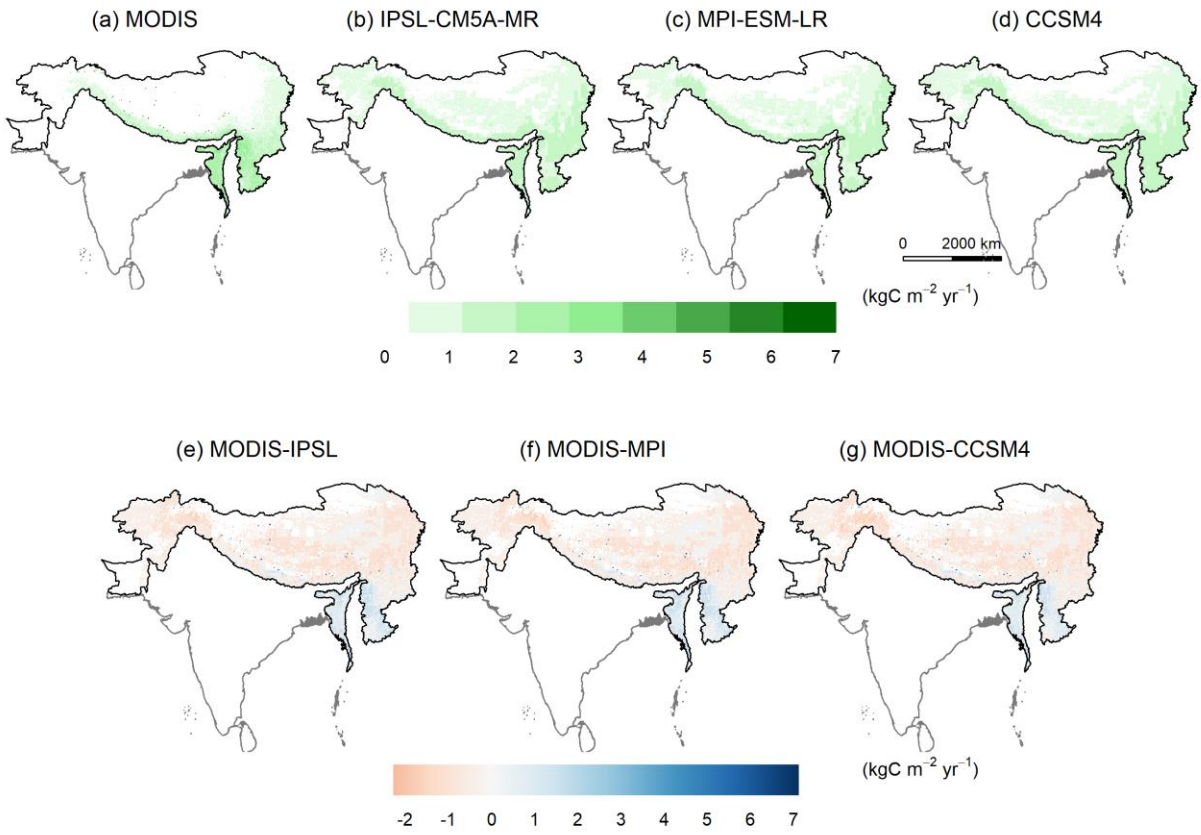

Figure S2: Mean GPP output simulations from 2000 and 2010 of (a) MODIS, (b) IPSL-CM5A-MR, (c) MPI-ESM-LR and (d) CCSM4 and (e, f, g) difference between MODIS and LPJ-GUESS simulations

