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Supplement of

The carbon cycle in Mexico: past, present and future of C stocks and fluxes

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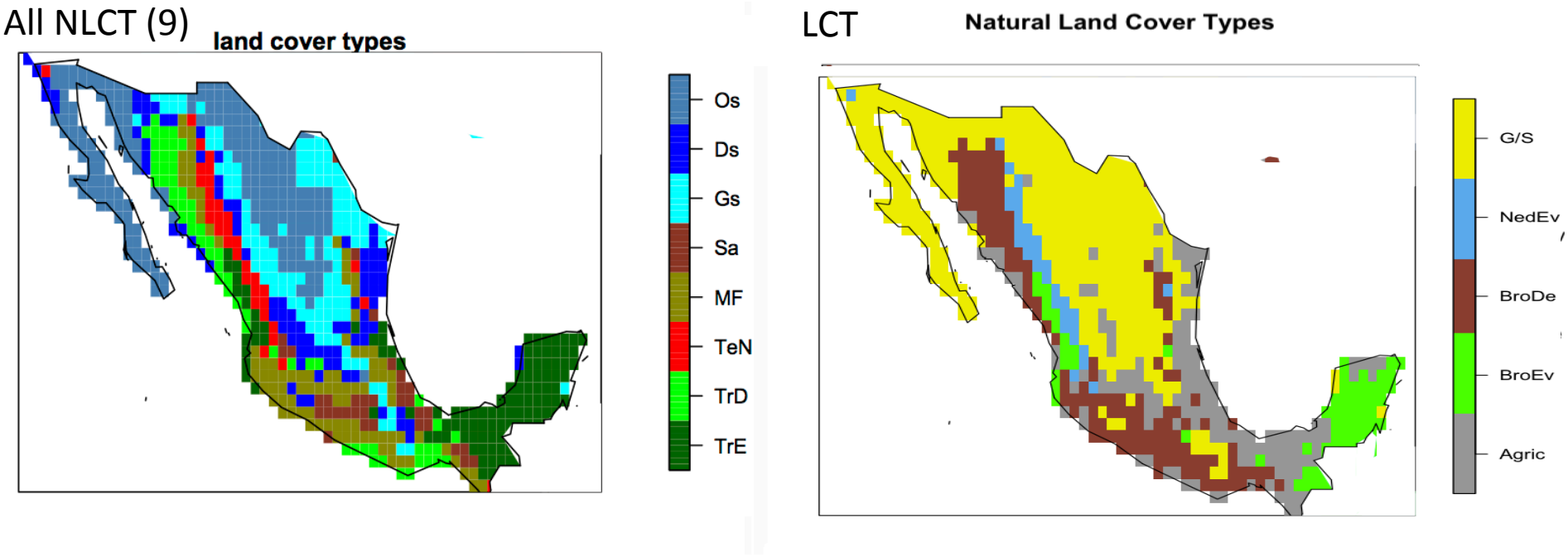
Figure S1: Vegetation cover types



Supplementary 1: natural land cover types (right) and aggregated covers (left). OS: Open shrubland, Ds: Dense Shrubland; Gs: Grassland; Sa: Savanna; MF: Mixed Forest; TeN: Temperate Needleaf forest; TrD: Tropical Deciduous Forest, TrE: Tropical Evergreen forest.

We aggregate the natural land cover type (as derived directly from Ramankuty and Foley, 1999) into four functional types to simplify the analysis and masked the areas where the agricultural fraction what higher than 50%. This four aggregated categories are in good agreement with the vegetation maps by Rzedowski (1978), except we aggregated all deciduous categories into one as they tend to co-exist at this scale. Additionally, we merged the shrublands and grasslands into one category for easier comparison against forested lands

Figure S2. Sampling points for the field data (vegetation and soil)

