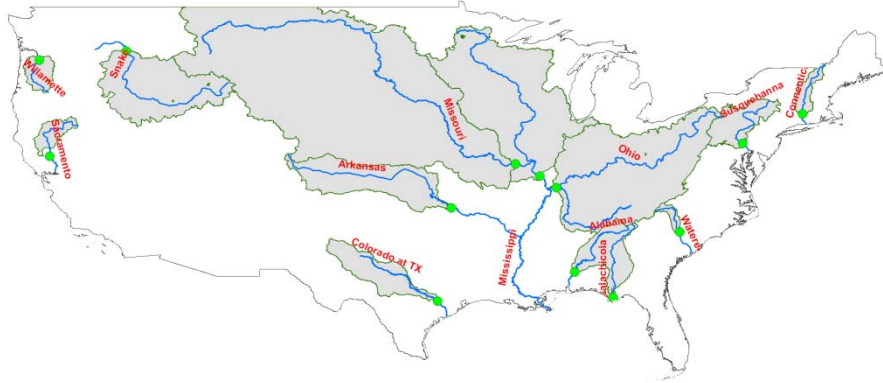**Supplementary Materials**

Fig. S1 The distribution of 13 USGS gage station (green points) and the corresponding rivers and watersheds selected in this study for model comparison. The watershed for each gage station is derived from the eight digits hydrological unit code data (Source: ftp://gateway2.ftw.nrcs.usda.gov/Gateway/WBD/).
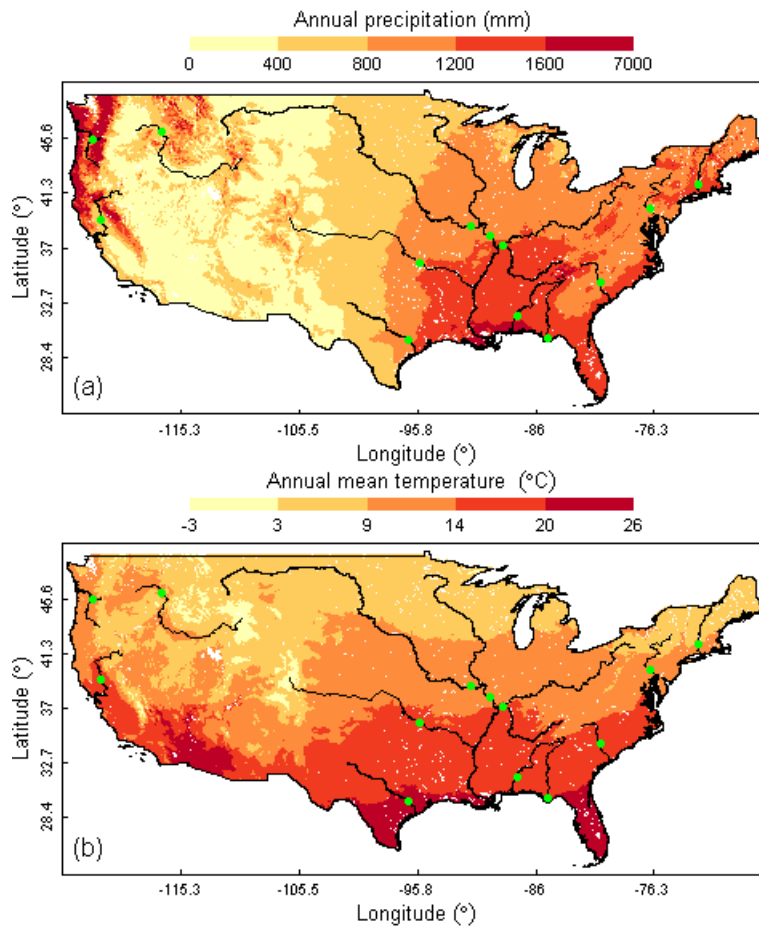

Fig.S2 The spatial pattern of annual total precipitation and annual mean temperature in the conterminous United States (Daly *et al.*, 2001, 2002).

