SUPPLEMENTARY MATERIAL:

DeLonge MS, Ryals R, and Silver WL. 2013**. A Lifecycle Model to Evaluate Carbon Sequestration Potential and Greenhouse Gas Dynamics of Managed Grasslands. Ecosystems.** DOI: 10.1007/s10021-013-9660-5

APPENDIX A: Variables used to calculate the net greenhouse gas flux from producing and applying soil amendments such as compost (C), manure (M) and inorganic fertilizer (INF) to grazed grasslands. The initial case study was developed for grazed annual grasslands in California (Ryals and Silver 2013); note that we assumed that the effects on net primary productivity (NPP) were dictated by the nitrogen (N) addition rates from Ryals and Silver (2013). The uncertainty analysis descriptors were used for the Monte Carlo analysis (n=10,000 simulations); variables with normal distributions were given a mean (μ) equal to the case study (CS) value.

	Case study (CS)			**Uncertainty analysis descriptors**			
Variable	**C**	**M**	**INF**	**Dist.**	**μ, min**	**σ, max**	**References**
N addition rate [kg N ha^{-1}]	250	250	250	Logn	5.4	0.45	Bouwman et al. 2002
N concentration [%]	1.8	2.4	46	Unif	-50%	+50%	(INF) Davis and Haglund 1999; (C,M) This study
C:N [-]	11.1	12	0.4	Unif	C:10 M:10	C:30 M:15	(C) Ryals and Silver 2013
Bulk density (wet) [kg m^{-3}]	480	521	480	Norm	CS	20%	Rynk 1992
Moisture content [%]	60	50	12	Norm	CS	20%	This study
Compost [% manure by mass]	75			Unif	0	100	This study
Distance from farm [km]	5	5	20	Exp	CS	n/a	This study
Manure mngt emission factor [-]	0.35	0.35		Logn	-1.00	0.25	EPA 2012b
Landfill waste CH_4-C loss [% init C]	11			Logn	2.25	0.5	EPA 2006
Landfill CH_4 capture [%]	50			Norm	CS	12	EPA 2006
Compost CH_4 emissions [kg m^{-2}]	0.05			Logn	-0.2	0.8	This study
Compost N_2O emissions [kg m^{-2}]	0.01			Logn	-4.0	0.75	This study
Mass loss during composting [%]	40			Norm	CS	20%	Larney et al. 2000
Unamended AGNPP [g C m^{-2} y^{-1}]	177	177	177	Norm	CS	20%	(C) Ryals and Silver 2013
Unamended BGNPP [g C m^{-2} y^{-1}]	56	56	56	Norm	CS	20%	(C) Ryals and Silver 2013
Increase in AGNPP [%]	55	55	55	Norm	CS	11	(C) Ryals and Silver 2013
Increase in BGNPP [%]	23	23	23	Norm	CS	4	(C) Ryals and Silver 2013
Sink efficiency [kg C kg^{-1} BG C]	0.2	0.2	0.2	Logn	-1.70	0.35	Plenet et al. 1993
NPP effect duration [y]	3	3	3	Exp	4	n/a	(C) Ryals and Silver 2013
Soil N_2O increase [kg N_2O-N kg^{-1} added-N]	0.003	0.01	0.01	Logn	C:-6.1 M:-4.7 I:-4.7	C: 0.5 M,I: 0.6	(C) Ryals and Silver 2013; (M, I) De Klein et al. 2006
Leachate N [kg leach-N kg^{-1} added-N]	0	0.075	0.3	Norm	CS	20%	Mosier et al. 1998 Kramer et al. 2006

