

Supplementary material S2:

EU scale maps for SOC and erosion used for model evaluation

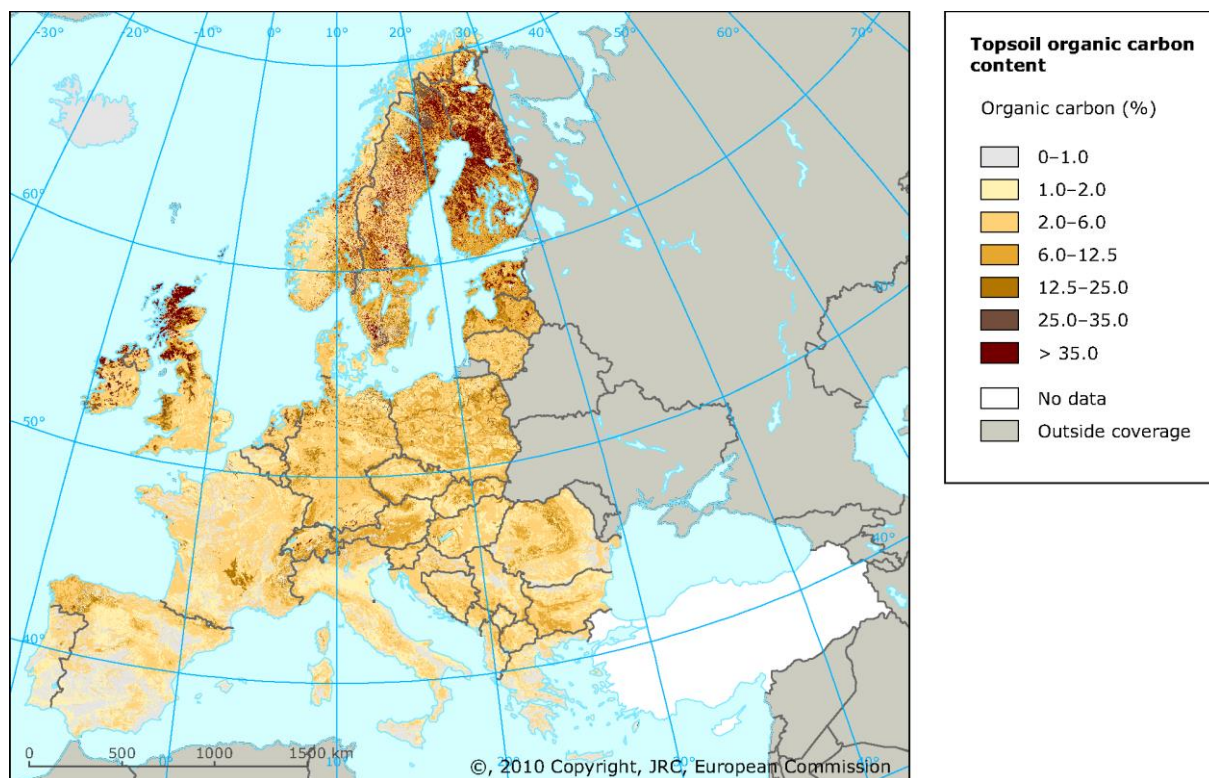


Figure S12: Topsoil organic carbon content (%) - Source: EEA, 2010: <https://www.eea.europa.eu/data-and-maps/figures/variatiions-in-topsoil-organic-carbon>

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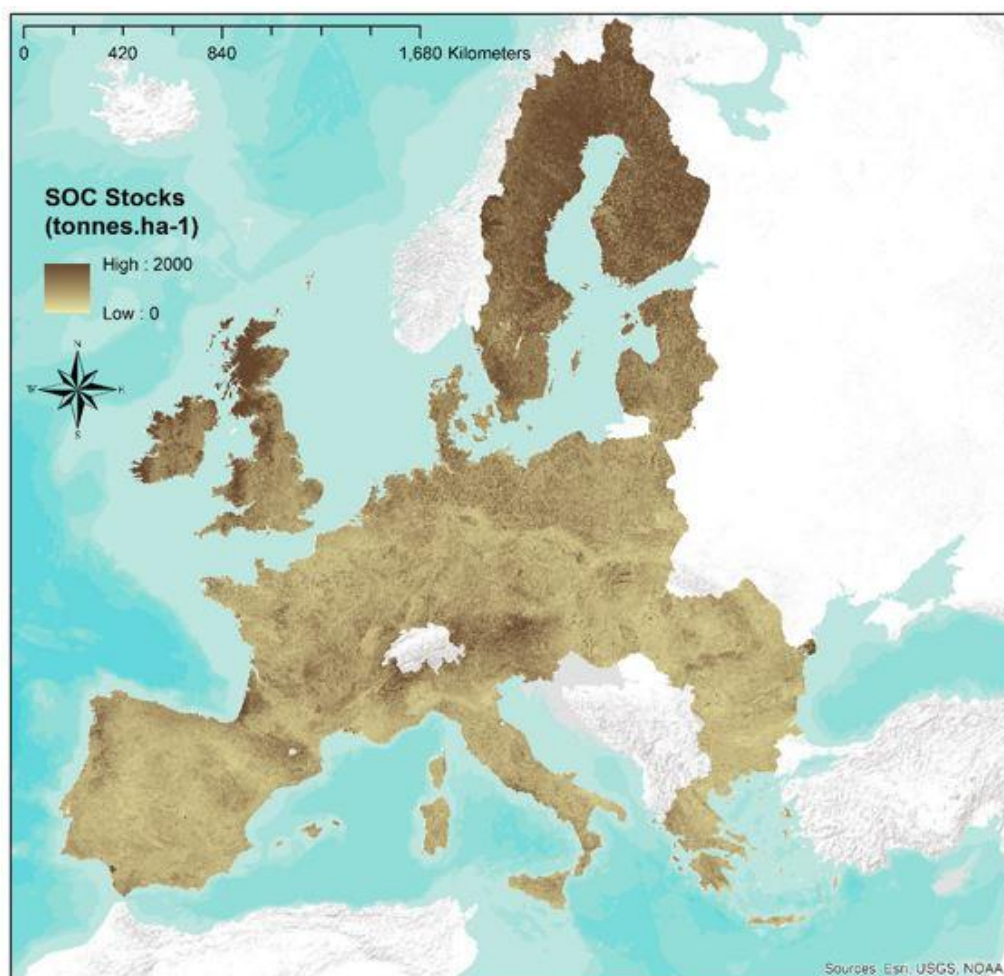


