# Supplementary Information for Pervin et al.

**"Importance of plant functional type, dynamic vegetation, and fire interactions for process-based modeling of gross carbon uptake across the drylands of western North America"**

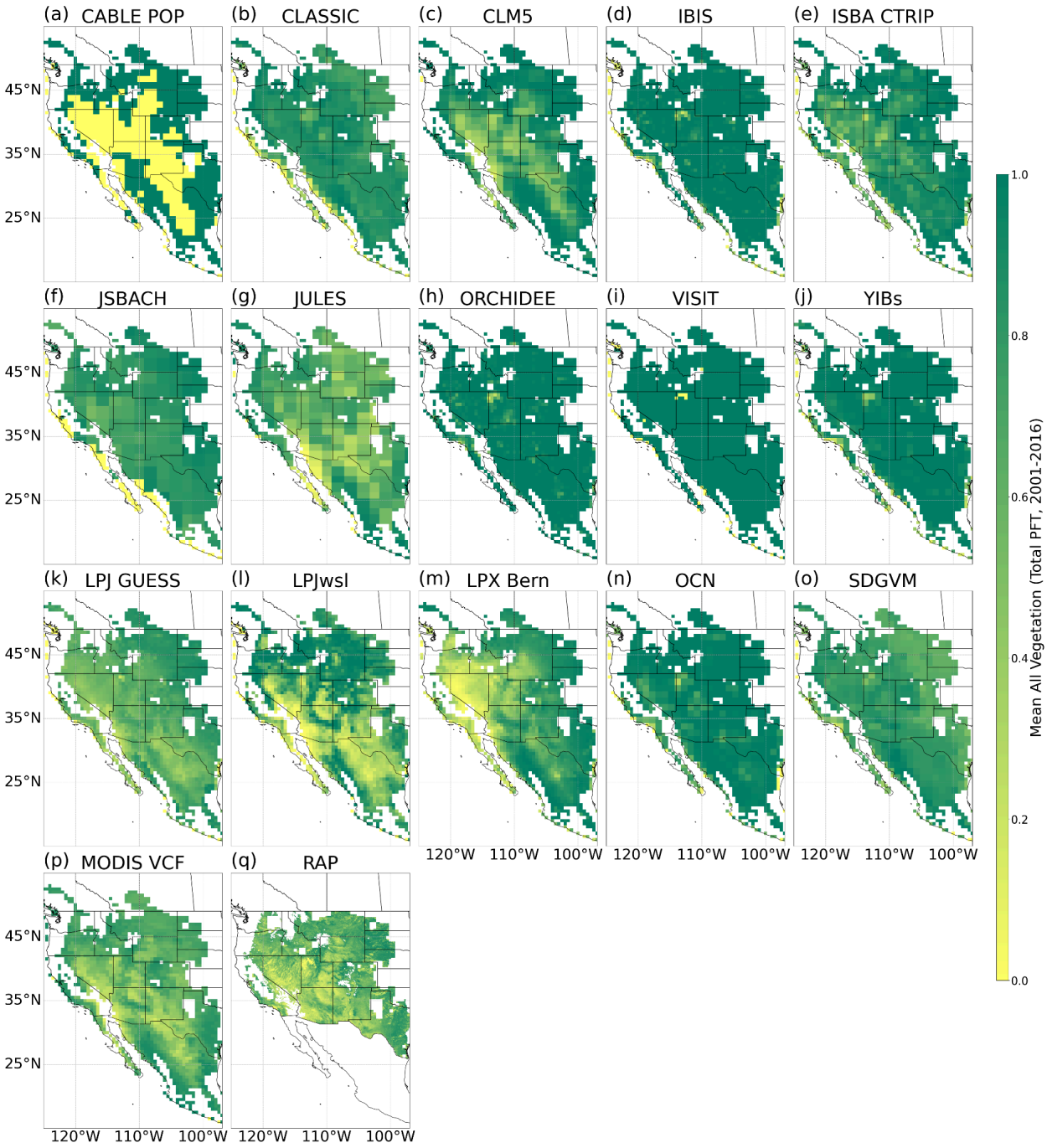


Figure S1a: Total PFT mean (PFT, 2001-2016) fractional cover maps for models (a to o) compared to reference data from MODIS VCF (p) and RAP (q).

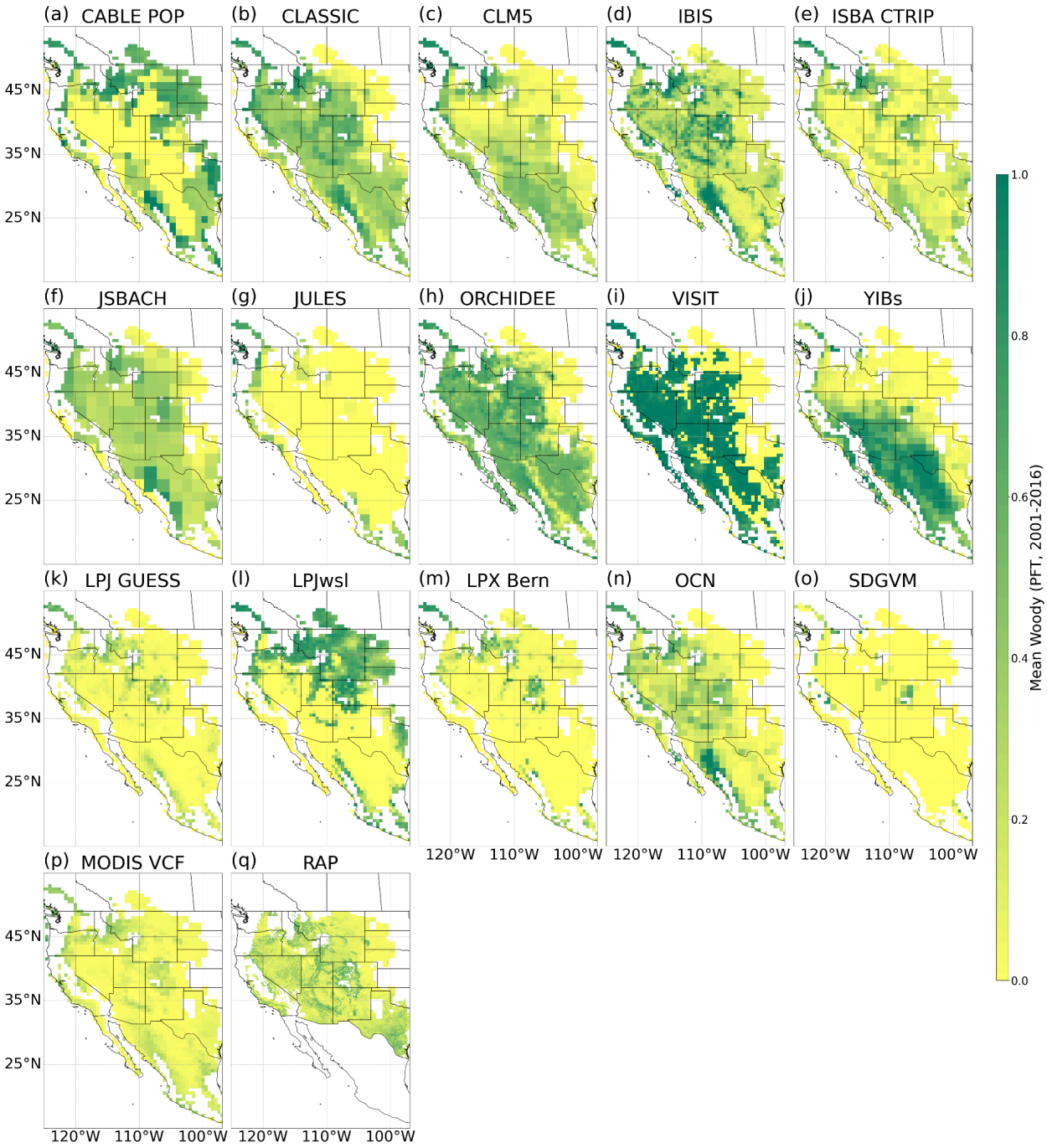


Figure S1b: Mean woody (PFT, 2001-2016) fractional cover maps for models (a to o) compared to reference data from MODIS VCF (p) and RAP (q).

