Supporting Information

Figure SI 1

Histograms of average monthly air temperature and precipitation (*Ave*, 24 variables). Red bars show averages for 1970-2000, while blue bars for 2061-2080.
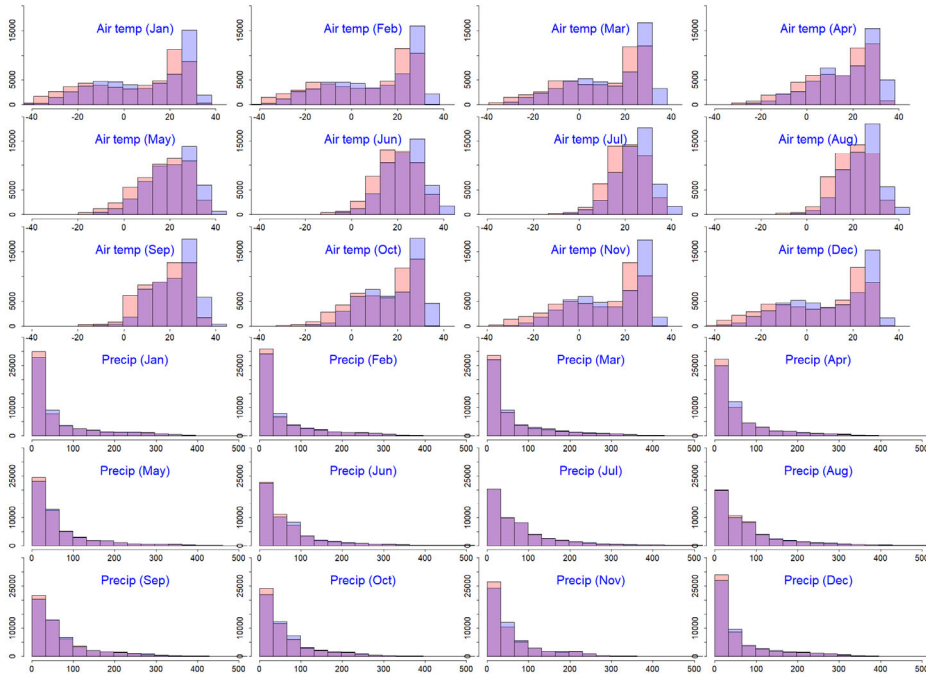


Figure SI 2

Histograms of average monthly climate indices (*AveI*, 16 variables). Red bars show averages for 1970-2000, while blue bars for 2061-2080.
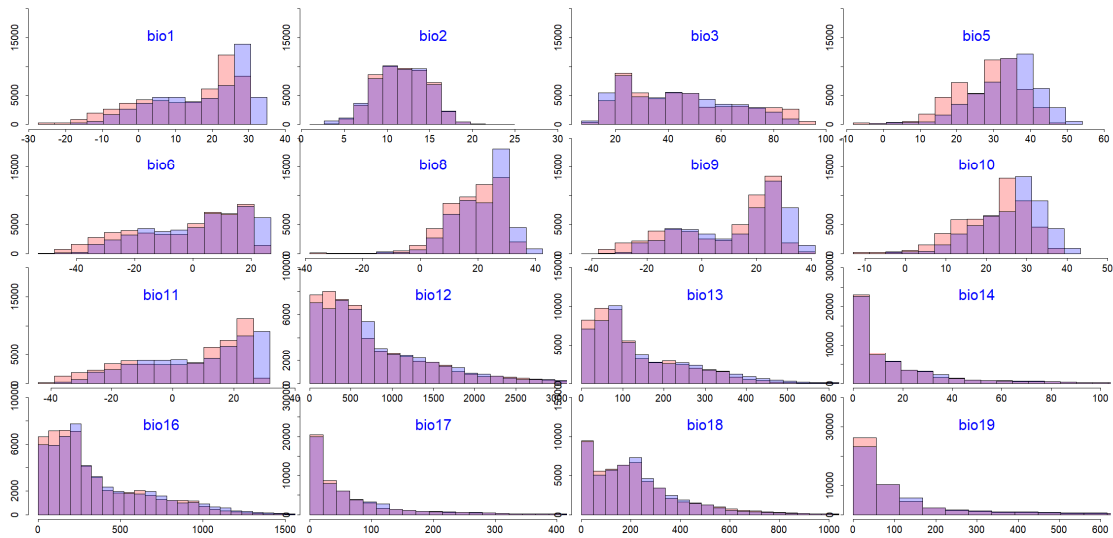
Figure SI 3

