



Supplement of

Regional assessment and uncertainty analysis of carbon and nitrogen balances at cropland scale using the ecosystem model LandscapeDNDC

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1 S1. Supplementary Material

2 S1.1 Material and Methods

3 **Sensitivity Index**

4 In the first step, the Sensitivity Index algorithm (SI) (Pannell, 1997) was calculated for all
5 process parameters by splitting the parameter ranges into 10 equidistant values from minimum
6 to maximum and by rating SI values:

7
$$SI = \frac{CUM_{max} - CUM_{min}}{CUM_{max}}$$

8 where CUM_{max} and CUM_{min} are the maximum and minimum cumulative results of 10
9 simulations. High SI values explain a high sensitivity of the underlying parameter with respect
10 to the model results, whereas low values or even zero indicate low or no sensitivity.

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12 S1.2 Results

13 *Table S 1. Observed yield rates in the region of Thessaly. Cotton yields are the cotton bolls, clover feed is the total*
14 *harvested above ground biomass, for wheat and barley it is the grain yield, maize is accounted grain ear and the*
15 *stems Source ELSTAT.*

Crop Yields [tons dry matter ha ⁻¹]						
Crops	2012	2013	2014	2015	2016	Mean
Cotton	2.7	3.6	3.5	3.4	3.3	3.3
Clover	8.6	8.9	8.7	7.9	7.7	8.4
Wheat	3.3	3.3	3.3	3.7	3.6	3.4
Barley	3.2	3.2	3.2	3.5	3.5	3.3
Maize	10.9	12.1	12.3	12.7	12.1	12.0

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17 *Table S 2. Crop rotation scenarios (R1 – R5) for the region of Thessaly where the crop abbreviations corn, wiwh,*
18 *perg, cott, and wbar refer to maize, winter wheat, clover (legume feed crops s.a. alfalfa or vetch), cotton and winter*
19 *barley respectively.*

years	R1	R2	R3	R4	R5
2010	corn	wiwh	perg	cott	wbar
2011	wiwh	perg	cott	wbar	corn
2012	perg	cott	wbar	corn	wiwh
2013	cott	wbar	corn	wiwh	perg

2014	wbar	corn	wiwh	perg	cott
2015	corn	wiwh	perg	cott	wbar
2016	wiwh	perg	cott	wbar	corn

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21 *Table S 3. Carbon Balance (totals) Summary of the Assessment and Uncertainty Analysis of the of cropland*
 22 *cultivation of the region of Thessaly, Greece, GPP gross primary productivity, TER terrestrial ecosystem respiration,*
 23 *Biomass export includes all C in yield, straw and feed exported from the fields, 360000 ha cropland.*

	Mean	Std	Median	Q25	Q75
	[mio. tons C yr ⁻¹]	[mio. tons C yr ⁻¹]	[mio. tons C yr ⁻¹]	[mio. tons C yr ⁻¹]	[mio. tons C yr ⁻¹]
C-Inputs	4.51	0.20	4.45	4.36	4.69
C-Outputs	4.32	0.17	4.31	4.19	4.45
SOC-changes	0.19	0.11	0.20	0.14	0.27
Input fluxes					
GPP	4.25	0.20	4.21	4.11	4.42
C in manure	0.25	0.01	0.26	0.25	0.26
Output fluxes					
TER	3.08	0.16	3.06	2.97	3.20
Biomass export	1.24	0.05	1.24	1.21	1.27

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25 *Table S 4 Nitrogen balance (totals) Summary of the Assessment and Uncertainty Analysis of the total Nitrogen*
 26 *Balance of cropland cultivation of the region of Thessaly, Greece.*

	Mean	Std	Median	Q25	Q75
	[kt-N yr ⁻¹]	[kt-N yr ⁻¹]	[kt-N yr ⁻¹]	[kt-N yr ⁻¹]	[kt-N yr ⁻¹]
N-Inputs	76.5	3.2	77.8	73.3	79.1
N-Outputs	71.7	3.2	71.2	69.4	73.7
N-stock-changes	4.8	0.0	6.6	3.9	5.4
Input fluxes					
N deposition	2.0	0.3	2.1	1.9	2.1
Bio. N fixation	16.7	1.6	16.7	15.9	17.5
N in min. fertilizer	28.9	1.7	29.3	27.6	29.8
N in organic fertilizer	28.9	1.3	29.2	27.9	29.8

Output fluxes					
Gaseous emissions ¹⁾	21.2	3.1	21.1	18.9	23.4
N ₂ O	0.9	0.3	0.9	0.7	1.1
NO	1.1	0.5	1.0	0.7	1.4
N ₂	4.9	2.4	4.5	2.9	6.6
NH ₃	14.3	2.6	13.5	12.5	15.6
Aquatic fluxes ²⁾					
NO ₃ leaching	3.9	1.3	3.8	3.0	4.7

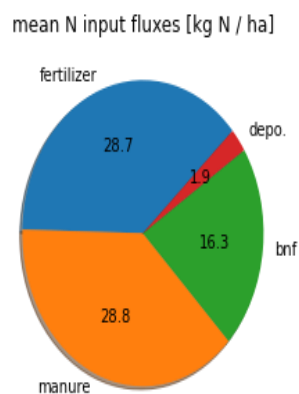
27 1) Gaseous emissions are the sum of N₂O, NO, N₂ and NH₃ fluxes; 2) Aquatic flux is nitrate leaching (NO₃)

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29 Table S 5. Total crop yields per cultivar and year.

Crop Yields [tons dry matter]						
Crops	2012	2013	2014	2015	2016	Mean
Cotton	303 676.9	374 424.6	359 806.7	322 292.0	285 780.3	329 196.1
Clover	302 753.2	319 401.7	338 134.6	341 938.4	360 693.9	332 584.4
Wheat	477 700.7	461 875.5	395 902.1	430 014.4	450 254.3	443 149.4
Barley	84 520.8	99 091.8	139 402.9	139 990.8	102 454.7	113 092.2
Maize	332 531.6	431 324.6	377 783.9	351 285.4	334 277.7	365 440.6

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32 Figure S 1. Shares of components of the annual nitrogen in- and output fluxes.

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36 *Table S 6. Simulated crop yields per cultivar and year for the irrigated land.*

Crop Yields [tons dry matter ha ⁻¹]			
Crops	Median	Mean	STD
Cotton	4.0	3.7	0.9
Clover	9.8	9.6	0.6
Wheat	3.9	3.6	0.9
Barley	5.3	5.0	1.2
Maize	10.9	10.6	1.3

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38 *Table S 7. Simulated crop yields per cultivar and year for the rain feed land.*

Crop Yields [tons dry matter ha ⁻¹]			
Crops	Median	Mean	STD
Cotton	3.0	2.9	0.7
Clover	9.8	9.6	0.6
Wheat	3.9	3.6	0.9
Barley	4.0	3.9	0.9
Maize	9.5	9.2	1.5

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