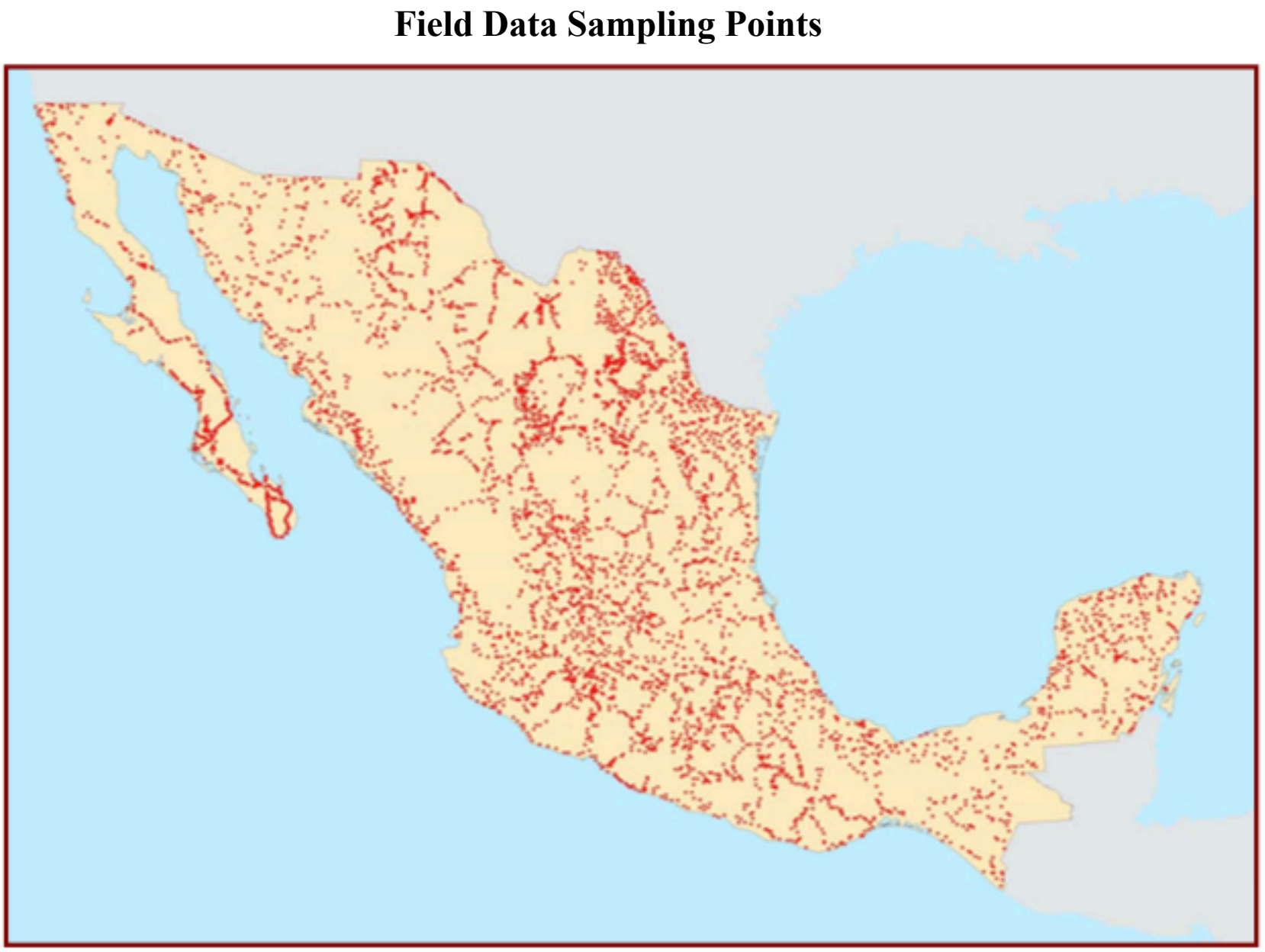


Figure S3: Gridded temperature trend for 2005-2100 for four RCPs. Stippled for >66% model agreement.