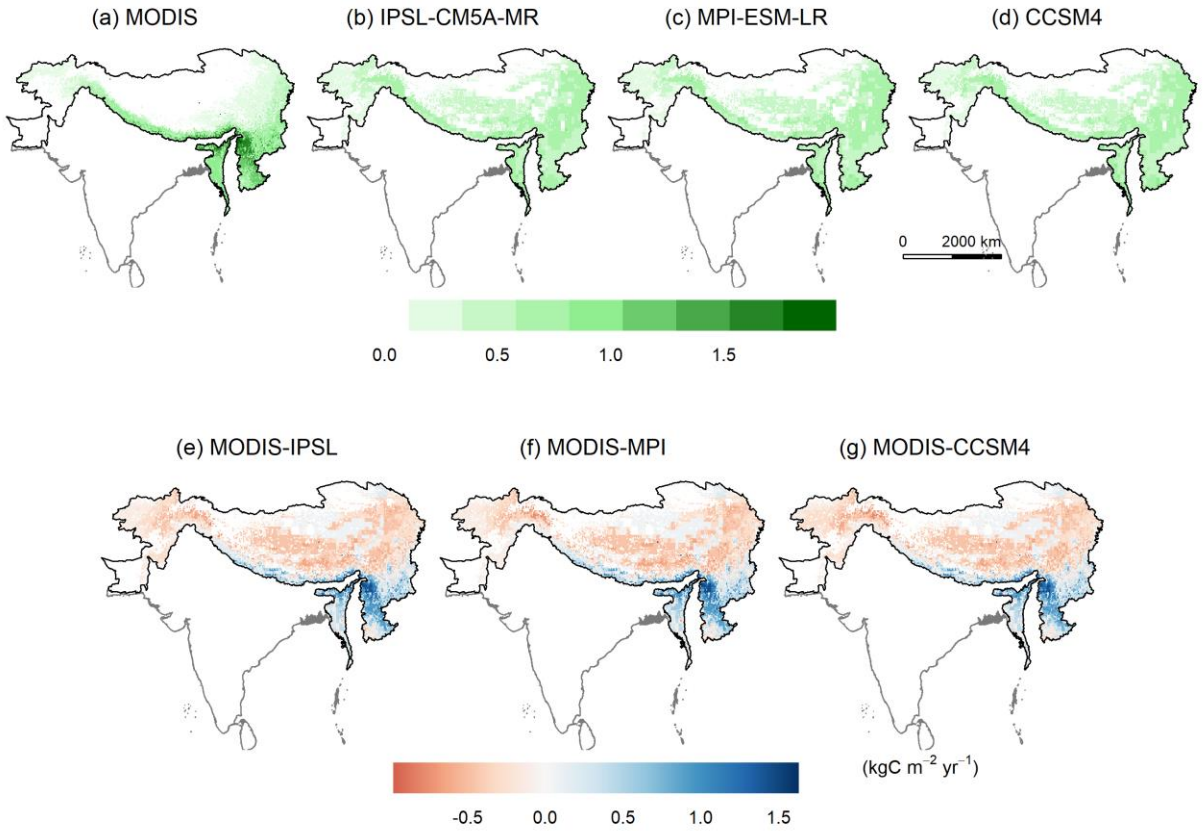

Figure S3: Mean NPP output simulations from 2000 and 2010 of (a) MODIS, (b) IPSL-CM5A-MR, (c) MPI-ESM-LR and (d) CCSM4 and (e, f, g) difference between MODIS and LPJ-GUESS simulations. The MODIS NPP pixel values were constrained to 2 kgC m^{-2} yr^{-1}.