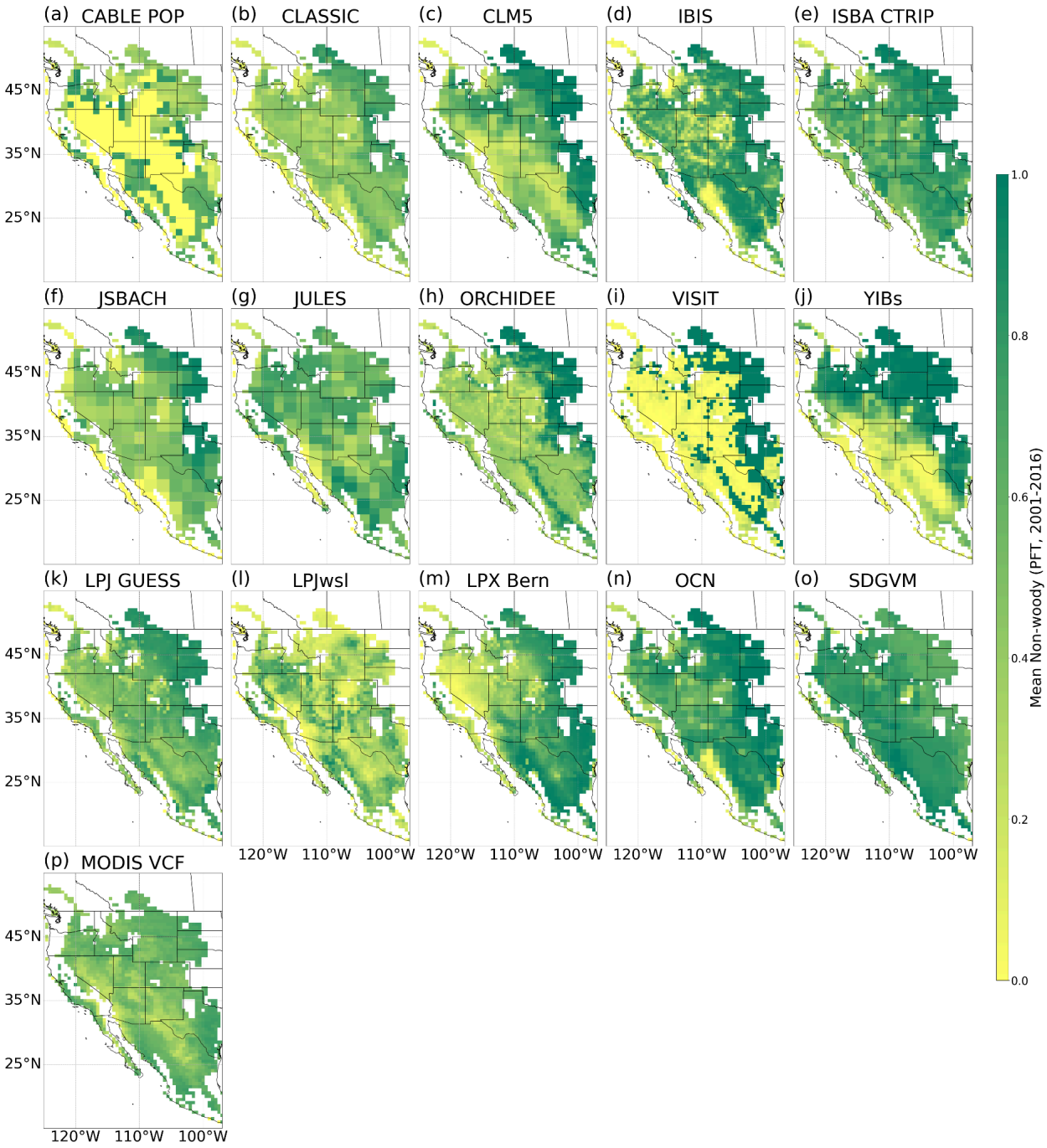


Figure S1c: Mean non-woody (PFT, 2001-2016) fractional cover maps for models (a to o) compared to reference data from MODIS VCF (p)

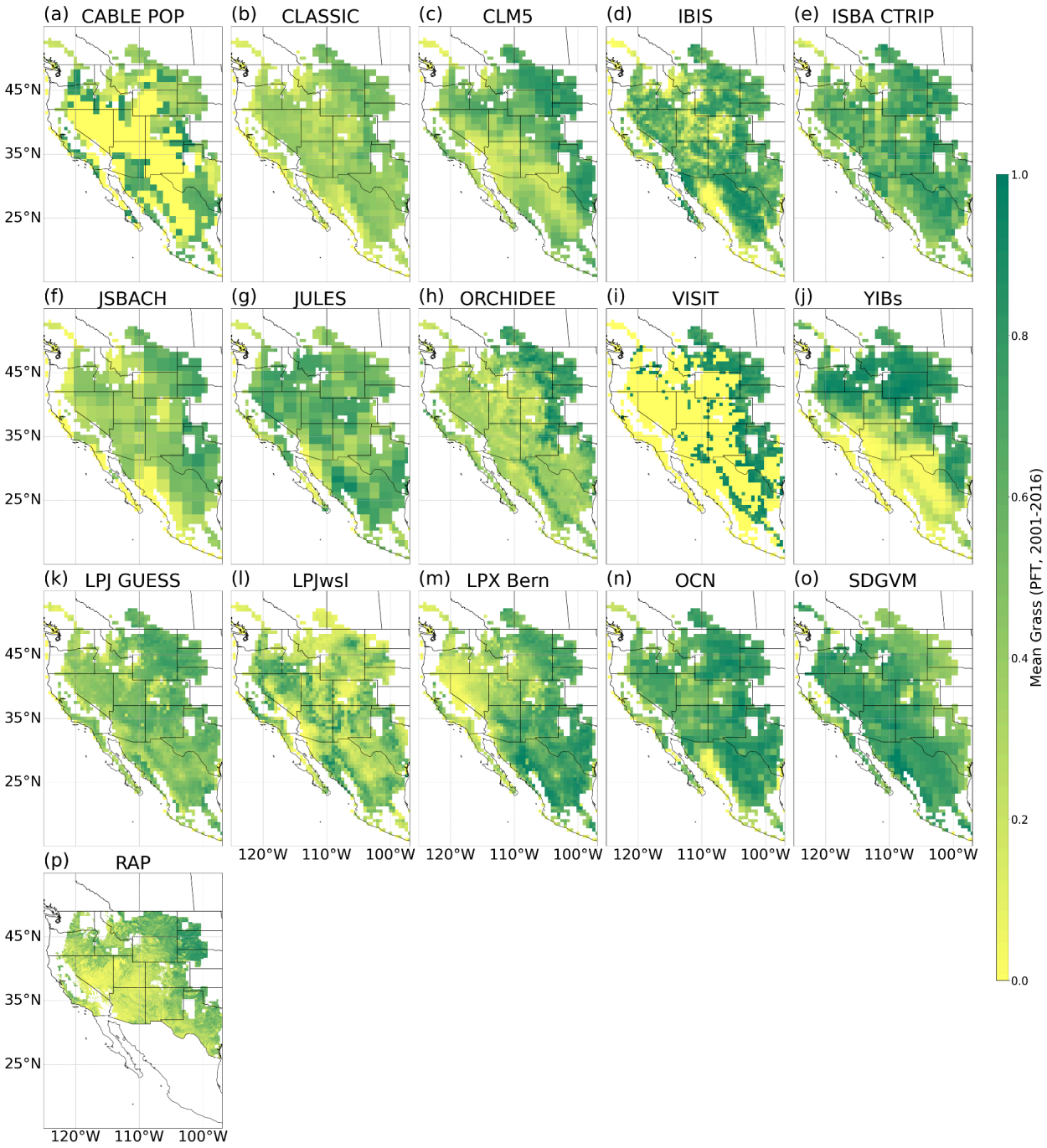


Figure S1d: Mean grass (PFT, 2001-2016) fractional cover maps for models (a to o) compared to reference data from RAP (p).

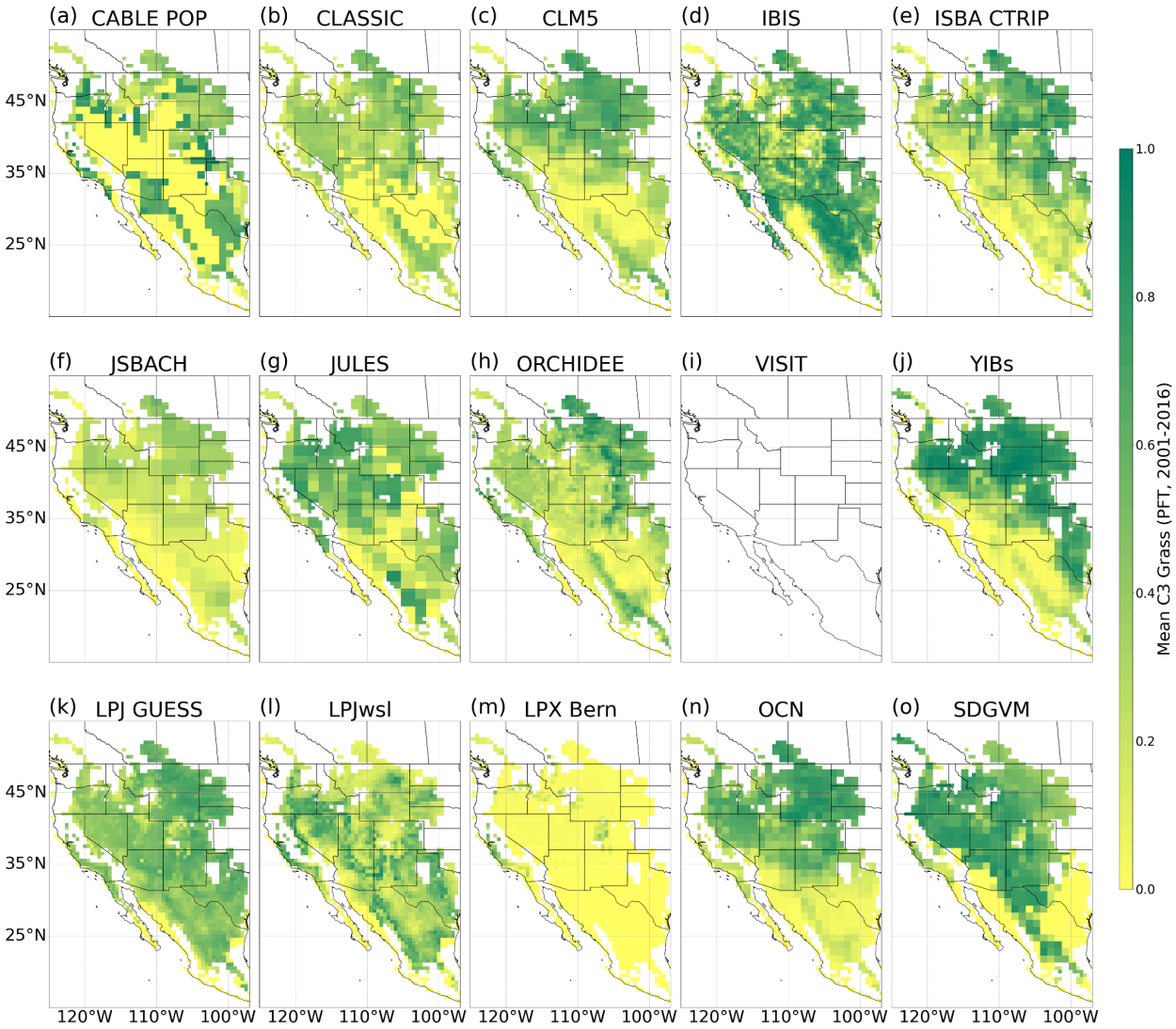


Figure S1e: Mean C3 grass (PFT, 2001-2016) fractional cover maps for models (a to o)