Histograms of climate extreme indices (*CEI*, 27 variables). Red bars show averages for 1970-2000, while blue bars for 2061-2080.
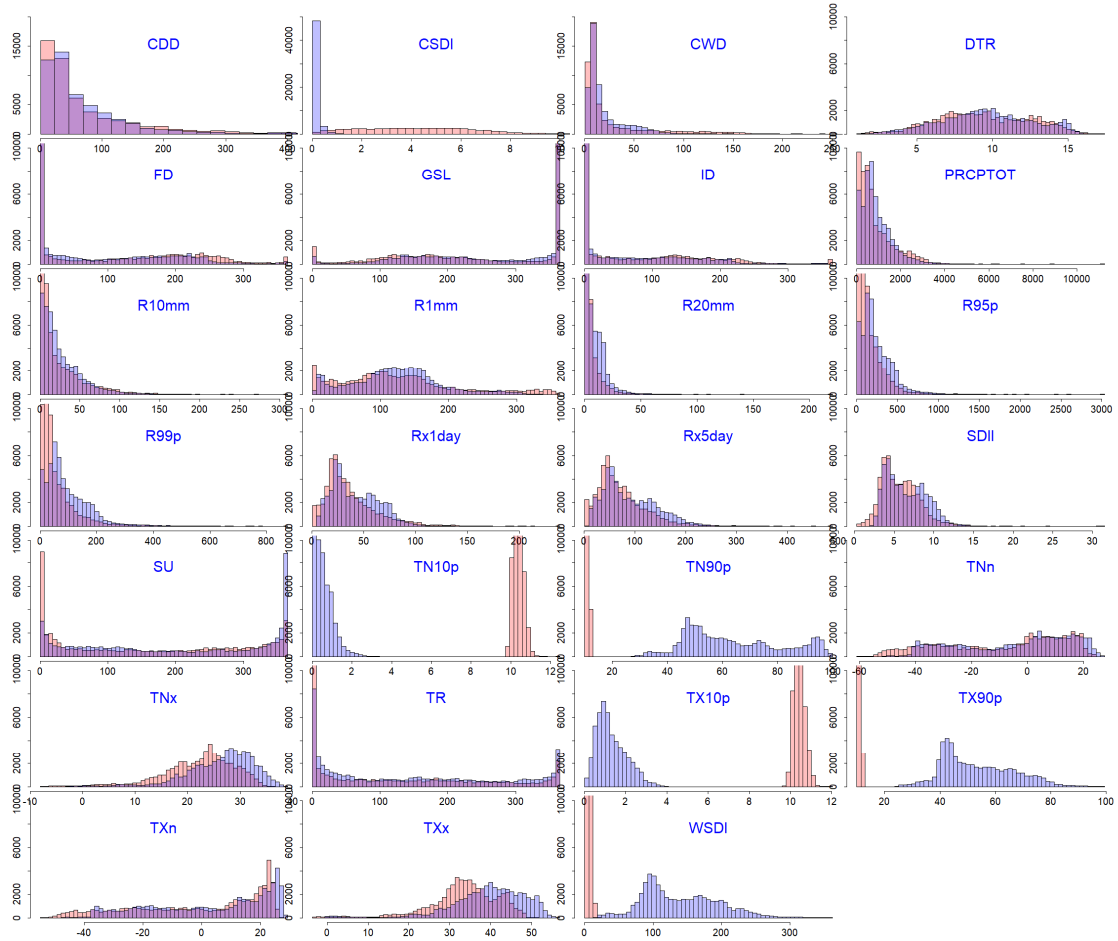
Figure SI 4

The simulated PNV under current climatic conditions using the RF model. Four sets of climate data were used for training and simulation: (a) *Ave*, (b) *AveI*, (c) *Ave + CEI*, (d) *AveI + CEI*, (e) *Ave + CEI$_{part}$*, and (f) *AveI + CEI$_{part}$*. Color definitions are available in Fig. 1.

Figure SI 5

Same as Fig. SI4, except the SVM model was employed.

Figure SI 6

Same as Fig. SI4, except the NV model was employed.

Figure SI 7

Same as Fig. SI4, except the CNN model was employed.