Leach. N_2O [kg N_2O-N kg^{-1} leach-N]	0.0075	0.0075	0.0075	Norm	CS	20%	Mosier et al. 1998
Volatized N [kg vol-N kg^{-1} added-N]	0.05	0.2	0.1	Norm	CS	20%	De Klein et al. 2006
Vol. N_2O [kg N_2O-N kg^{-1} vol-N]	0.01	0.01	0.01	Norm	CS	20%	De Klein et al. 2006
CH_4 consum., unfertilized [kg ha^{-1} y^{-1}]	5.11	5.11	5.11	Norm	CS	20%	(C) Ryals and Silver 2013
Reduction in soil CH_4 consumpt. [%]	0	25	25	Norm	CS	20%	(C) Ryals and Silver 2013
Fuel efficiency of truck [mpg]	5.9	5.9	5.9	Norm	CS	10%	EPA 2008
Farm equipment fuel efficiency [gph]	0.048	0.048	0.048	Norm	CS	20%	Downs and Hansen 1998
Fuel production CO_2 [g km^{-1}]	208	208	208	Norm	CS	20%	Beer et al. 2002
Fuel production CH_4 [g km^{-1}]	0.635	0.635	0.635	Norm	CS	20%	Beer et al. 2002
Fuel production N_2O [g km^{-1}]	0.012	0.012	0.012	Norm	CS	20%	Beer et al. 2002
Fuel combustion CO_2 [kg $gallon^{-1}$]	10.15	10.15	10.15	Norm	CS	20%	EPA 2008
Fuel combustion CH_4 [g km^{-1}]	0.0032	0.0032	0.0032	Norm	CS	20%	EPA 2008
Fuel combustion N_2O [g km^{-1}]	0.0030	0.0030	0.0030	Norm	CS	20%	EPA 2008
Herbicide prod. [kg CO_2e kg^{-1}]	17.24	17.24	17.24	Norm	CS	20%	West and Marland 2002
Insecticide prod. [kg CO_2e kg^{-1}]	18.08	18.08	18.08	Norm	CS	20%	West and Marland 2002
Farming operations [kg C ha^{-1}]	31.8	31.8	31.8	Norm	CS	20%	Adler et al. 2007
Land treated [ha]	20	20	20	Exp	20	n/a	This study
Stocking rate [cows ha^{-1}]	0.5	0.5	0.5	Logn	0.5	0.2	This study
Forage consumption [%]	90	90	90	Exp	10	n/a	This study
Corn silage prod. (dry) [kg $acre^{-1}$]	5603	5603	5603	n/a			USDA NASS 2011
Corn silage fert. [kg N $acre^{-1}$]	59.9	59.9	59.9	n/a			USDA NASS 2011
Corn silage pest. [kg $acre^{-1}$]	0.95	0.95	0.95	n/a			USDA NASS 2011
Corn silage insect. [kg $acre^{-1}$]	0.09	0.09	0.09	n/a			USDA NASS 2011
Hay silage prod. (dry) [kg $acre^{-1}$]	2179	2179	2179	n/a			USDA NASS 2011
Hay silage fert. [kg N $acre^{-1}$]	35.8	35.8	35.8	n/a			USDA NASS 2011
Hay silage pest. [kg $acre^{-1}$]	0.14	0.14	0.14	n/a			USDA NASS 2011
Hay silage insect. [kg $acre^{-1}$]	0.09	0.09	0.09	n/a			USDA NASS 2011
CH_4 from waste [m^3 kg^{-1} waste]	0.24			n/a			EPA 2012b
Truck volume [yd]	40	40	40	n/a			This study
Truck weight capacity [Mg]	36	36	36	n/a			CDOT

APPENDIX B. Change in predicted net greenhouse gas flux (ΔGHG_{net}) associated with the application of soil amendments (compost (C), manure (M), and inorganic N fertilizer (INF)) to grasslands following changes to the initial case study model values ranging from -90 to 500 %.

		ΔGHG_{net} [Mg CO_2e ha^{-1}]							
Change to case study value [%]		**-90**	**-50**	**-20**	**20**	**50**	**90**	**200**	**500**
Management variables									
N addition rate	C	24	13	5	-5	-13	-24	-53	-132
	M	-17	-9	-4	4	9	17	37	93
	INF	-4	-2	-1	1	2	4	9	21
Production emissions	C	-2	-1	0	0	1	2	4	9
	M	-15	-11	-5	7	19	39	120	526
	INF	-1	0	0	0	0	1	1	3
Manure management emission factor (EF)	C	22	12	5	-5	-12	-22	-49	-
	M	-2	-1	0	0	1	2	4	-
Landfill CH_4 loss	C	3	1	1	0	-1	-2	-4	-9
Landfill CH_4 capture	C	-5	-3	-1	1	3	5	10	26
Compost (% manure)	C	15	8	3	-3	-	-	-	-
Compost hauling distance	C	0	0	0	0	0	0	0	0
Ecosystem variables									
Soil trace gas (TG) effect: efflux	M	-2	-1	0	0	1	2	4	9
	INF	-1	-1	0	0	1	1	3	7
NPP effect: mass	C	-2	-1	-1	1	1	2	5	13
	M	-2	-1	-1	1	1	2	5	13
	INF	-2	-1	-1	1	1	2	5	13
Soil trace gas effect: years	M	-2	-1	0	0	1	2	4	9
	INF	-1	-1	0	0	1	1	3	7
NPP effect: years	C	1	0	0	0	0	-1	-1	-4
	M	1	0	0	0	0	-1	-1	-4
	INF	1	0	0	0	0	-1	-1	-4
C sink efficiency	C	0	0	0	0	0	0	-1	-1
	M	0	0	0	0	0	0	-1	-1
	INF	0	0	0	0	0	0	-1	-1