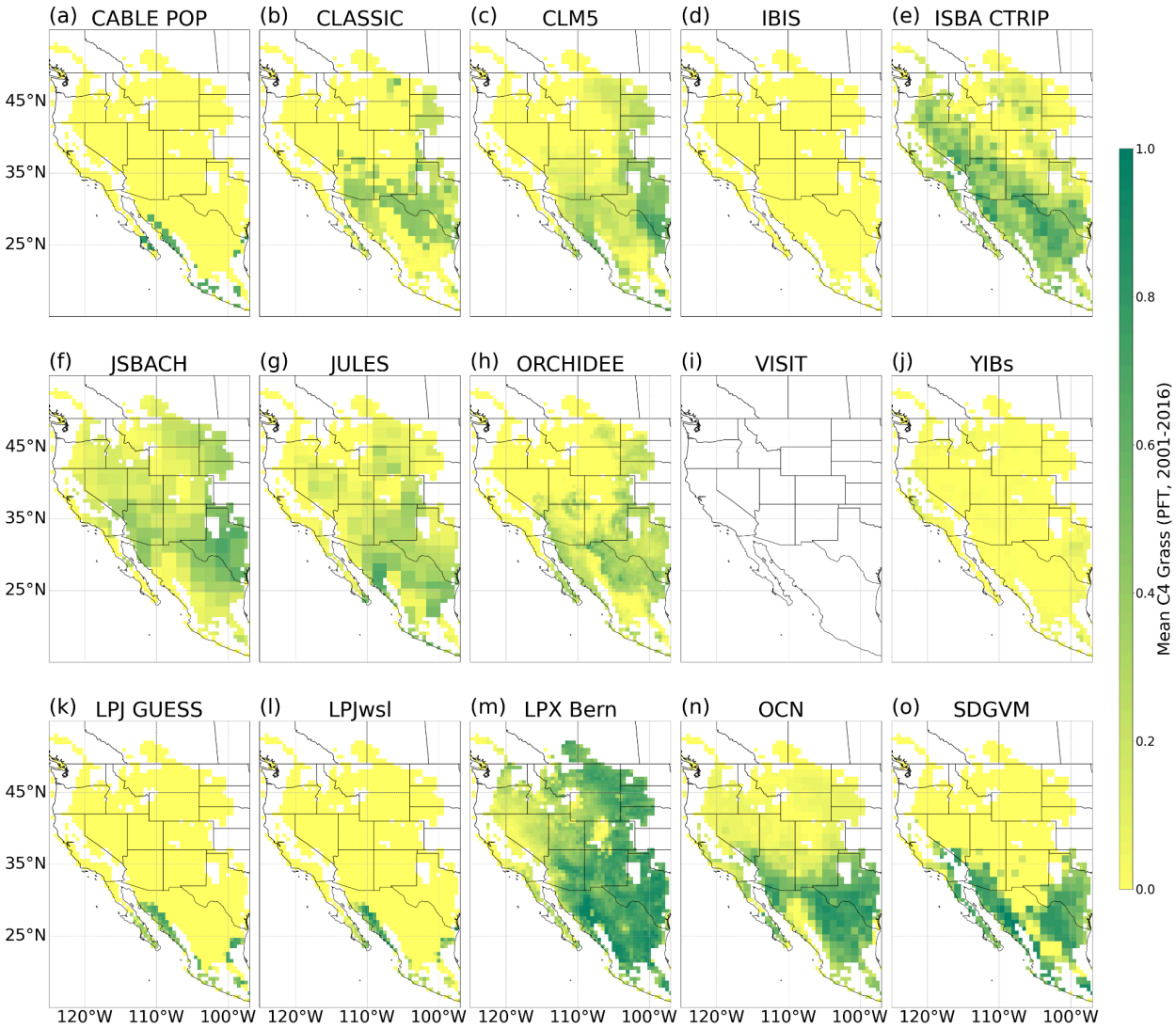


Figure S1f: Mean C4 grass (PFT, 2001-2016) fractional cover maps for models (a to o)

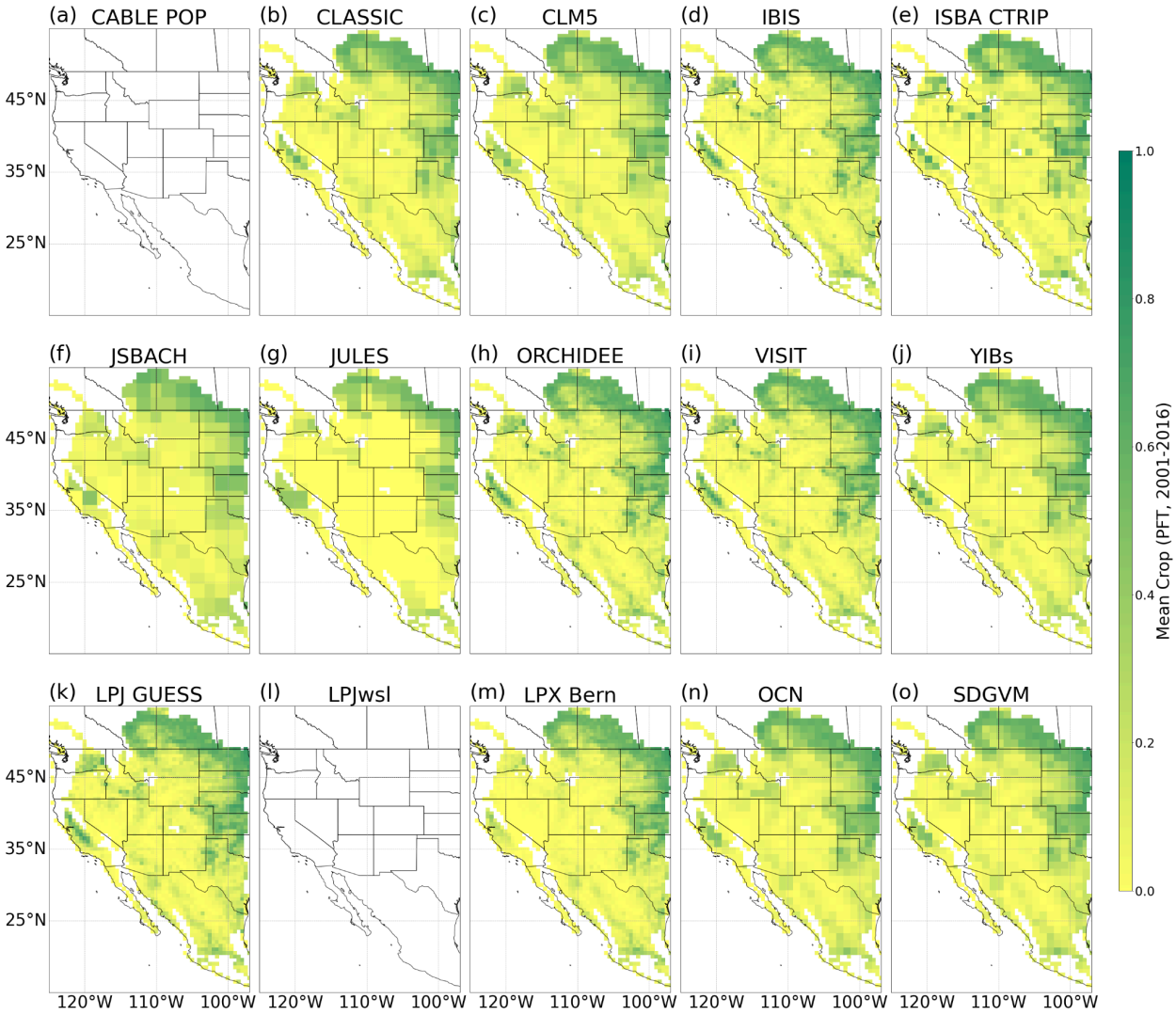


Figure S1g: Mean crop (PFT, 2001-2016) fractional cover maps for models (a to o)