Figure SI 8

The simulated PNV at a climatic condition 2100, which is projected under the IPCC's RCP8.5 scenario. The RF model was employed. Four sets of climate data were used for training and simulation: (a) *Ave*, (b) *AveI*, (c) *Ave + CEI*, (d) *AveI + CEI*, (e) *Ave + CEI_{part}*, and (f) *AveI + CEI_{part}*. Color definitions are available in Fig. 1.
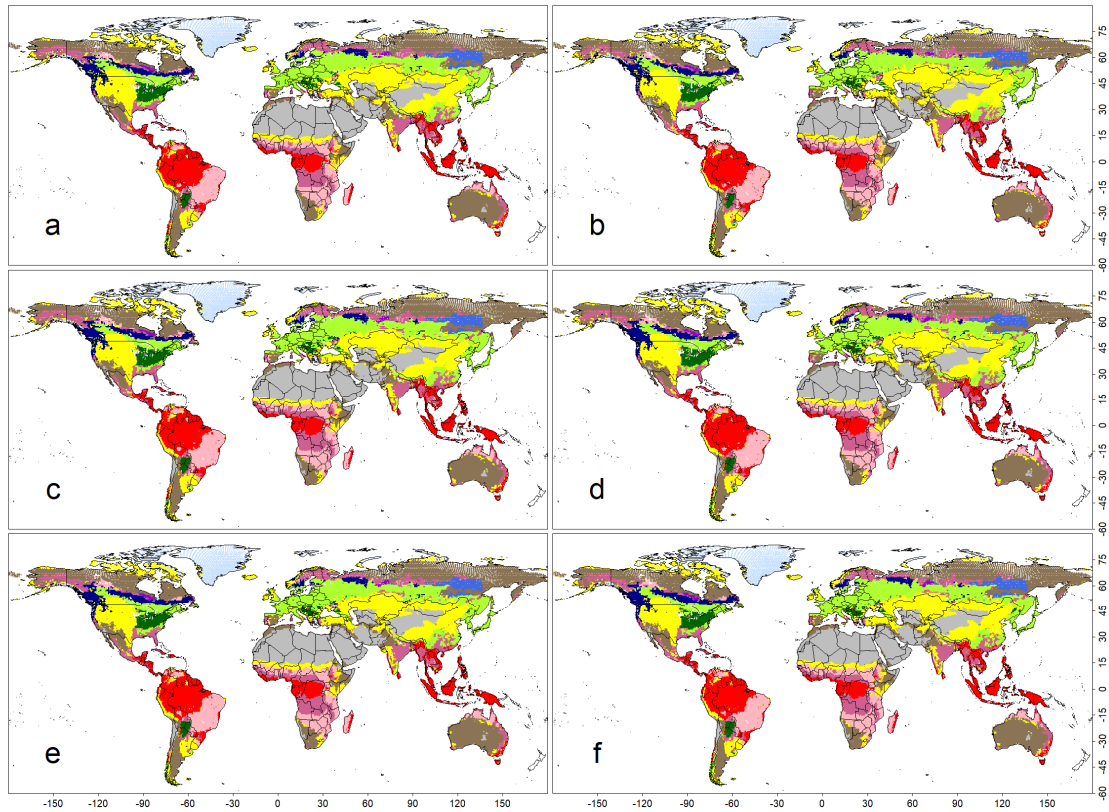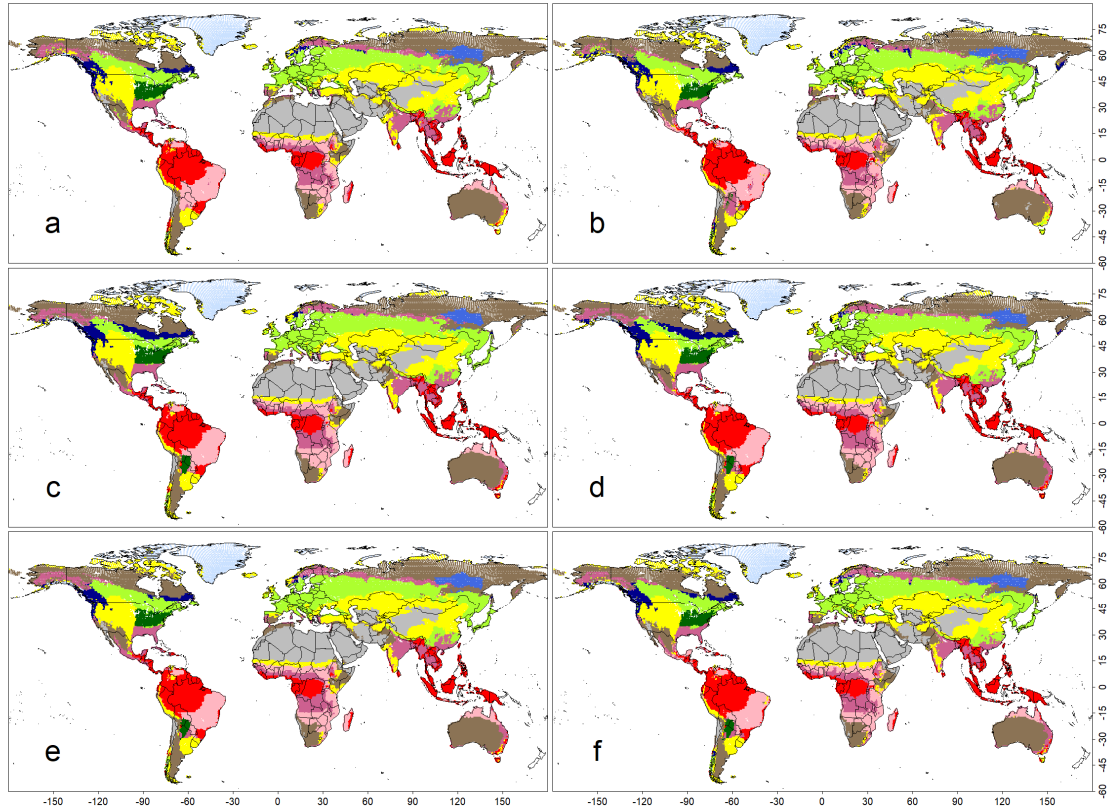
Figure SI 9

Same as Fig. SI8, except the SVM model was employed.

