Table 2: Observations and LPJ-GUESS results of soil C changes during agriculture (cropland and/or pasture) and vegetation and soil C recovery after abandonment.

Observation type	Biome	Observation value	Closest simulations in terms of LU history	Average model value for the specific biome	Reference
soil C changes during agriculture					
soil C change averaged over different depths	global	42 % loss for forest-cropland conversions, 8 % gain for forest-pasture conversions	P20, P60, P100, C20, C60, C100	7-17 % loss in forest biomes for croplands, 2 % gain to 7 % loss for pastures	Guo and Gifford (2002)
soil C change at 36 cm	tropical forest	25 % loss for cropland, 12 % loss for pasture/ grassland	C20, C60, P20, P60	11-12 % loss for croplands, 2 % gain to 4 % loss for pastures	Don et al. (2011)
soil C change at 29 cm	temperate forest	new equilibrium after 23 years	C100	C loss throughout the entire cropland duration	Poeplau et al. (2011)
vegetation recovery after agricultural abandonment					
ag vegetation recovery time	tropical forest	189 years	C20	121 years	Saldarriaga et al. (1988)
ag vegetation recovery rate	tropical forest	slowdown with time, recovery slower for pasture than for cropland	P20, P60, P100, C20, C60, C100	(slight) slowdown, pasture recovery slower only for long durations (P100/C100)	Silver et al. (2000)
total and vegetation C recovery rate	temperate forest	linear with time	P60, P100	(slight) slowdown	Hooker and Compton (2003)
vegetation recovery rate	temperate forest	linear with time	C20, C60	(slight) slowdown	Poulton et al. (2003)
ag vegetation recovery rate	tropical forest	recovery speed inversely related to LU duration	P20, P60, P100	recovery speed inversely related to LU duration	Uhl et al. (1988)
ag vegetation recovery rate and time	tropical forest	73 years, recovery speed inversely related to LU duration	C20, C60, C100	121-139 years, recovery speed inversely related to LU duration	Hughes et al. (1999)
maximum tree height recovery rate	tropical forest	recovery speed inversely related to LU duration	C20, C60, C100	recovery speed inversely related to LU duration	Randriamalala et al. (2012)
vegetation height recovery rate	tropical forest	slower for pasture than for cropland	P20, P60, P100, C20, C60, C100	slower only for long durations (C100/P100)	Moran et al. (2000)
ag vegetation	tropical	slower for pasture than	P20, C20	faster for P20 than for	Wandelli and

recovery rate	forest	for cropland		C20	Fearnside (2015)
soil C recovery after agricultural abandonment					
soil C recovery at up to 30 cm	global	large variation across studies, tendency to lose C in the first years for pastures, immediate accumulation for croplands	P20, P60, P100, C20, C60, C100	tendency to lose C in the first years for pastures, immediate accumulation for croplands	Paul et al. (2002)
soil C recovery at 34 cm	global	more accumulation for croplands than for pastures, no accumulation in boreal zone	P20, P60, P100, C20, C60, C100	more accumulation for croplands than for pastures, slower accumulation in boreal zone	Laganiere et al. (2010)
soil C recovery at 28/40 cm	temperate forest	linear accumulation, no equilibrium after 120 years	C20	linear accumulation, no equilibrium after 120 years	Poeplau et al. (2011)
soil C recovery time at 0-60 cm	grassland	158 years	C100	198 years	Potter et al. (1999)
soil C recovery time at 0-60 cm	savanna/ temperate forest	230 years	C20	85 (savanna) / 237 (temperate forest) years	Knops and Tilman (2000)
soil C recovery time 0-10 cm	temperate forest	>100 years	C20, C60, C100	237-261 years	Foote and Grogan (2010)
soil C recovery time 0-25 cm	tropical forest	50-60 years	P20, P60, P100, C20, C60, C100	49-80 years	Silver et al. (2000)

Table A1: Plant Functional Types used in this study.

BNE	Boreal needleleaved evergreen tree
BINE	Boreal shade-intolerant needleleaved evergreen tree
BNS	Boreal needleleaved summergreen tree
TeBS	Shade-tolerant temperate broadleaved summergreen tree
IBS	Shade-intolerant broadleaved summergreen tree
TeBE	Temperate broadleaved evergreen tree
TrBE	Tropical broadleaved evergreen tree
TrIBE	Tropical shade-intolerant broadleaved evergreen tree
TrBR	Tropical broadleaved raingreen tree
C3G	Cool C3 grass
C4G	Warm C4 grass