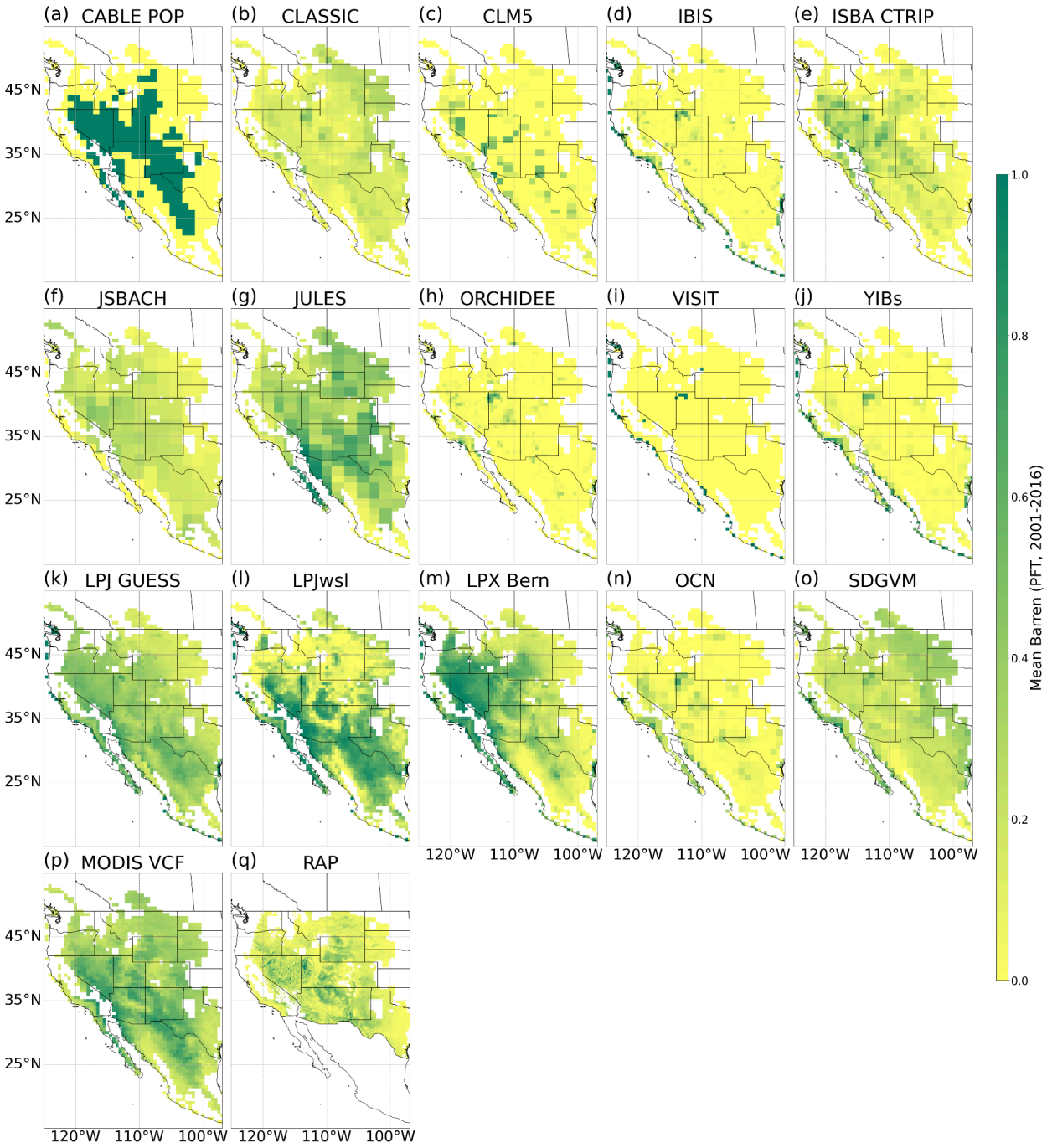


Figure S1h: Mean barren (PFT, 2001-2016) fractional cover maps for models (a to o) compared to reference data from MODIS VCF (p) and RAP (q).

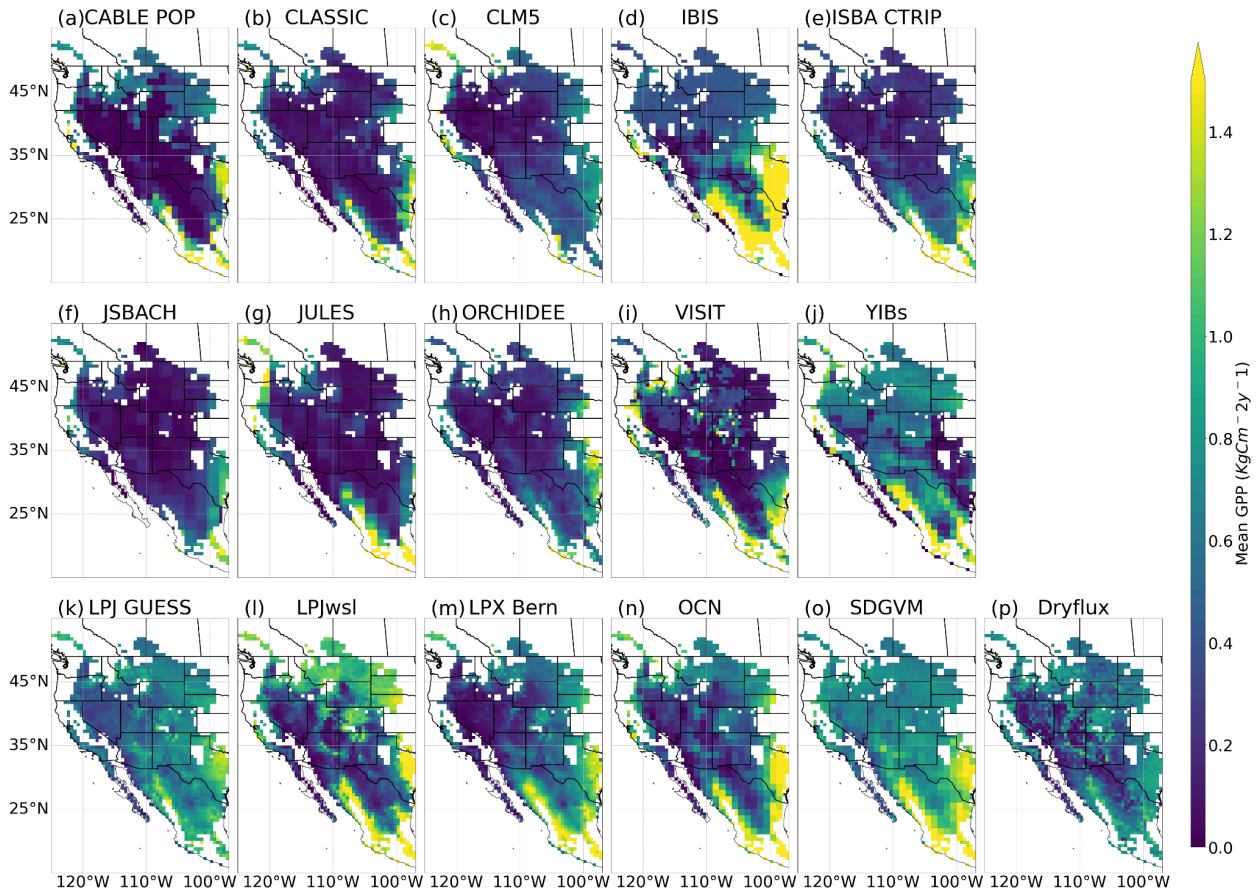


Figure S2: Spatial distribution of mean annual GPP (2001-2016) in $kgCm^{-2}y^{-1}$ for all TRENDY v11 models (a-o) used in this study and DryFlux (p).

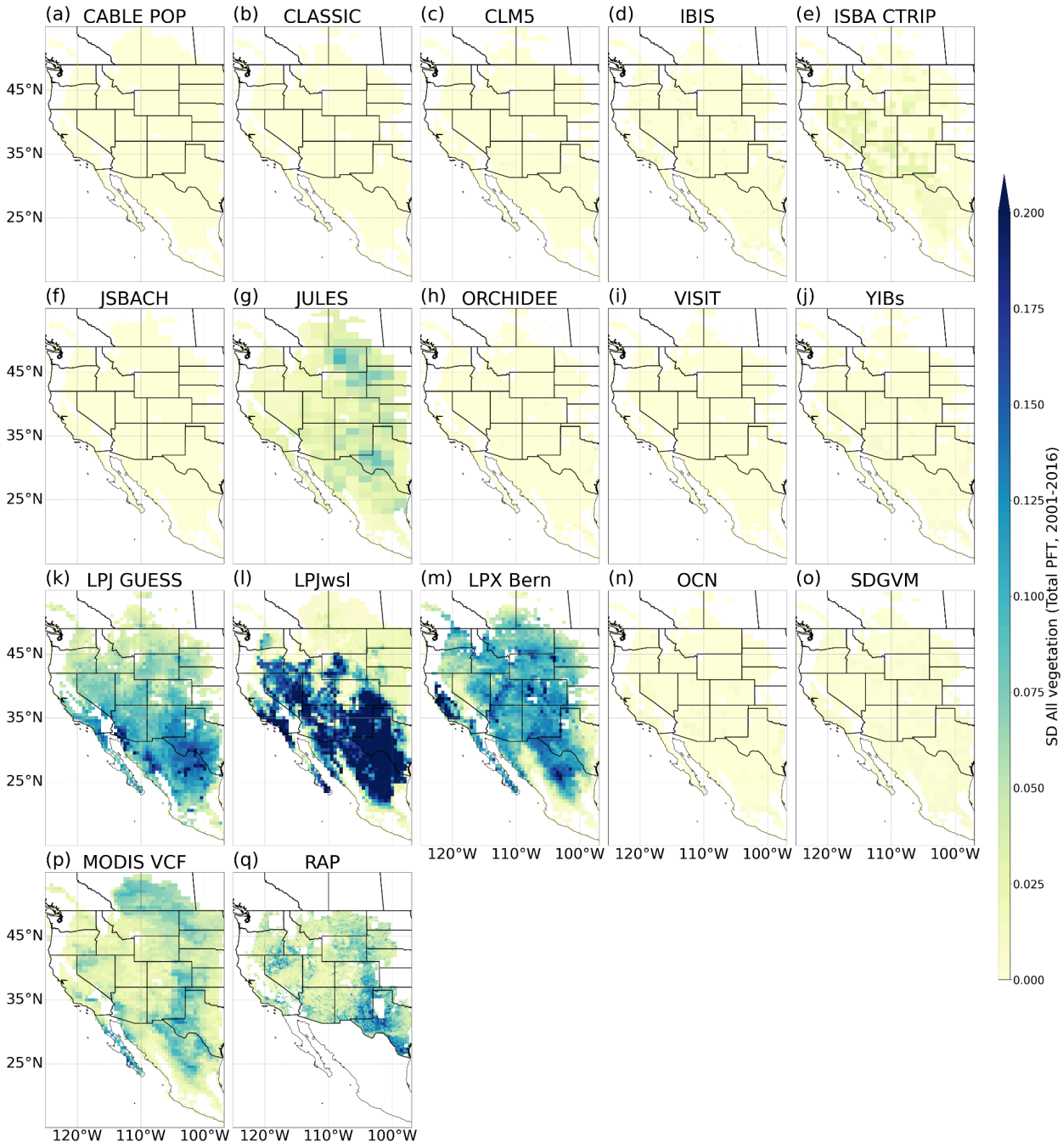


Figure S3a: Standard deviation of total PFT (PFT, 2001-2016) fractional cover maps for models (a to o) compared to reference data from MODIS VCF (p) and RAP (q). We note that the ISBA-CTRIP vegetation fCover annual variability is mostly in patches that have a higher mean bare ground fraction (Fig. S1a)