Figure SI 10

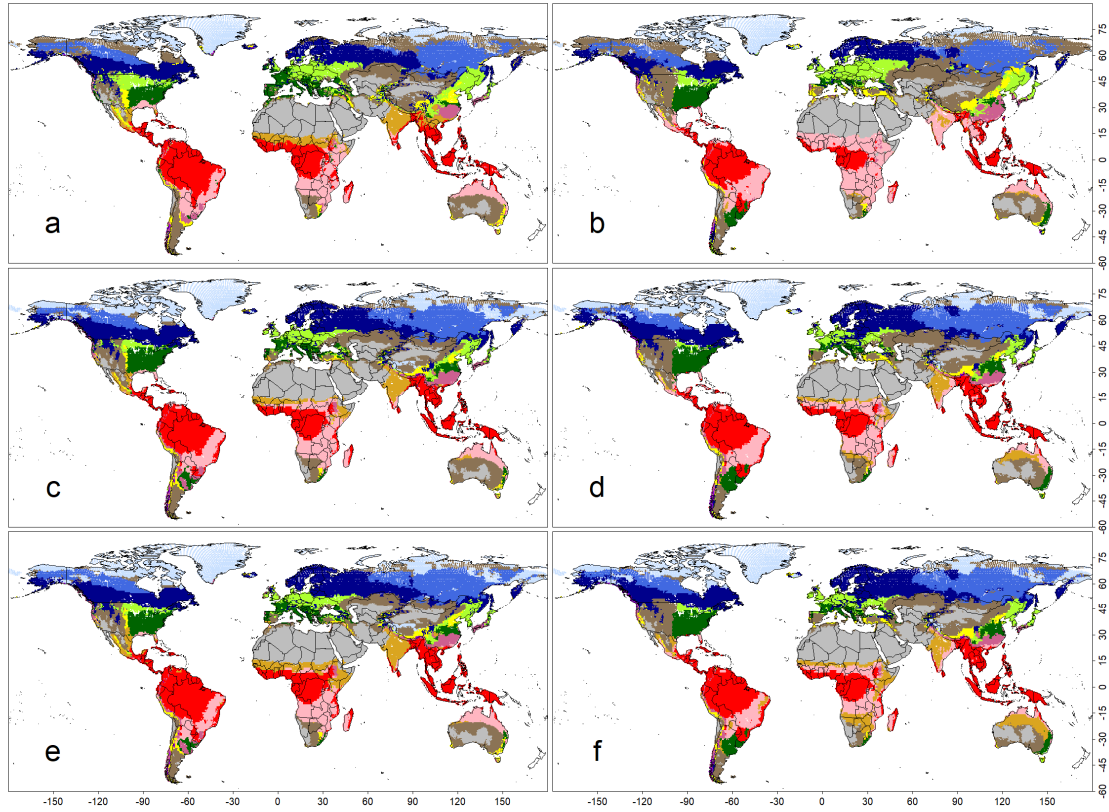Same as Fig. SI8, except the NV model was employed.