3. Projected Spatial Changes in the Pattern of NBP and Components

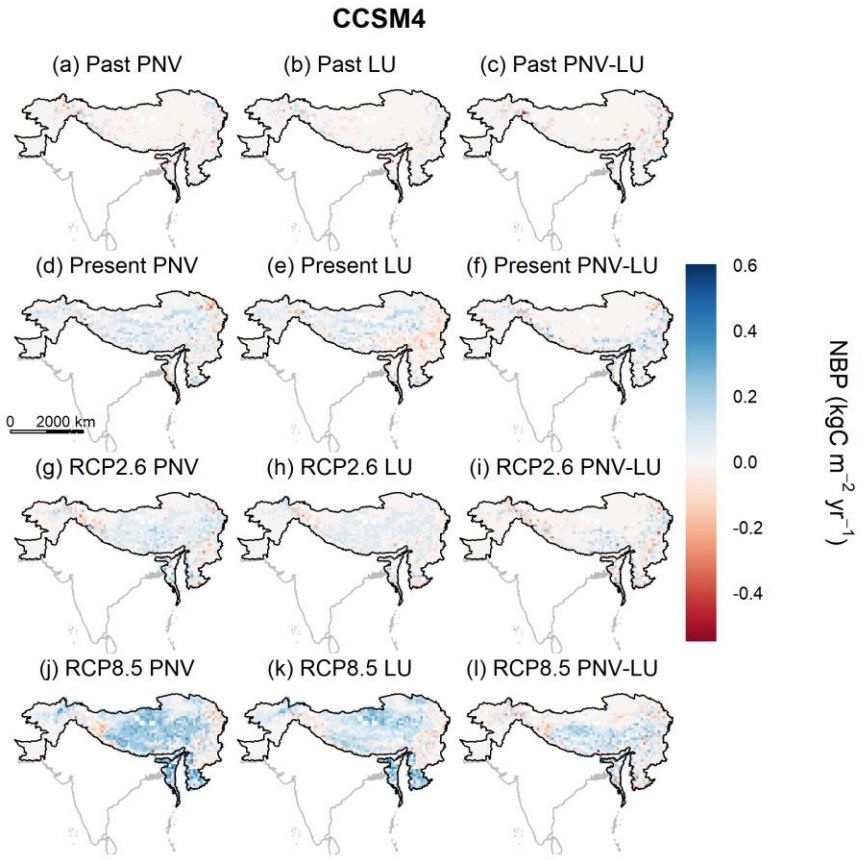

Figure S4 LPJ-GUESS simulated distribution by CCSM4 on NBP in HKH region under a) past period (1851-1880) with PNV b) past period (1851-1880) with land use change c) difference between past PNV and past LU d) present period (1986-2015) with PNV e) present period (1986-2015) with land use change f) difference between present PNV and past LU g) future scenario RCP2.6 (2071-2100) with PNV h) future scenario RCP2.6 with LU (2071-2100) i) difference between future RCP2.6 PNV and LU j) future scenario RCP8.5 (2071-2100) with PNV k) future scenario RCP8.5 with LU l) difference between future RC8.5 PNV and LU