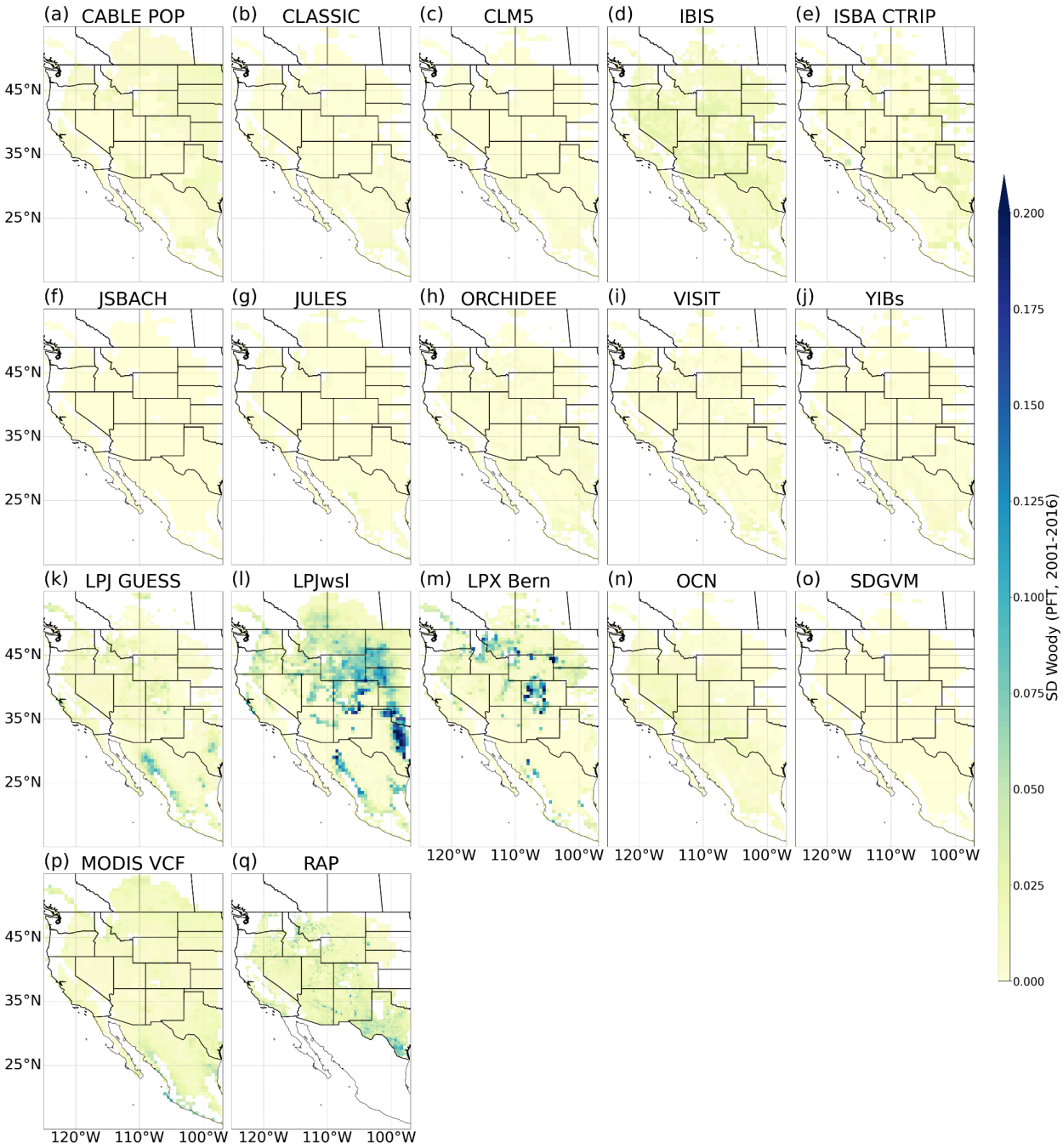


Figure S3b: Standard deviation of woody (PFT, 2001-2016) fractional cover maps for models (a to o) compared to reference data from MODIS VCF (p) and RAP (q).

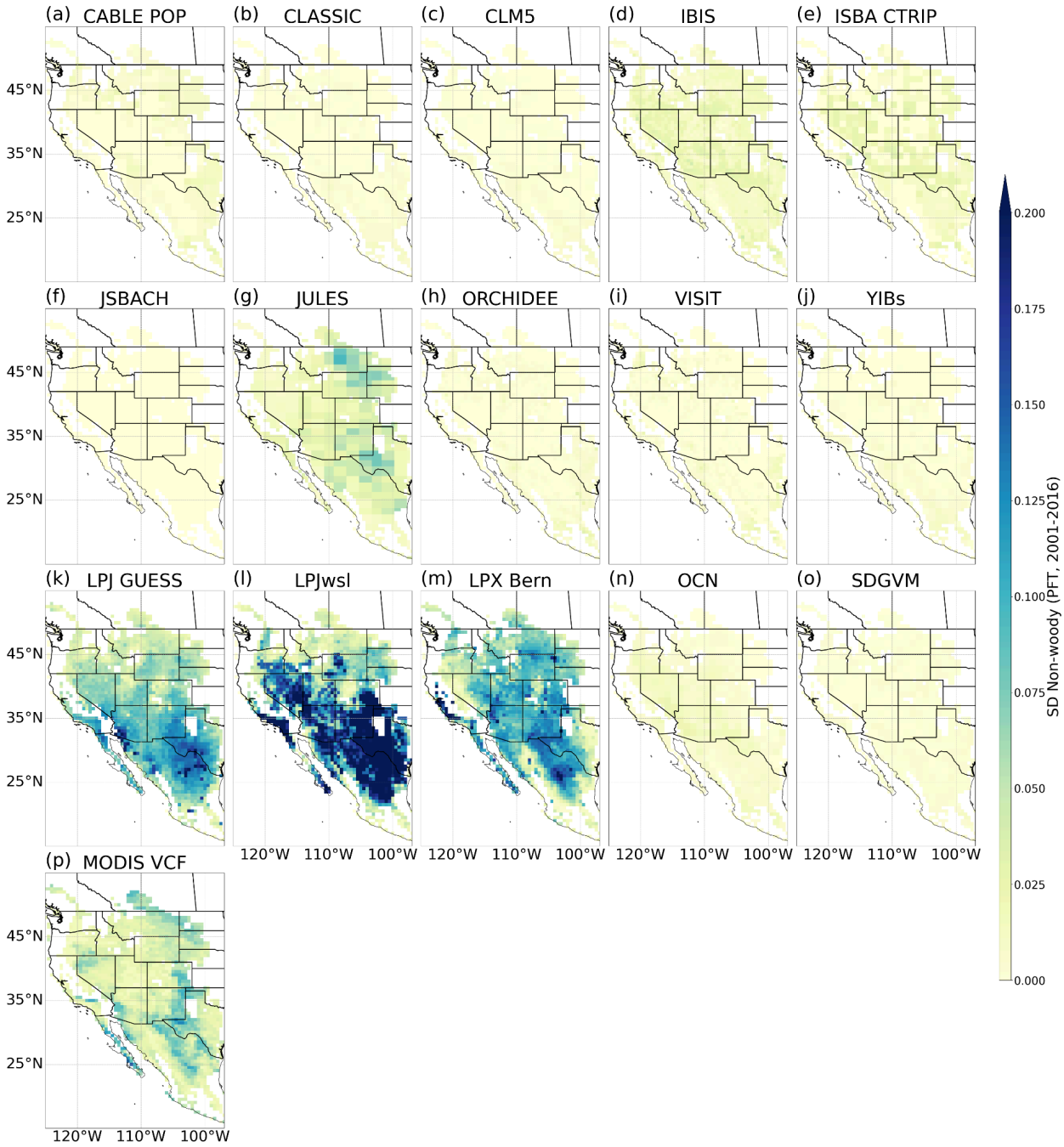


Figure S3c: Standard deviation of non-woody (PFT, 2001-2016) fractional cover maps for models (a to o) compared to reference data from MODIS VCF (p)