Figure SI 11

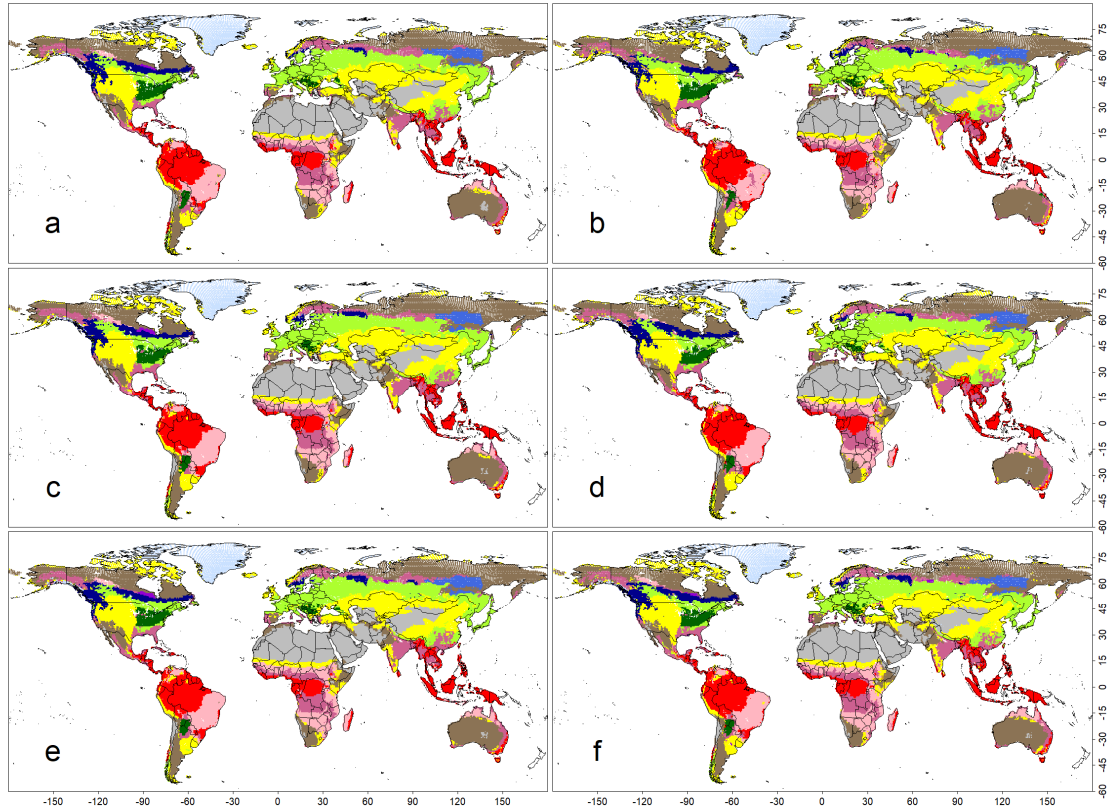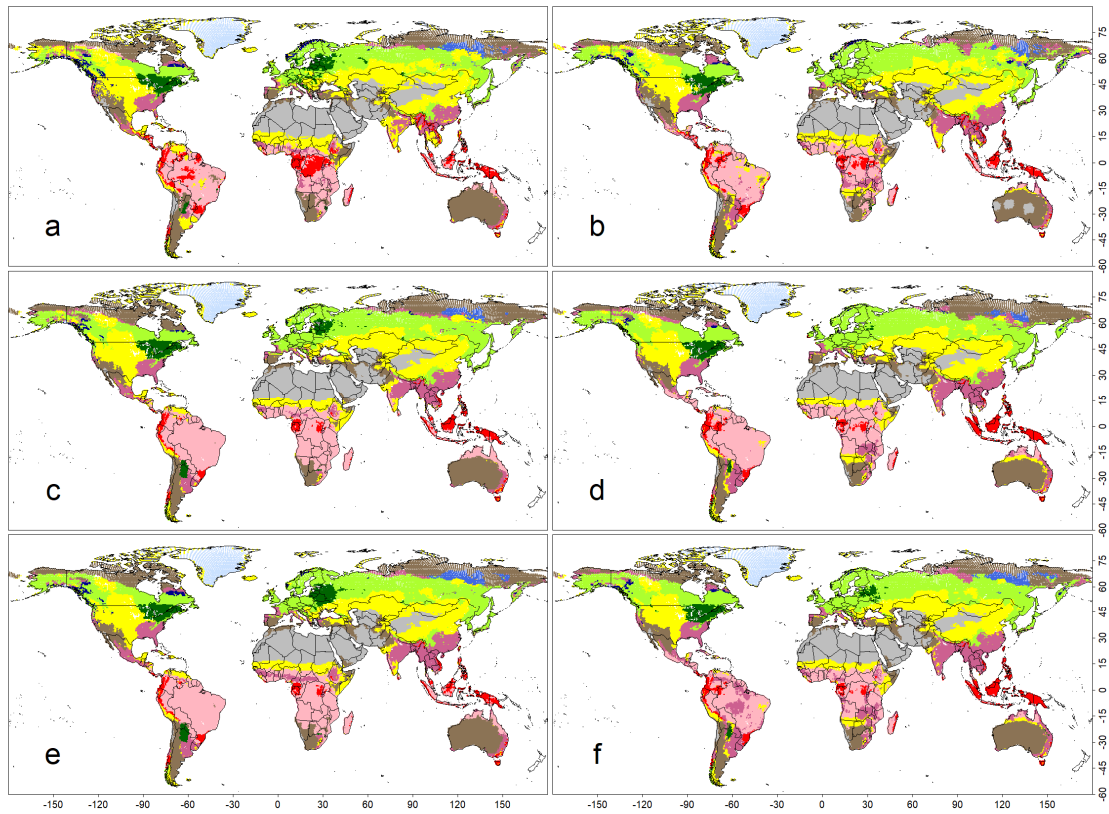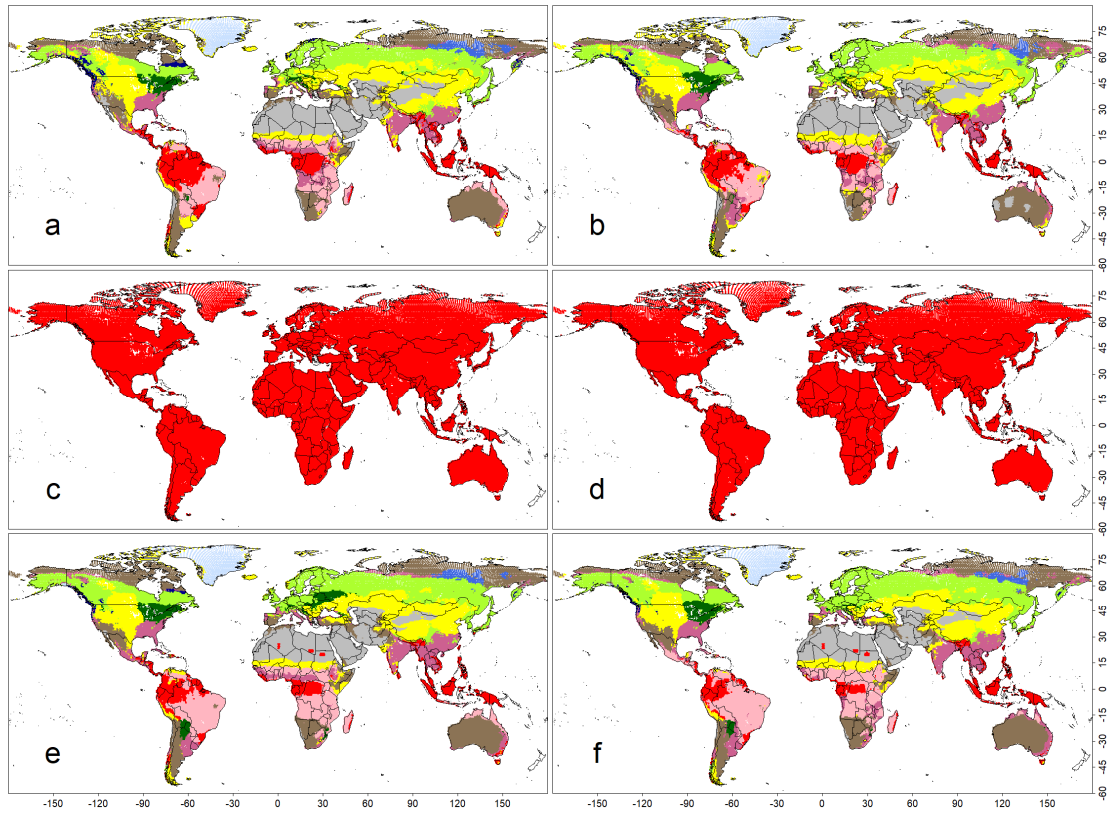