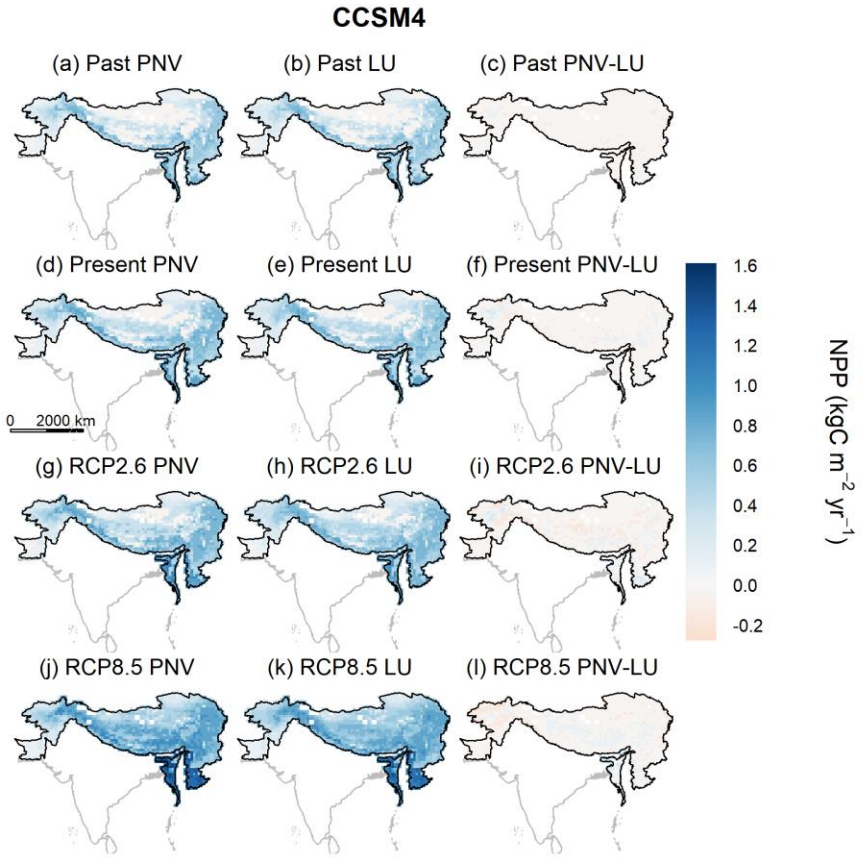

Figure S5 LPJ-GUESS simulated distribution by CCSM4 on NPP in HKH region under a) past period (1851-1880) with PNV b) past period (1851-1880) with land use change c) difference between past PNV and past LU d) present period (1986-2015) with PNV e) present period (1986-2015) with land use change f) difference between present PNV and past LU g) future scenario RCP2.6 (2071-2100) with PNV h) future scenario RCP2.6 with LU (2071-2100) i) difference between future RCP2.6 PNV and LU j) future scenario RCP8.5 (2071-2100) with PNV k) future scenario RCP8.5 with LU l) difference between future RC8.5 PNV and LU

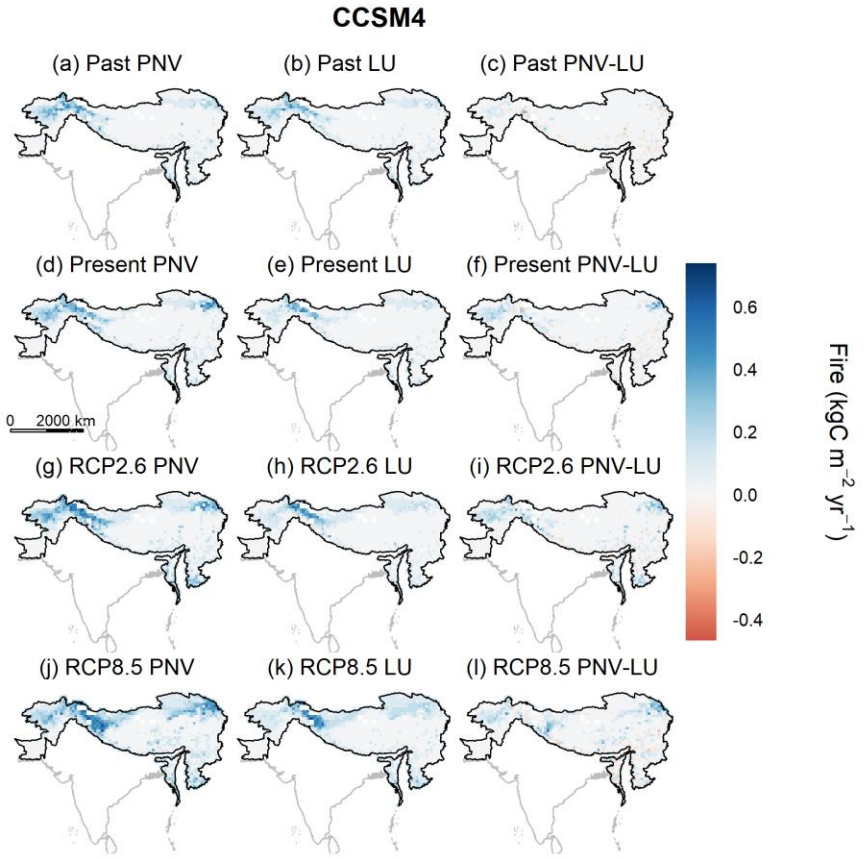

Figure S6 LPJ-GUESS simulated distribution by CCSM4 on Fire Flux in HKH region under a) past period (1851-1880) with PNV b) past period (1851-1880) with land use change c) difference between past PNV and past LU d) present period (1986-2015) with PNV e) present period (1986-2015) with land use change f) difference between present PNV and past LU g) future scenario RCP2.6 (2071-2100) with PNV h) future scenario RCP2.6 with LU (2071-2100) i) difference between future RCP2.6 PNV and LU j) future scenario RCP8.5 (2071-2100) with PNV k) future scenario RCP8.5 with LU l) difference between future RC8.5 PNV and LU