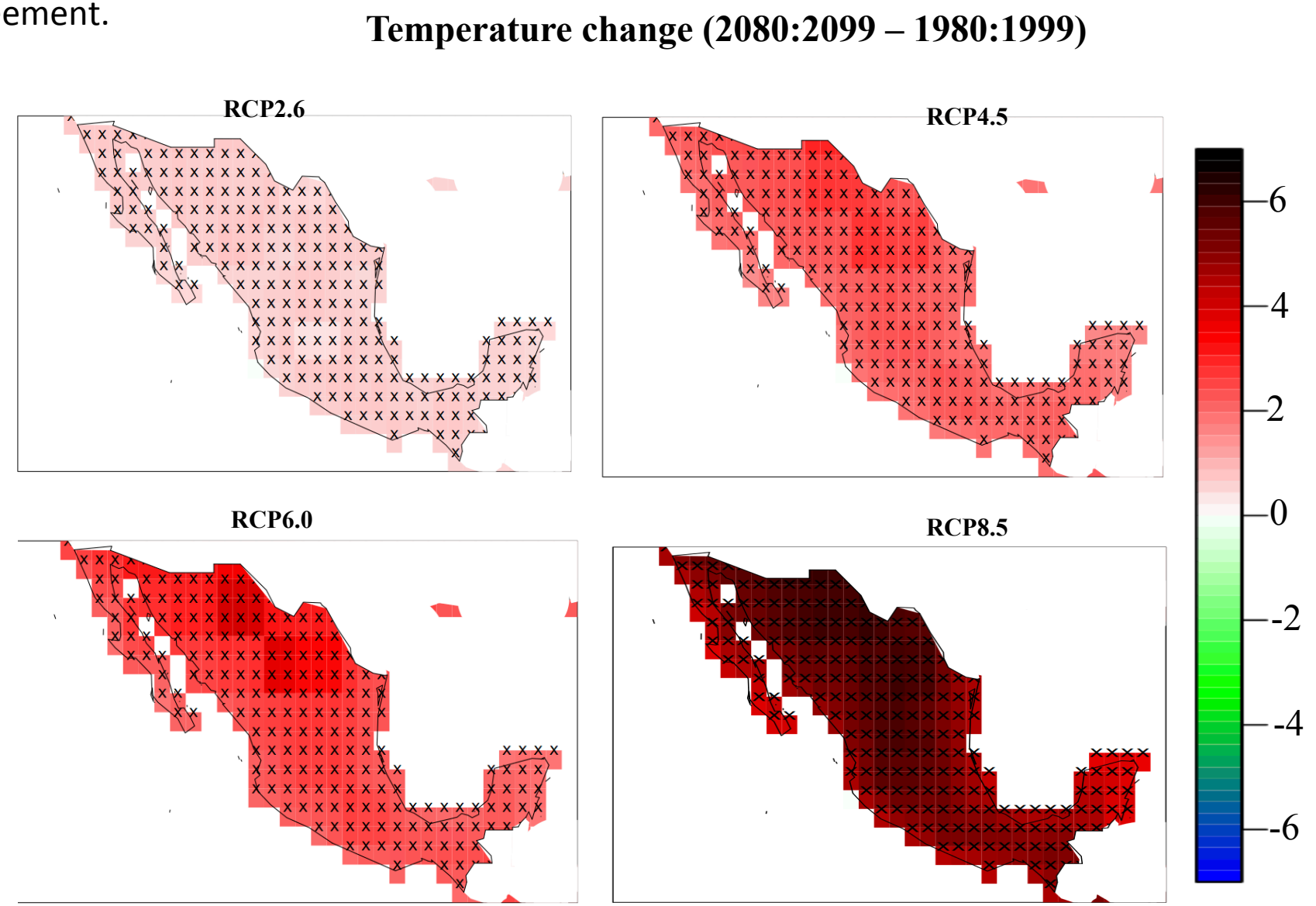


Figure S4: Gridded precipitation trend for 2005-2100 for four RCPs. Stippled for >66% model agree