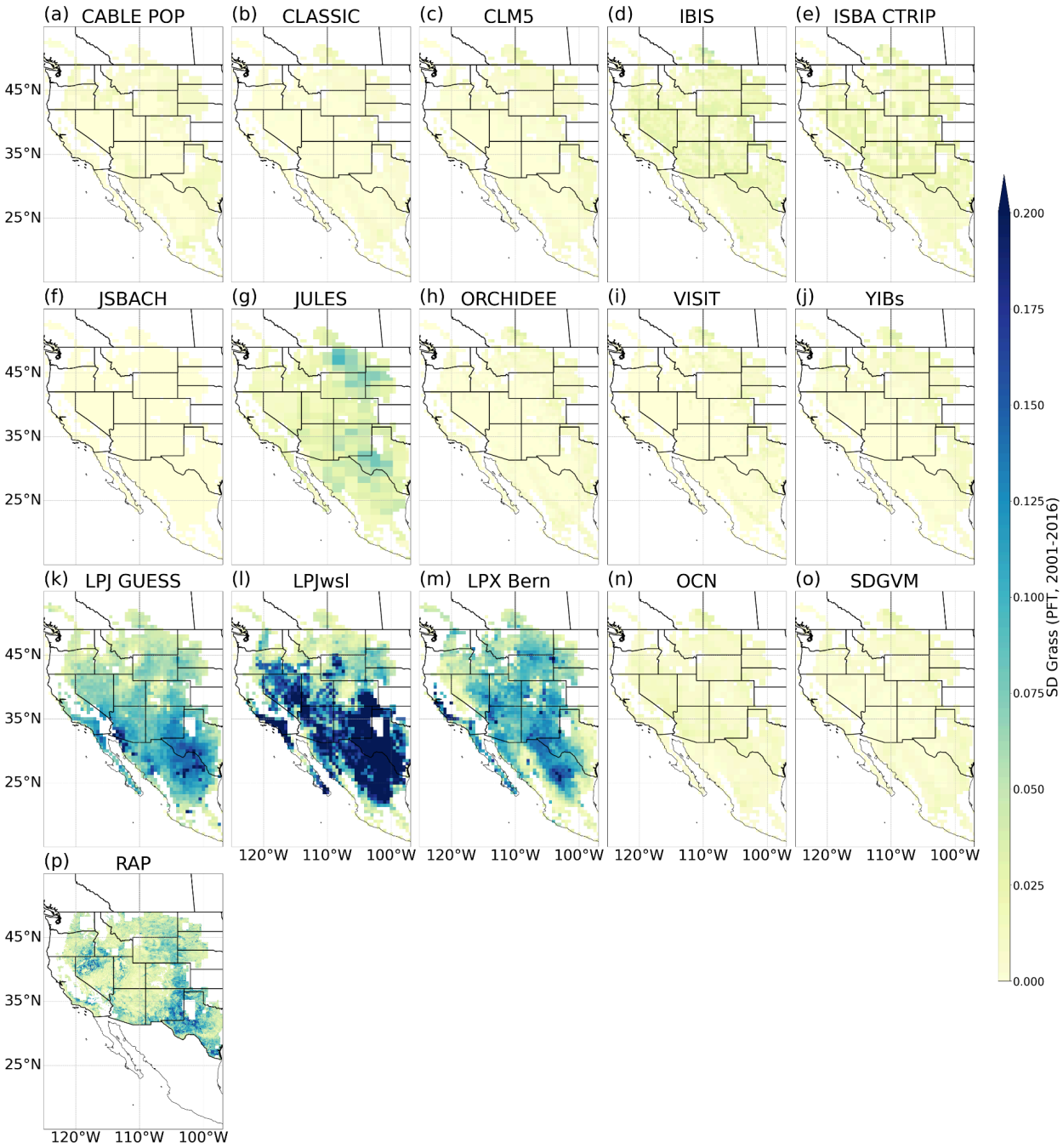


Figure S3d: Standard deviation of grass (PFT, 2001-2016) fractional cover maps for models (a to o) compared to reference data from RAP (p).

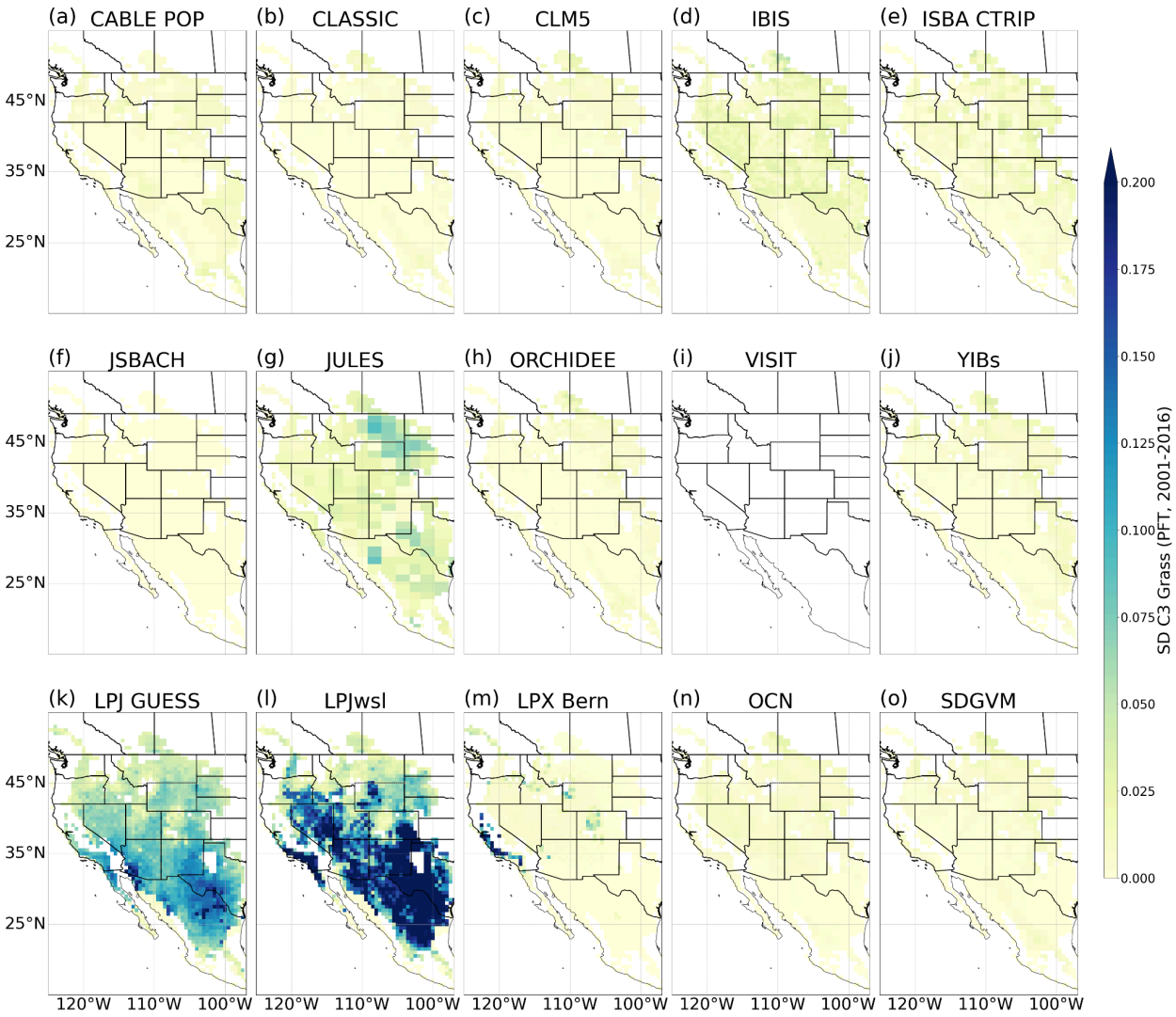


Figure S3e: Standard deviation of C3 grass (PFT, 2001-2016) fractional cover maps for models (a to o)

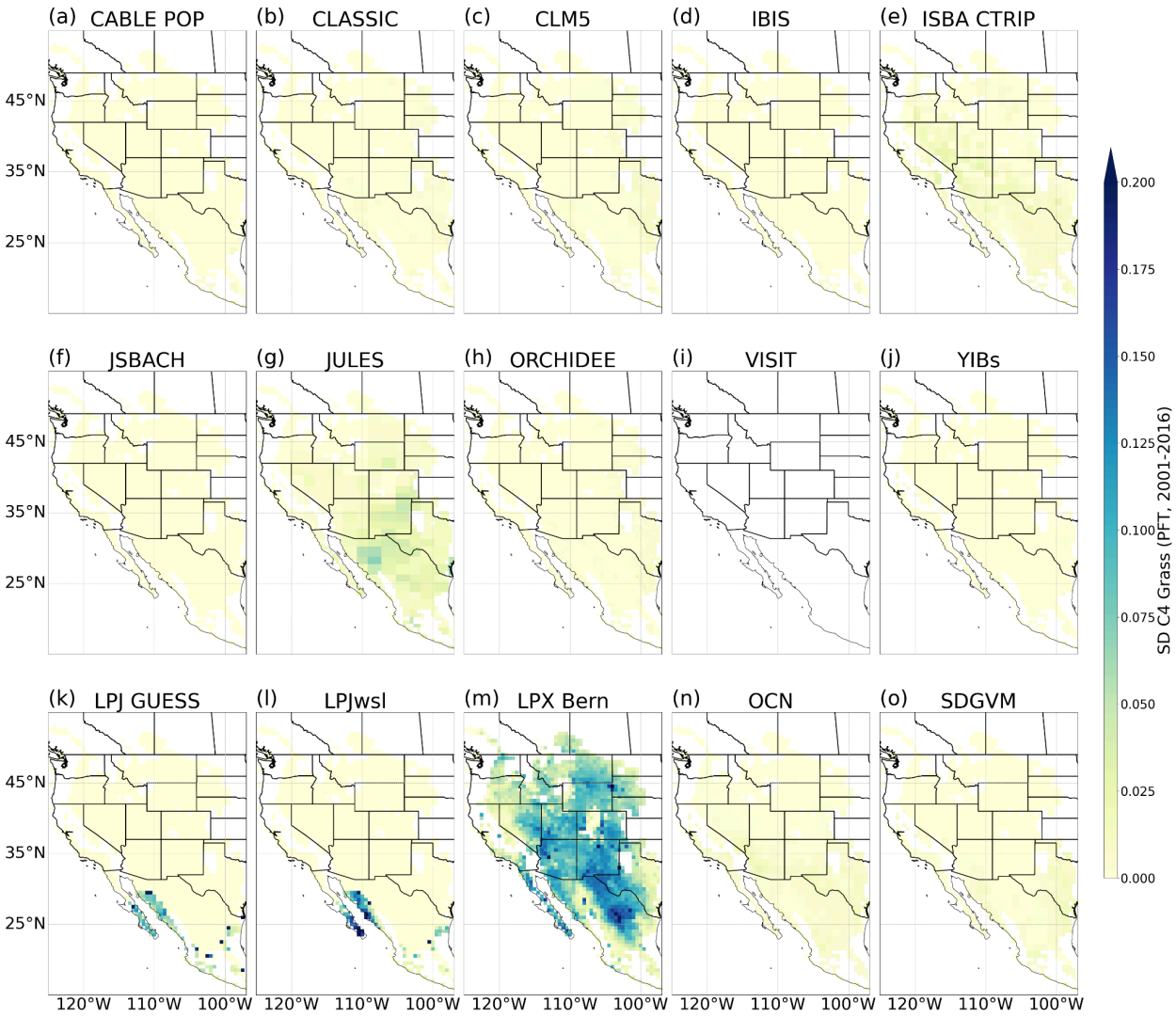


Figure S3f: Standard deviation of C4 grass (PFT, 2001-2016) fractional cover maps for models (a to o)