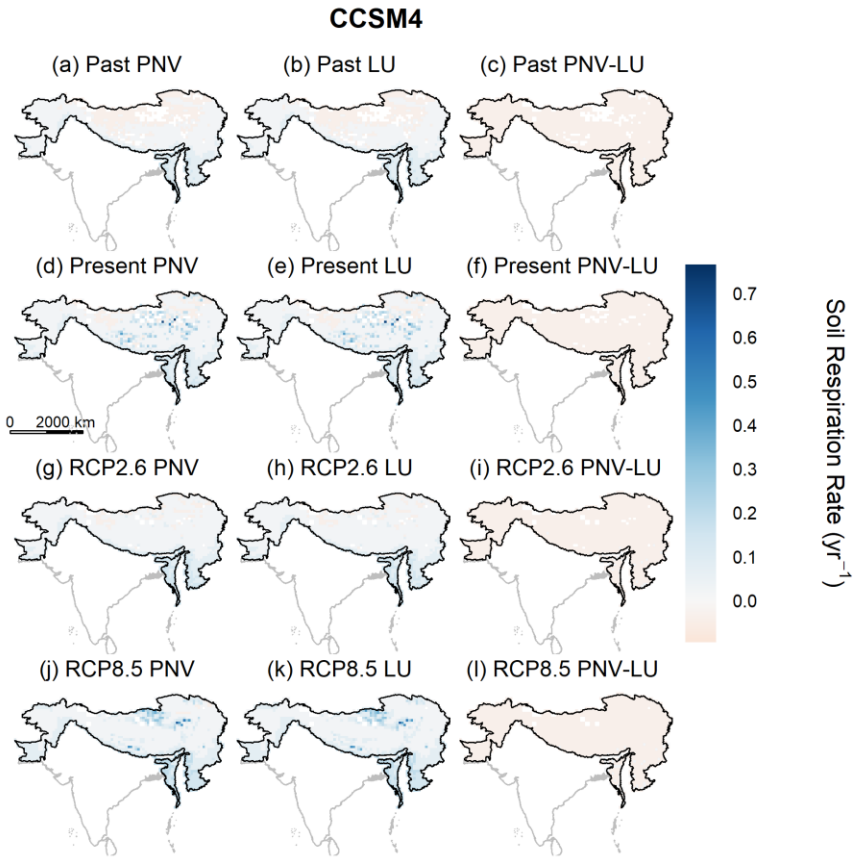

Figure S7 LPJ-GUESS simulated distribution by CCSM4 on Soil Respiration Rate in HKH region under a) past period (1851-1880) with PNV b) past period (1851-1880) with land use change c) difference between past PNV and past LU d) present period (1986-2015) with PNV e) present period (1986-2015) with land use change f) difference between present PNV and past LU g) future scenario RCP2.6 (2071-2100) with PNV h) future scenario RCP2.6 with LU (2071-2100) i) difference between future RCP2.6 PNV and LU j) future scenario RCP8.5 (2071-2100) with PNV k) future scenario RCP8.5 with LU l) difference between future RC8.5 PNV and LU

(a)	1851-1880		1986-2015		2071-2100 (RCP2.6)		2071-2100 (RCP8.5)	
ESM	PNV	LU	PNV	LU	PNV	LU	PNV	LU
CCSM4	-0.00002	0.0004	0.025	0.013	0.021	0.016	0.082	0.058
MPI	0.005	0.005	0.024	0.014	0.020	0.014	0.049	0.037
IPSL	0.003	0.003	0.025	0.017	-	0.017	0.063	0.037
Mean	0.003	0.003	0.037	0.015	0.0021	0.015	0.064	0.044