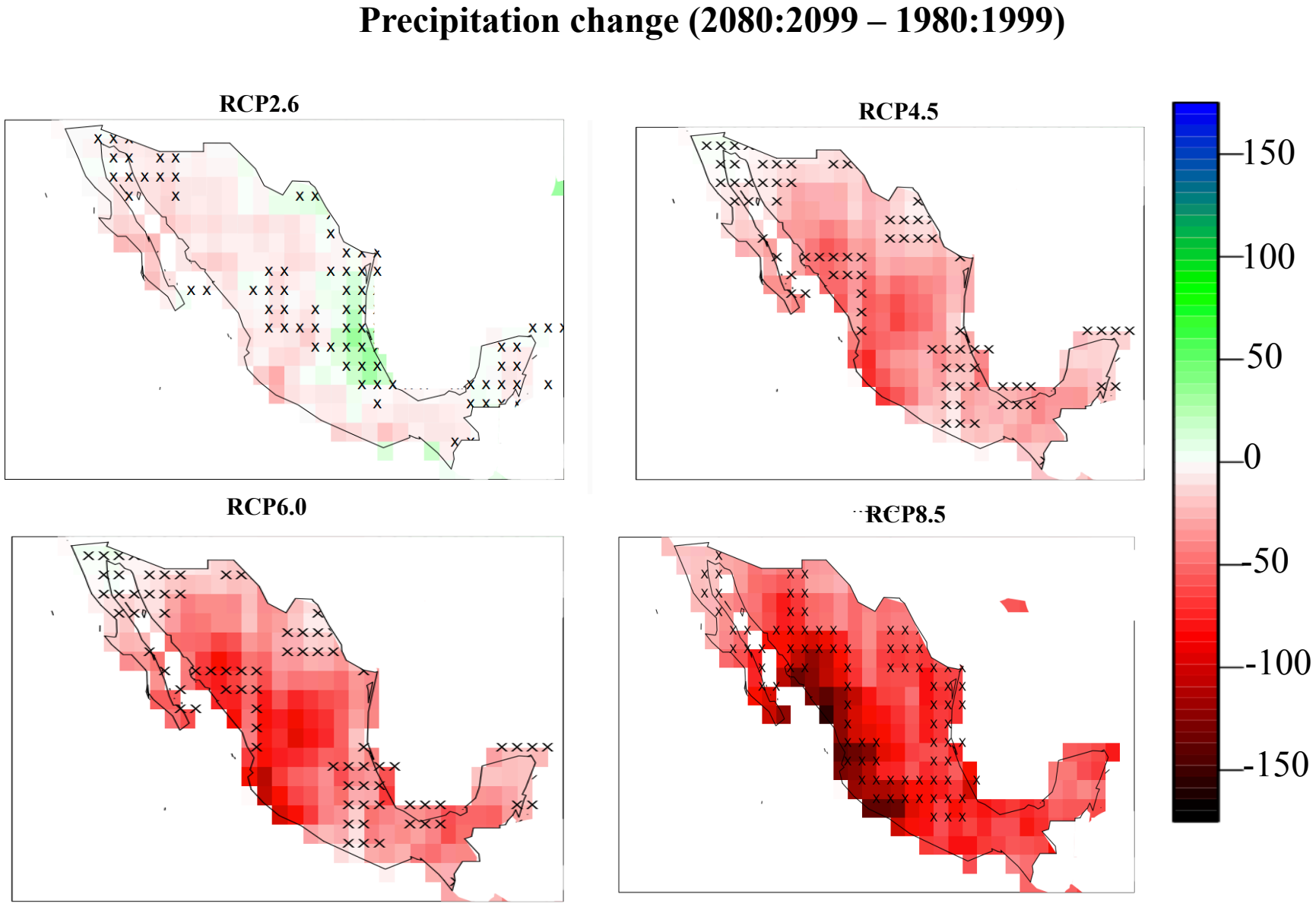