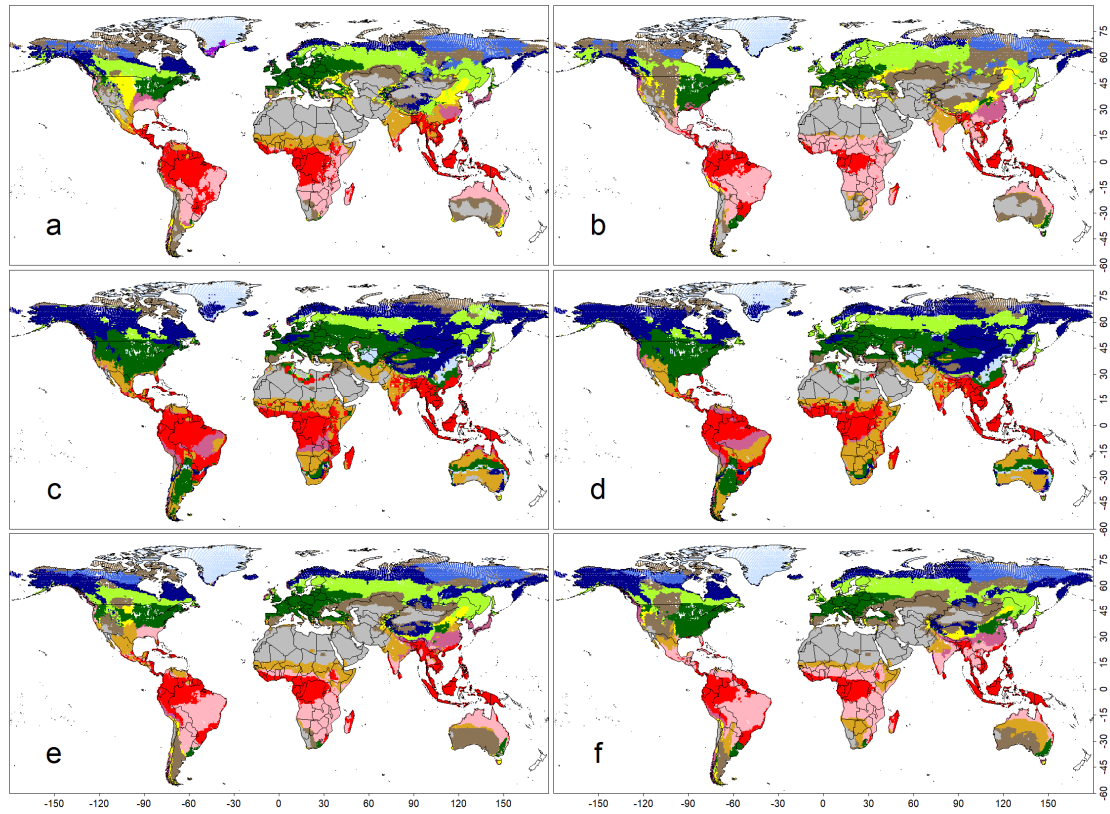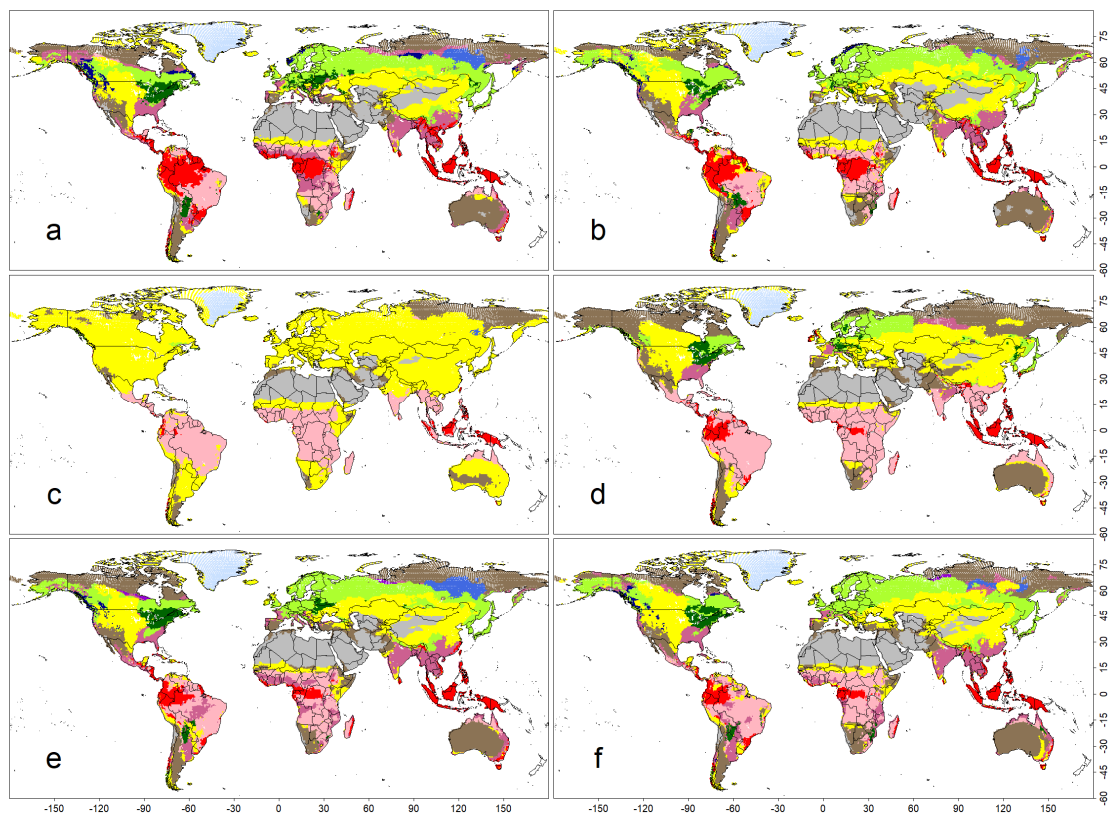Same as Fig. SI8, except the CNN model was employed.