(a) GLCF land covers (Source: Hansan et al. 2000, 2003)

Evergreen needleleaf forest
Evergreen broadleaf forest
Deciduous broadleaf forest — Woodland — Grassland — Bare
Mixed forest — Shrubland — Cropland — Urban

(b) DGVM-simulated potential natural vegetation

Tropical broadleaf evergreen tree
Tropical needleleaf evergreen tree
Temperate broadleaf evergreen tree — TeBST — BrBST — C4 grassland
Temperate needleleaf evergreen tree — BrNET — C3 grassland — Bare
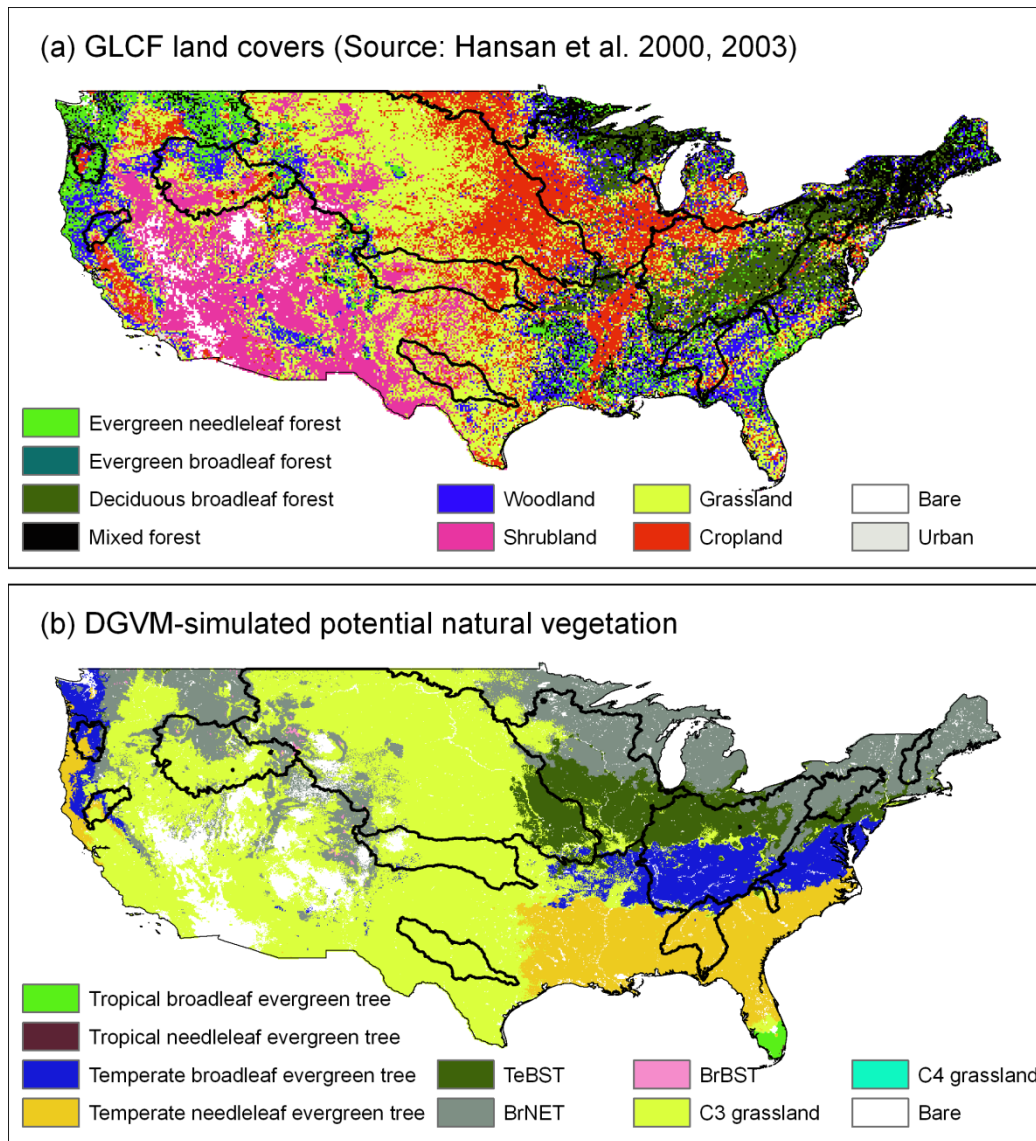
Fig.S3 (a) The predefined land covers in LH based on the GLCF data (Hansen *et al.*, 2000, 2003) and (b) the DGVM-simulated potential natural vegetation for the coterminous US.Note: The DGVM (version 1.2) simulated vegetation might be biased because we did not calibrate and parameterize it for modeling potential natural vegetation and because we keep values of same parameters same between LH and DGVM simulation. TeBST, BrNET and BrBST in (b) are short for temperate needleleaf evergreen tree, boreal needleleaf evergreen tree and boreal broadleaf summergreen tree, respectively.

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