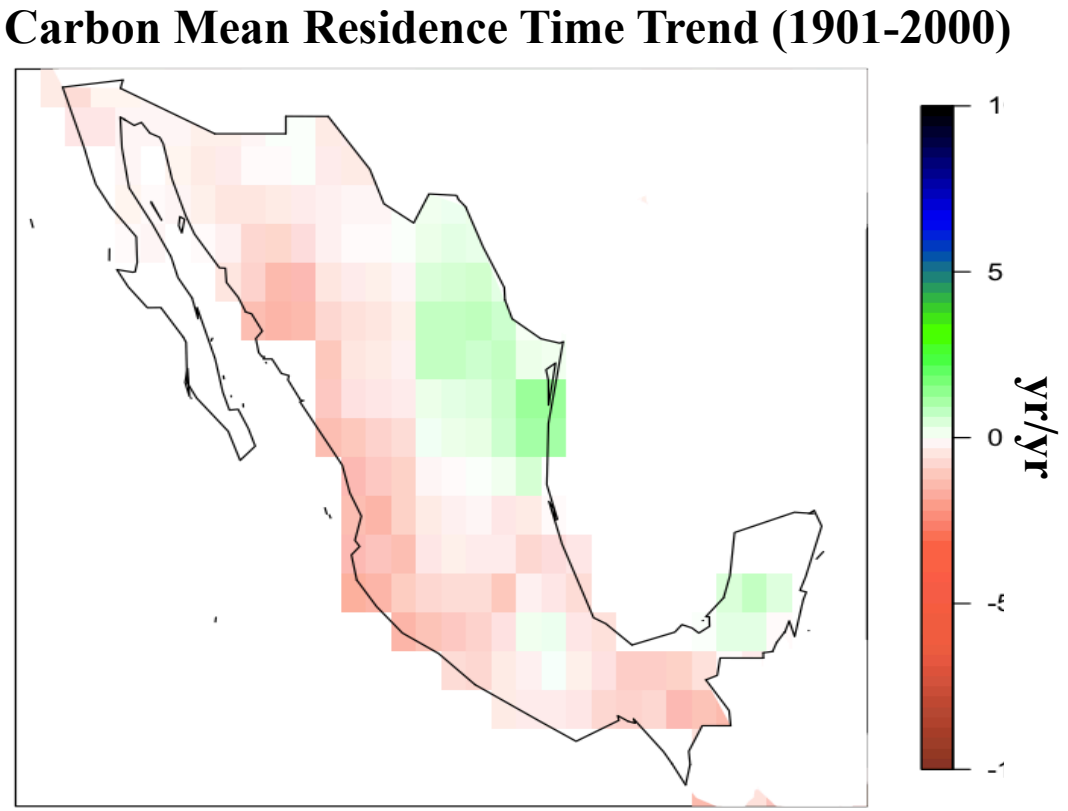