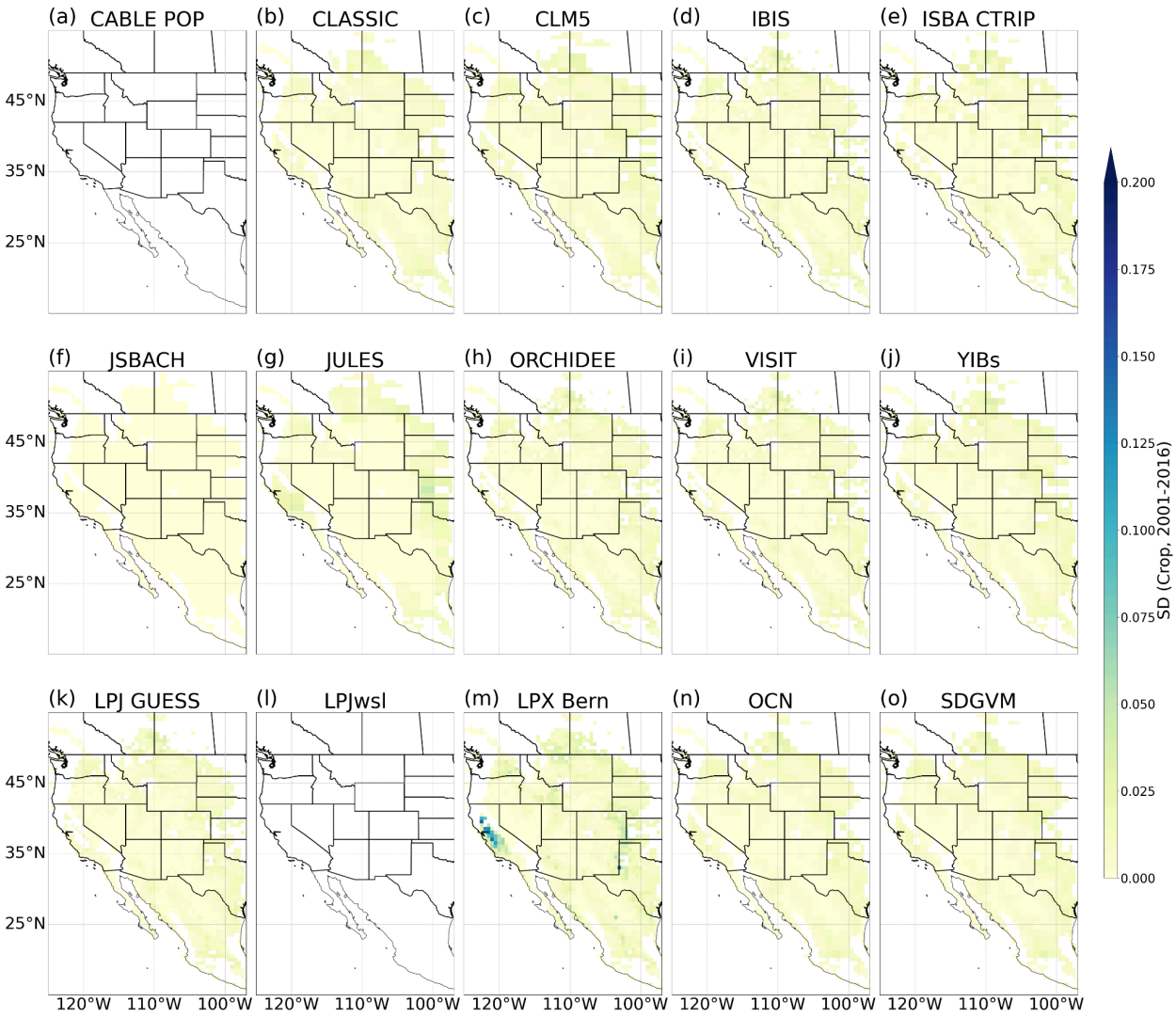


Figure S3g: Standard deviation of crop (PFT, 2001-2016) fractional cover maps for models (a to o)

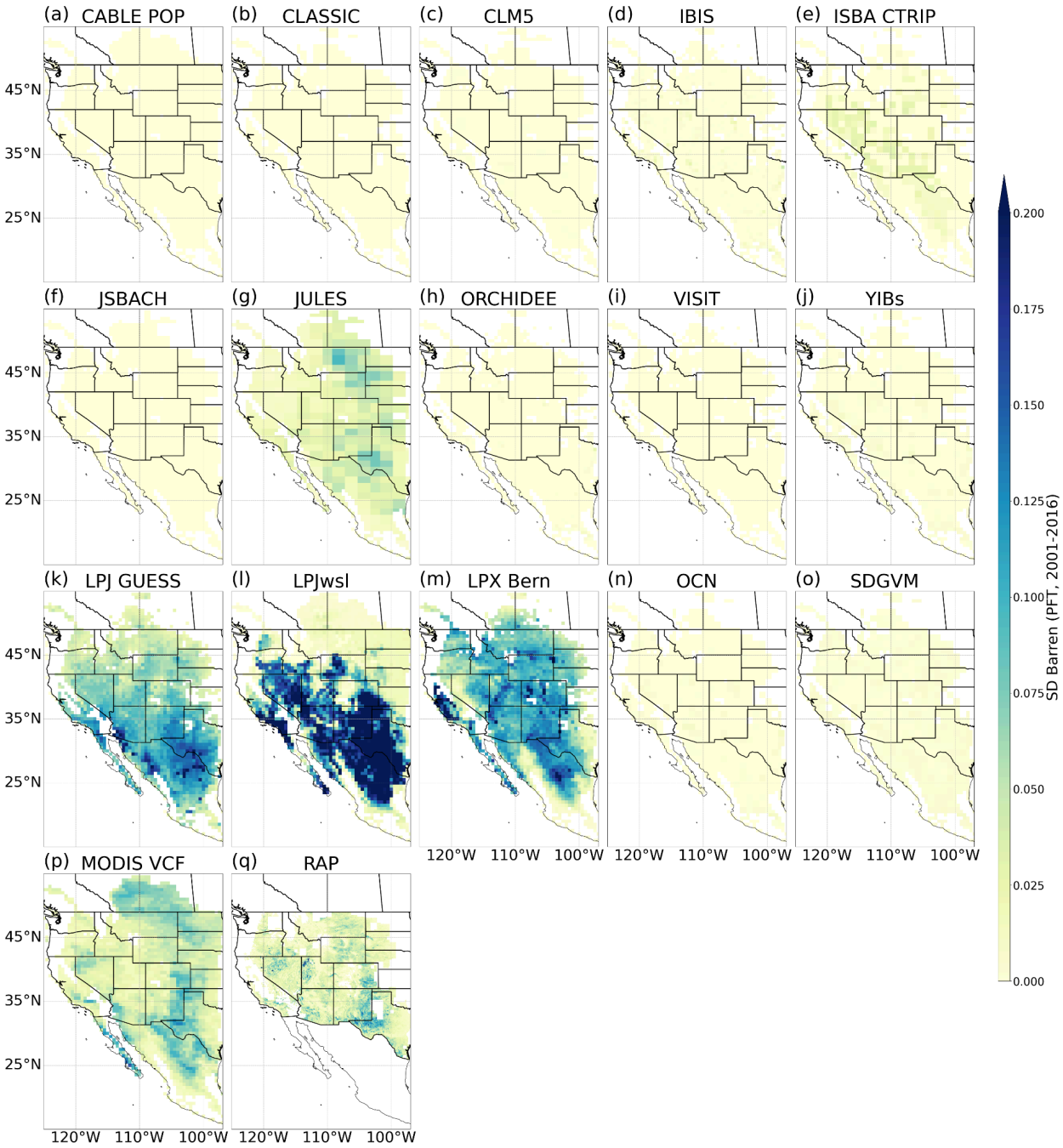


Figure S3h: Standard deviation of barren (PFT, 2001-2016) fractional cover maps for models (a to o) compared to reference data from MODIS VCF (p) and RAP (q).

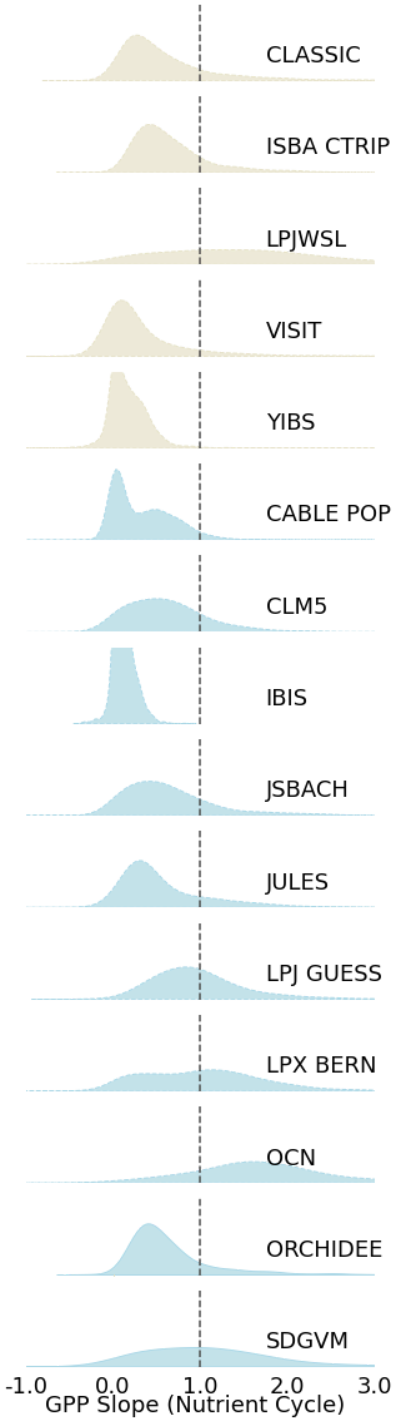


Figure S4: GPP slope ridgeline plots of nutrient cycle on (blue) vs those that are not available (light yellowish green) for the models.