Table SI 1.

Potential Natural Vegetation (PNV) employed in modellings. From the IGBP classification, three human-mediated classifications (Croplands, Cropland/Natural Vegetation Mosaics, and Urban and Built-Up Lands) and Water Bodies were neglected. Descriptions were based on Loveland and Belward (1997).

| Name | Description | Prevalence |
|---|---|---|
| Evergreen Needleleaf Forests | Canopy cover of needle leaf trees >60% and height >2m. Evergreen needle-leaf trees dominate. | 2.4% |
| Evergreen Broadleaf Forests | Canopy cover of broad leaf trees >60% and height >2m. Evergreen broadleaf trees dominate. | 11.2% |
| Deciduous Needleleaf Forests | Woody vegetation cover >60% and height >2m. Deciduous needle-leaf trees (larch) dominate. | 0.9% |
| Deciduous Broadleaf Forests | Woody vegetation cover >60% and height >2m. Deciduous broadleaf trees dominate. | 2.0% |
| Mixed Forests | Woody vegetation cover >60% and height >2m. Consists of interspersed mixtures or mosaics of the other four forest cover types. None of the forest types exceeds 60% of the landscape. | 9.5% |
| Closed Shrublands | Lands with woody vegetation <2m in height and with shrub canopy cover >60%. The shrub foliage can be either deciduous or evergreen. | 0.2% |
| Open Shrublands | Lands with woody vegetation <2m in height and with shrub canopy cover between 10-60%. The shrub foliage can be either evergreen or deciduous. | 16.8% |
| Woody Savannas | Lands with herbaceous and other understory plants and with forest canopy cover between 30-60%. The forest cover height is >2m. | 11.5% |
| Savannas | Lands with herbaceous and other understory plants and with forest canopy cover between 10-30%. The forest cover height is >2m. | 9.3% |
| Grasslands | Lands dominated by grass. Tree and shrub cover is <10%. | 17.8% |
| Wetlands | Lands with a permanent mixture of water and grass or woody vegetation cover extensive areas. The foliage can be present in either salt, brackish, or fresh water. | 0.5% |
| Snow and Ice | Lands under snow/ice cover most of the year. | 2.3% |

| Barren | Lands with exposed soil, sand, or rocks and <10% vegetative cover throughout the year. | 15.5% |
| --- | --- | --- |