Figure S5: Change in the mean residence time of C over the last 60 years (1950-2010).



Supplementary 5: In the DGVMs soil C depends directly on vegetation input (i.e. litterfall) and accumulates slowly over time in different pools that are decomposed at different times (e.g. labile, intermediate and resistant). The soil microorganism use this C for their metabolism and as a consequence respire it as CO2 (Rh). Hence the actual content of soil C is a fine balance between vegetation inputs and RH. Under stable conditions the two tend to be balance, but climate change alters this two fluxes. By dividing the soil C stock by the Rh, we get a measurement of weather soil C is increasing or decreasing over time (i.e. weather we have a source or a sink of C in the soil).

For the particular case of Mexico, Rh is mostly negative, which means soil C is been lost faster that it is been accumulated. This is particularly important in future scenarios as temperature increases, because it can rapidly alter the country from been a sink of C to been a source. However, considerable uncertainties remain in our understanding of MRT and more direct observations are needed.

Figure S6: Mean Land-Use-Change Emissions (gC m^{-2} yr^{-1})

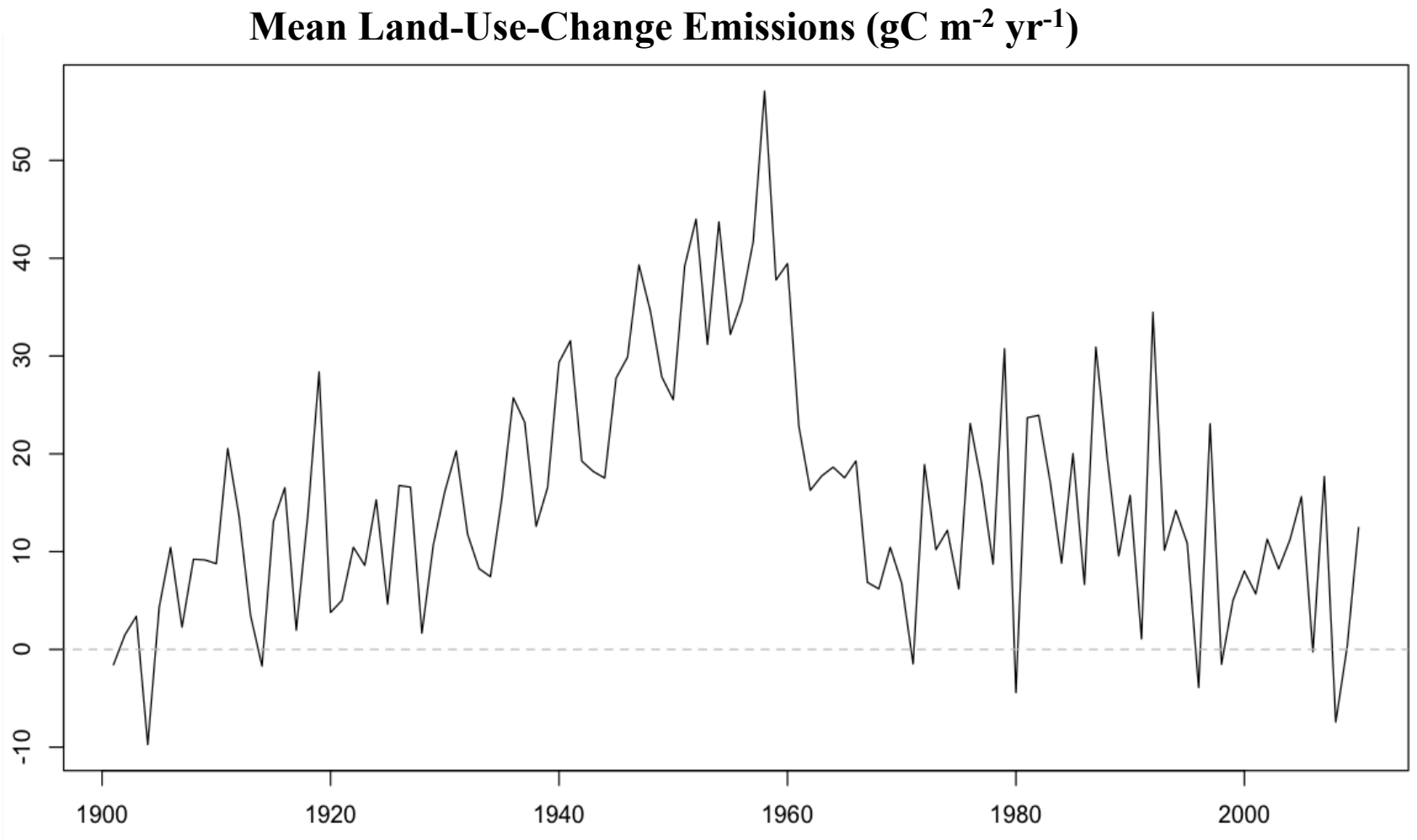
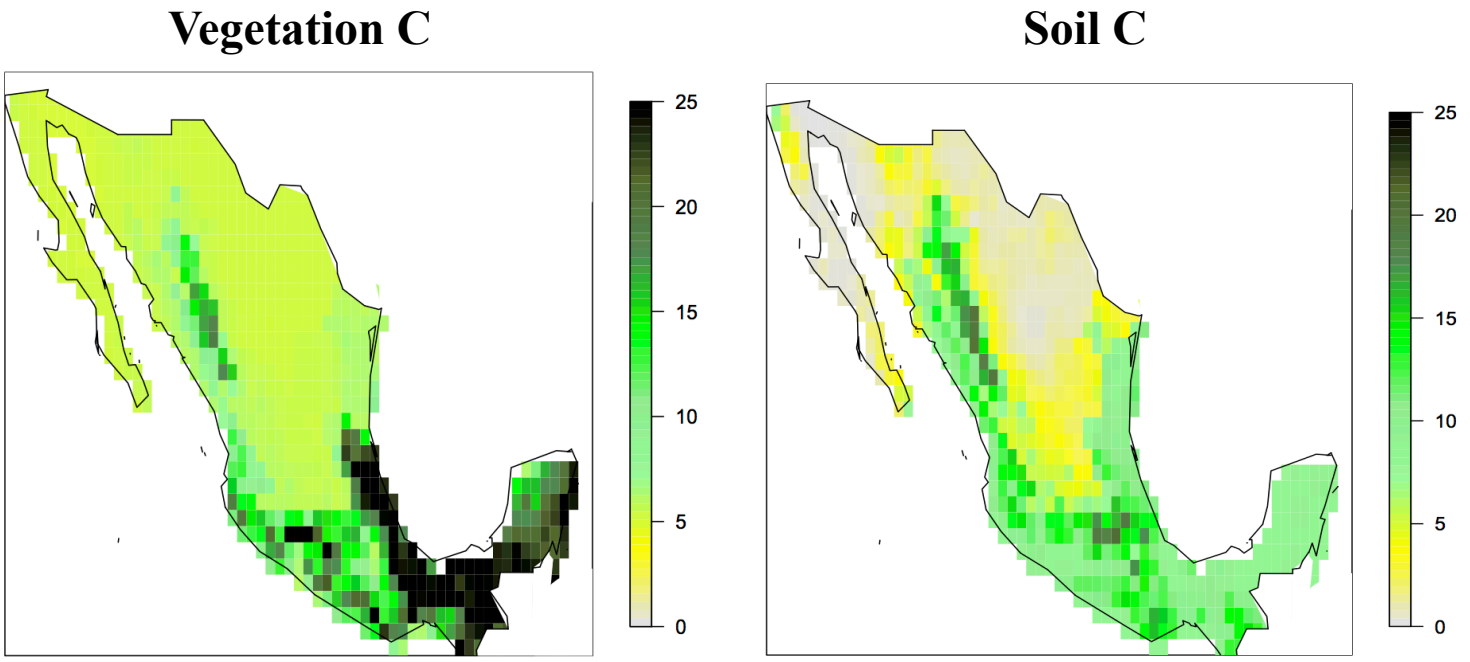