Table S1: Additional information on processes relevant for GPP variability for each TRENDY v11 model used in this study. All PFT included in each PFT group are listed here. PFT that are mostly contributing to the PFT groups are in black and those that have fCover near 0 within the study area are in light gray.

| Model | PFTs included in each category |
|---|---|
| **CABLE-POP** | **Woody**: Evergreen Needleleaf Forest, Evergreen Broadleaf Forest, Deciduous Needleleaf Forest, Deciduous Broadleaf Forest, Shrub |
| | **Non-woody**: C3 Grass, C4 Grass, Tundra |
| | **Bare ground**: Barren, Ice |
| **CLASSIC** | **Woody**: Needleleaf Evergreen, Needleleaf Deciduous, Broadleaf Evergreen, Broadleaf Cold Deciduous, Broadleaf Drought/Dry Deciduous |
| | **Non-woody**: C3 Crop, C4 Crop, C3 Grass, C4 Grass |
| | **Bare ground**: Bareground |
| **CLM5** | **Woody**: Needleleaf Evergreen Temperate Tree, Needleleaf Evergreen Boreal Tree, Needleleaf Deciduous Boreal Tree, Broadleaf Evergreen Tropical Tree, Broadleaf Evergreen Temperate Tree, Broadleaf Deciduous Tropical Tree, Broadleaf Deciduous Temperate Tree, Broadleaf Deciduous Boreal Tree, Broadleaf Evergreen Shrub, Broadleaf Deciduous Temperate Shrub, Broadleaf Deciduous Boreal Shrub |
| | **Non-woody**: C3 Arctic Grass, C3 Non-Arctic Grass, C4 Grass, C3 Crop, C3 Irrigated, Temperate Corn, Irrigated Temperate Corn, Spring Wheat, Irrigated Spring Wheat, Winter Wheat, Irrigated Winter Wheat, Temperate Soybean, Irrigated Temperate Soybean, Cotton, Irrigated Cotton, Rice, Irrigated Rice, Sugarcane, Irrigated Sugarcane, Tropical Corn, Irrigated Tropical Corn, Tropical Soybean, Irrigated Tropical Soybean |
| | **Bare ground**: Not-vegetated |
| **IBIS** | **Woody**: enf, ebf, dnf, dbf, shrub, |
| | **Non-woody**: c3grass, c4grass, c3crop, c4crop, |
| | **Bare ground**: nonveg |
| **ISBA-CTRIP** | **Woody**: Temperate broadleaf cold-deciduous, Boreal needleleaf evergreen, Tropical broadleaf evergreen, Tropical broadleaf dry-deciduous, Temperate broadleaf evergreen, Temperate needleleaf evergreen, Boreal broadleaf cold-deciduous, Boreal needleleaf cold-deciduous, Deciduous shrub |
| | **Non-woody**: C3 crops C4 crops, Irrigated crops, C3 grass, C4 grass, Boreal grass, |
| | **Bare ground**: non veg, non veg, non veg |
| **JSBACH** | **Woody**: |
| | **Non-woody**: |

| | |
|---|---|
| | **Bare ground**: |
| **JULES** | **Woody**: BL Decid, BL Everg - Trop, BL Everg - Temp, NL Decid, NL Everg, Shrub Decid, Shrub Everg |
| | **Non-woody**: C3 grass, C3 crop, C3 Pasture, C4 grass, C4 crop, C4 Pasture |
| | **Bare ground**: Bare Ground |
| **LPJ-GUESS** | **Woody**: Boreal needleleaf evergreen (BNE), Boreal shade-intolerant needleleaf evergreen (BINE), Boreal needleleaf summergreen (BNS), Temperate needleleaf evergreen (TeNE), Temperate broadleaf summergreen (TeBS), Temperate shade-intolerant broadleaf summergreen (IBS), Temperate broadleaf evergreen (TeBE), Tropical broadleaf evergreen (TrBE), Tropical shade-intolerant broadleaf evergreen (TrIBE), Tropical broadleaf raingreen (TrBR) |
| | **Non-woody**: C3 grass (C3G), C4 grass (C4G), C3 grass in pasture (C3G_pas), C4 grass in pasture (C4G_pas), C3 annual crops (wheat w/o ccg) (CC3ann), C3 perennial crops (summer wheat w/ ccg) (CC3per), C3 nitrogen-fixing crops (summer wheat w/o ccg) (CC3nfx), C4 annual crops (corn w/o ccg) (CC4ann), C4 perennial crops (corn w/ ccg) (CC4per), C3 annual crops irrigated (wheat w/o ccg) (CC3anni), C3 perennial crops irrigated (summer wheat w/ ccg) (CC3peri), C3 nitrogen-fixing crops irrigated (summer wheat w/o ccg) (CC3nfxi), C4 annual crops irrigated (corn w/o ccg) (CC4anni), C4 perennial crops irrigated (corn w/ ccg) (CC4peri), C3 cover crop grass (ccg) (CC3G_ic), C4 cover crop grass (ccg) (CC4G_ic) |
| | **Bare ground**: 1- All vegetation |
| **LPJwsl** | **Woody**: TROPICAL BROADLEAVED EVERGREEN_TREE, TROPICAL BROADLEAVED RAINGREEN_TREE, TEMPERATE NEEDLELEAVED EVERGREEN_TREE, TEMPERATE BROADLEAVED EVERGREEN_TREE, TEMPERATE BROADLEAVED SUMMERGREEN_TREE, BOREAL NEEDLELEAVED EVERGREEN_TREE, BOREAL BROADLEAVED SUMMERGREEN_TREE, BOREAL NEEDLELEAVED SUMMERGREEN_TREE, |
| | **Non-woody**: C3_PERENNIAL GRASS, C4_PERENNIAL GRASS |
| | **Bare ground**: 1- All vegetation |
| **LPX-Bern** | **Woody**: Tropical Broad Evergreen; Tropical Broad Raingreen, Temperate Needle Evergreen, Temperate Broad Evergreen, Temperate Broad Summergreen, Boreal Needle Evergreen, Boreal Needle Summergreen, Boreal Broad Summergreen, Tropical Broad Evergreen in Old Peatland, Tropical Broad Raingreen in Old Peatland, Temperate Needle Evergreen in Old Peatland, Temperate Broad Evergreen in Old Peatland, Temperate Broad Summergreen in Old Peatland, Boreal Needle Evergreen in Old Peatland, Boreal Needle Summergreen in Old Peatland, Boreal Broad Summergreen in Old Peatland |
| | **Non-woody**: C3 Herbaceous, C4 Herbaceous, Peat Graminoid, Peat Sphagnum Moss, Peat Flood Tolerant Tropical Broad Evergreen, Peat Flood Tolerant Tropical Broad Raingreen, Peat Flood Tolerant Herbaceous, C3 Herbaceous in Old Peatland, C4 Herbaceous in Old Peatland, Cropland C3 Herbaceous, Cropland C4 Herbaceous, Pasture C3 Herbaceous, Pasture C4 Herbaceous |
| | **Bare ground**: 1 - All vegetation |
| **ORCHIDEE** | **Woody**: Tropical broadleaf evergreen, Tropical broadleaf raingreen, Temperate |

| | |
|---|---|
| | needleleaf evergreen, Temperate broadleaf evergreen, Temperate broadleaf summergreen, Boreal needleleaf evergreen, Boreal broadleaf summergreen, Boreal needleleaf summergreen |
| | **Non-woody**:Temperate C3 grass, C4 grass, C3 agriculture, C4 agriculture, Tropical C3 grass, Boreal C3 grass |
| | **Bare ground**: Bare soil |
| **OCN** | **Woody**: Tropical Broad Evergreen, Tropical Broad Raingreen, Temperate Needle Evergreen, Temperate Broad Evergreen, Temperate Broad Summergreen, Boreal Needle Evergreen, Boreal Broad Summergreen, Boreal Needle Summergreen |
| | **Non-woody**: Temperate Herbaceous, Tropical Herbaceous, Temperate Herbaceous Crop, Tropical Herbaceous Crop |
| | **Bare ground**: Bare soil |
| **SDGVM** | **Woody**: Dc_Bl, Dc_Nl, Ev_Bl, Ev_Nl |
| | **Non-woody**: C3, C3 Crop, C4, C4 Crop |
| | **Bare ground**: Bare |
| **VISIT** | **Woody**: Tropical Evergreen Forest/Woodland, Tropical Deciduous Forest/Woodland, Temperate Broadleaf Evergreen Forest/Woodland, Temperate Needleleaf Evergreen Forest/Woodland, Temperate Deciduous Forest/Woodland, Boreal Evergreen Forest/Woodland, Boreal Deciduous Forest/Woodland, Evergreen/Deciduous Mixed Forest/Woodland, Savanna, Dense Shrubland, Open Shrubland |
| | **Non-woody**: Grassland/Steppe, Cropland |
| | **Bare ground**: 1- all vegetation |
| **YIBs** | **Woody**: Evergreen Broadleaf Forest, Evergreen Needleleaf Forest, Deciduous Broadleaf Forest, Shrubland |
| | **Non-woody**: C3 Grassland, C4 Grassland, C3 Cropland, C4 Cropland |
| | **Bare ground**: 1- all vegetation |

Table S2: PFTs included within the woody vegetation, non-woody vegetation and bare ground classes for all TRENDY v11 models included in this study. Total vegetation was calculated as the sum of all vegetation in the woody and non-woody classes. Non vascular plants were ignored. If a barren or bare soil/ground class was not present it was calculated as 1 – total vegetation (vascular and nonvascular plants). PFTs in light grey were largely not present in the study area, and therefore do not contribute to the fractional cover within the main woody or non-woody vegetation classes.