(b)	1851-1880		1986-2015		2071-2100 (RCP2.6)		2071-2100 (RCP8.5)	
ESM	PNV	LU	PNV	LU	PNV	LU	PNV	LU
CCSM4	0.317	0.316	0.394	0.383	0.460	0.441	0.665	0.633
MPI	0.301	0.297	0.384	0.373	0.444	0.426	0.637	0.603
IPSL	0.299	0.296	0.386	0.375	-	0.445	0.669	0.631
Mean	0.306	0.303	0.388	0.377	0.452	0.437	0.657	0.622

(c)	1851-1880		1986-2015		2071-2100 (RCP2.6)		2071-2100 (RCP8.5)	
ESM	PNV	LU	PNV	LU	PNV	LU	PNV	LU
CCSM4	0.049	0.041	0.059	0.038	0.080	0.047	0.107	0.068
MPI	0.047	0.040	0.063	0.041	0.080	0.048	0.143	0.088
IPSL	0.051	0.043	0.072	0.048	-	0.043	0.141	0.089
Mean	0.065	0.041	0.065	0.042	0.080	0.046	0.13	0.081

(d)	1851-1880		1986-2015		2071-2100 (RCP2.6)		2071-2100 (RCP8.5)	
ESM	PNV	LU	PNV	LU	PNV	LU	PNV	LU
CCSM4	0.042	0.042	0.062	0.063	0.053	0.053	0.077	0.077
MPI	0.040	0.041	0.058	0.058	0.054	0.054	0.073	0.074
IPSL	0.041	0.040	0.059	0.061	-	0.055	0.074	0.075
Mean	0.041	0.041	0.060	0.061	0.053	0.054	0.075	0.075

Table S1 Means for (a) NBP (kg C m^{-2} yr^{-1}) (b) NPP (kg C m^{-2} yr^{-1}) (c) Fire (kg C m^{-2} yr^{-1}) (d) Soil Respiration rate (yr^{-1}) were calculated for past (1851-1880), present (1986-2005) and future scenarios (2071-2100) under RCP2.6 and RCP8.5 as simulated by LPJ-GUESS forced by CCSM4, MPI-ESM-LR and IPSL-CM5A-MR climate (The data for PNV RCP2.6 for IPSL-CM5A-MR was not available).