Figure S7: Modeled soil and vegetation C for the period 1990-2009



Supplementary 7: We calculated the Vegetation and Soil C in the DGVMs for an extended period of time (1990-2009) for the analysis on the present. We found that the country estimates for the period 2000-2005 (VegC: 20.3, SoilC 14.1 PgC) were similar than those for the longer time period (VegC: 20.2, SoilC 14.0 PgC).

Table S1. Models used for the analysis.

DGVMs	**ESMs**
CLM4.5	CCSM4
ISAM	GFDL-ESM2G
LPJ	HadGEM2-ES
LPJ-GUESS	IPSL-CM5A-LR
LPX-Bern	IPSL-CM5A-MR
JULES3.2	MIROC-ESM
OCN	MIROC-ESM-CHEM
VEGAS	NorESM1-M
VISIT	NorESM1-ME

Table S2: GPP for each product by NLCT

GPP	DGVM		Satellite		Fluxtower	
Potential Land Cover Type	**Mean ($gC\ m^{-2}\ yr^{-1}$)**	**Sum (TgC)**	**Mean ($gC\ m^{-2}\ yr^{-1}$)**	**Sum (TgC)**	**Mean ($gC\ m^{-2}\ yr^{-1}$)**	**Sum (TgC)**
Broadleaf evergreen forest	2.16	555	2.29	588	2.01	516
Broadleaf deciduous forest	1.11	486	1.25	547	1.20	525
Needleleaf evergreen forest	1.41	129	1.42	130	1.57	144
Grassland/Shrubland	0.62	463	0.58	433	0.49	366
Croplands	1.15	486	1.19	503	1.27	537
National total		2119		2203		2089

Table S3: Vegetation and Soil C for each product by NLCT

Vegetation Carbon	DGVMs		SATELLITE		FIELD	
Land Cover Type	Mean ($gC\ m^{-2}$)	Sum (TgC)	Mean ($gC\ m^{-2}$)	Sum (TgC)	Mean ($gC\ m^{-2}$)	Sum (TgC)
Broadleaf evergreen forest	23.8	6116	22.8	5859	22.1	5679
Broadleaf deciduous forest	12.5	5475	11.9	5212	12.8	5606
Needleleaf evergreen forest	15.2	1398	14.2	1306	15.8	1453
Grassland/Shrubland	6.6	4930	6.3	4706	5.1	3809
Cropland	7.4	3130	7.2	3045	7.8	3299
TOTALS		21050		20129		19864

Soil Carbon	DGVMs		FAO		Field	
Land Cover Type	Mean ($gC\ m^{-2}$)	Sum (TgC)	Mean ($gC\ m^{-2}$)	Sum (TgC)	Mean ($gC\ m^{-2}$)	Sum (TgC)
Broadleaf evergreen forest	11.8	3032	12.5	3212	11.9	3058
Broadleaf deciduous forest	8.9	3898	8.3	3625	9.4	4117
Needleleaf evergreen forest	10.5	966	11.2	1030	11.0	2012
Grassland/Shrubland	4.2	3137	4.5	3361	5.5	4108
	5.8	2454	6.2	2622	6.7	2834
TOTALS		13487		13862		15130

Table S4: Links to freely available datasets used in this paper

- Climate: http://www.cru.uea.ac.uk/high-resolution-gridded-datasets
- Land Cover: https://nelson.wisc.edu/sage/data-and-models/global-potential-vegetation/index.php
- Land Use Change: http://themasites.pbl.nl/tridion/en/themasites/hyde/
- DGVMS (Data used is version 2, not freely available, but version 1 is): http://www-lscedods.cea.fr/invsat/RECCAP/V2/
- MTE (Fluxtowers): https://climatedataguide.ucar.edu/climate-data/fluxnet-mte-multi-tree-ensemble
- ESMs (CMIP5): http://cmip-pcmdi.llnl.gov/cmip5/data_portal.html
- Biomass (National Forest Inventory): http://www.alianza-mredd.org/componentes/monitoreo-reporte-y-verificacion/productos/mapa-de-la-densidad-de-carbono-en-biomasa-lenosa-aerea-de-los-bosques-y-selvas-en-mexico-2#.VldkgGAlJst
- Soil C from FAO: http://www.fao.org/soils-portal/soil-survey/soil-maps-and-databases/harmonized-world-soil-database-v12/en/

- The rest of the data is available under request by contacting Guillermo Murray-Tortarolo (gnm202@exeter.ac.uk or gmurrayt@gmail.com)