Reference

Loveland, T. R. and Belward, A. S.: The International Geosphere Biosphere Programme Data and Information System global land cover data set (DISCover), Acta Astronaut., 41, 681-689, 10.1016/s0094-5765(98)00050-2, 1997.

Table SI 2.

Indexed averaged monthly climate (*AveI*).

| ID | Description | Units |
|---|---|---|
| Bio1 | Annual mean temperature | °C |
| Bio2 | Mean diurnal range (mean of monthly (max temp - min temp)) | °C |
| Bio3 | Isothermality | °C |
| Bio5 | Maximum temperature of the warmest month | °C |
| Bio6 | Minimum temperature of the coldest month | °C |
| Bio8 | Mean temperature of the wettest quarter | °C |
| Bio9 | Mean temperature of the driest quarter | °C |
| Bio10 | Mean temperature of the warmest quarter | °C |
| Bio11 | Mean temperature of the coldest quarter | °C |
| Bio12 | Annual precipitation | mm |
| Bio13 | Precipitation of the wettest month | mm |
| Bio14 | Precipitation of the driest month | mm |
| Bio16 | Precipitation of the wettest quarter | mm |
| Bio17 | Precipitation of the driest quarter | mm |
| Bio18 | Precipitation of the warmest quarter | mm |
| Bio19 | Precipitation of the coldest quarter | mm |

Table SI3.

Indexed extreme climate (*CEI*).

| ID | Description | Units |
|---|---|---|
| FD | Number of frost days: annual count when TN (daily minimum) < 0°C | days |
| SU | Number of summer days: annual count of days when TX (daily maximum temperature) > 25°C | days |
| ID | Number of icing days: annual count of days when TX (daily maximum temperature) < 0°C | days |
| TR | Number of tropical nights: annual count of days when TN (daily minimum temperature) > 20°C | days |
| GSL | Growing season length: annual (1 January to 31 December in the northern hemisphere (NH), 1 July to 30 June in the southern hemisphere (SH)) count between first span of at least 6 days with TG (daily mean temperature) > 5°C and first span after 1st of July (1st of January in SH) of 6 days with TG < 5°C | days |
| TXx | Monthly maximum value of daily maximum temperature | °C |
| TNx | Monthly maximum value of daily minimum temperature | °C |
| TXn | Monthly minimum value of daily maximum temperature | °C |
| TNn | Monthly minimum value of daily minimum temperature | °C |
| Tn10p * | Cool nights: percentage of days when TN < 10th percentile | % |
| Tx10p * | Cool days: percentage of days when TX < 10th percentile | % |
| Tn90p * | Warm nights: percentage of days when TN > 90th percentile | % |
| Tx90p * | Warm days: percentage of days when TX > 90th percentile | % |
| WSDI * | Warm spell duration index: annual count of days with at least six consecutive days when TX > 90th percentile | days |
| CSDI * | Cold spell duration index: annual count of days with at least six consecutive days when TN < 10th percentile | days |
| DTR | Diurnal temperature range: monthly mean value of difference between Tx and Tn | °C |
| Rx1day | Monthly maximum consecutive 1-day precipitation | mm |
| Rx5day | Monthly maximum consecutive 5-day precipitation | mm |
| SDII | Simple precipitation intensity index: annual total precipitation divided by the number of wet days (defined as PRCP ≥ 1.0 mm) in the year | mm/day |
| R10mm | Number of heavy precipitation days: annual count of days when PRCP ≥ 10 mm | days |

| R20mm | Number of very heavy precipitation days: annual count of days when PRCP >= 20 mm | days |
|---|---|---|
| R1mm | Number of wet days: annual count of days when PRCP >= 1 mm (days) CDD Maximum length of dry spell: maximum number of consecutive days with RR (daily precipitation amount) < 1 mm | days |
| CDD | Maximum length of dry spell: maximum number of consecutive days with RR < 1 mm | days |
| CWD | Maximum length of wet spell: maximum number of consecutive days with RR >= 1 mm | days |
| R95p | Very wet days precipitation: annual total PRCP when RR > 95th percentile | mm |
| R99p | Extremely wet days precipitation: annual total PRCP when RR > 99th percentile | Mm |
| PRCPTOT | Annual total precipitation on wet days (RR >= 1 mm) | Mm |

* $CEI_{part}$ does not contain these six variables.