4. Projected Temporal Changes in the Pattern of NBP and Components according to Elevation

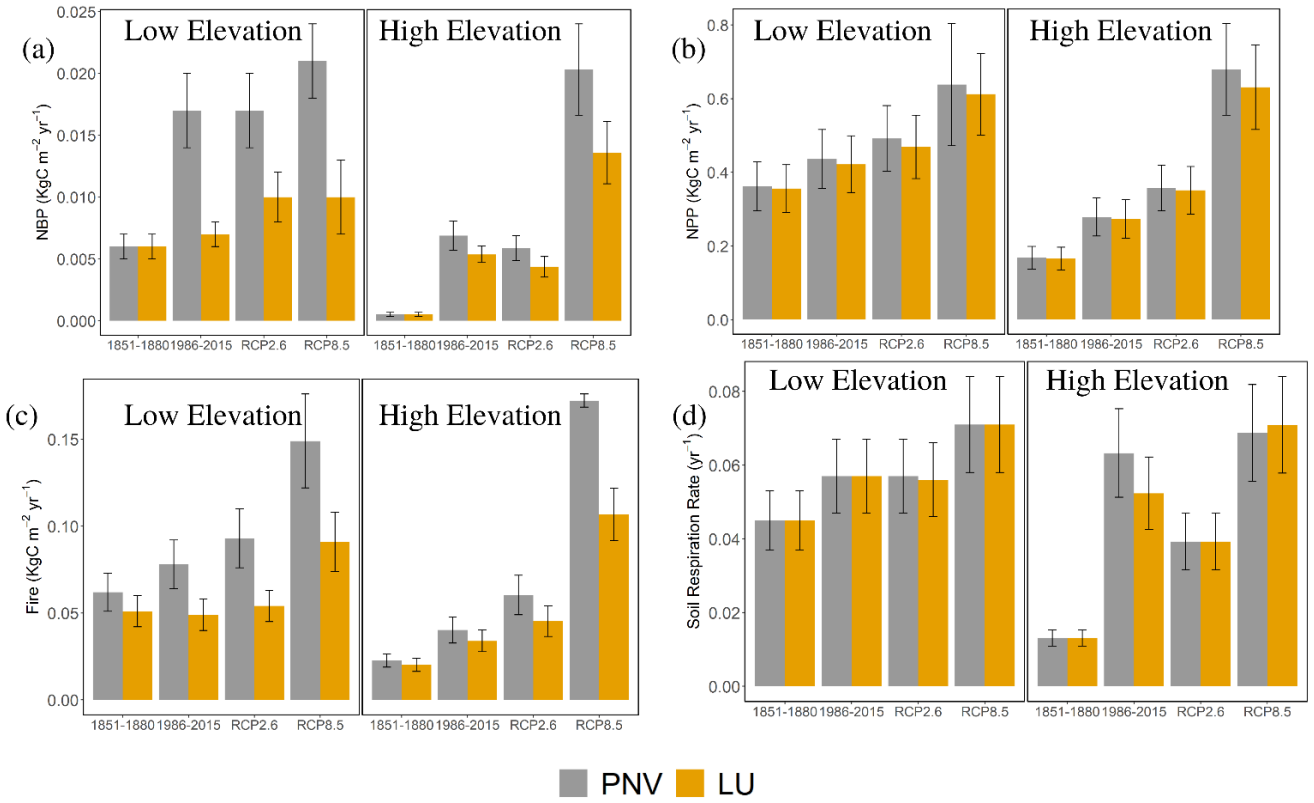

Figure S8 LPJ-GUESS simulated distribution by MPI-ESM-LR on a)NBP b) NPP c) Fire d) Soil Respiration rate in HKH according lower elevation (0-4500 m)and higher elevation (greater than 4500m) for PNV (grey color) and land use change (orange color). Vertical black bars illustrate ± standard error where *n*=30

5. Concentration levels of CO_2 in Future Scenarios

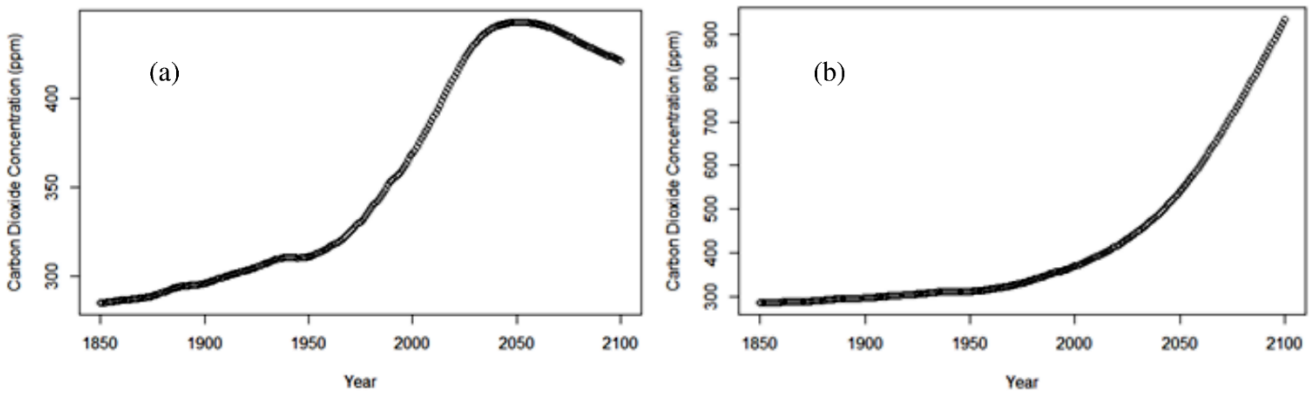

Figure S9 Temporal trend of CO_2 concentration representing a) future scenario 2.6 b) future scenario RCP8.5 simulated by LPJ-GUESS (CCSM4)