Figure S13: SOC Stocks (ton/ha) - Source: Yigini and Panagos (2016).

Reference:

Yigini, Y.; Panagos, P. Assessment of soil organic carbon stocks under future climate and land cover changes in Europe. *Sci. Total Environ.* **2016**, 557–558, 838–850.
<https://doi.org/10.1016/j.scitotenv.2016.03.085>

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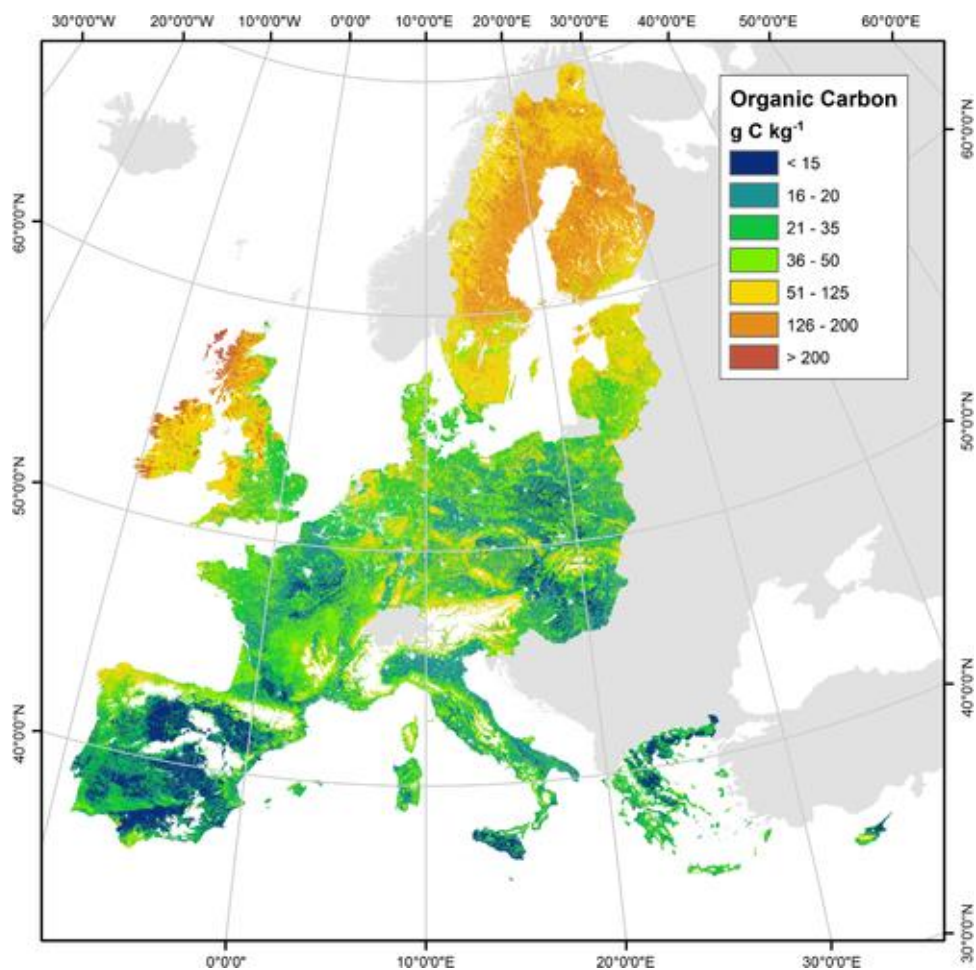


Figure S14: Organic Carbon (g/kg) - Source: De Brogniez et al., 2015

Reference:

de Brogniez, D.; Ballabio, C.; Stevens, A.; Jones, R.J.A.; Montanarella, L.; van Wesemael, B. A map of the topsoil organic carbon content of Europe generated by a generalized additive model. *Eur. J. Soil Sci.* **2015**, 66, 121–134. <https://doi.org/10.1111/ejss.12193>

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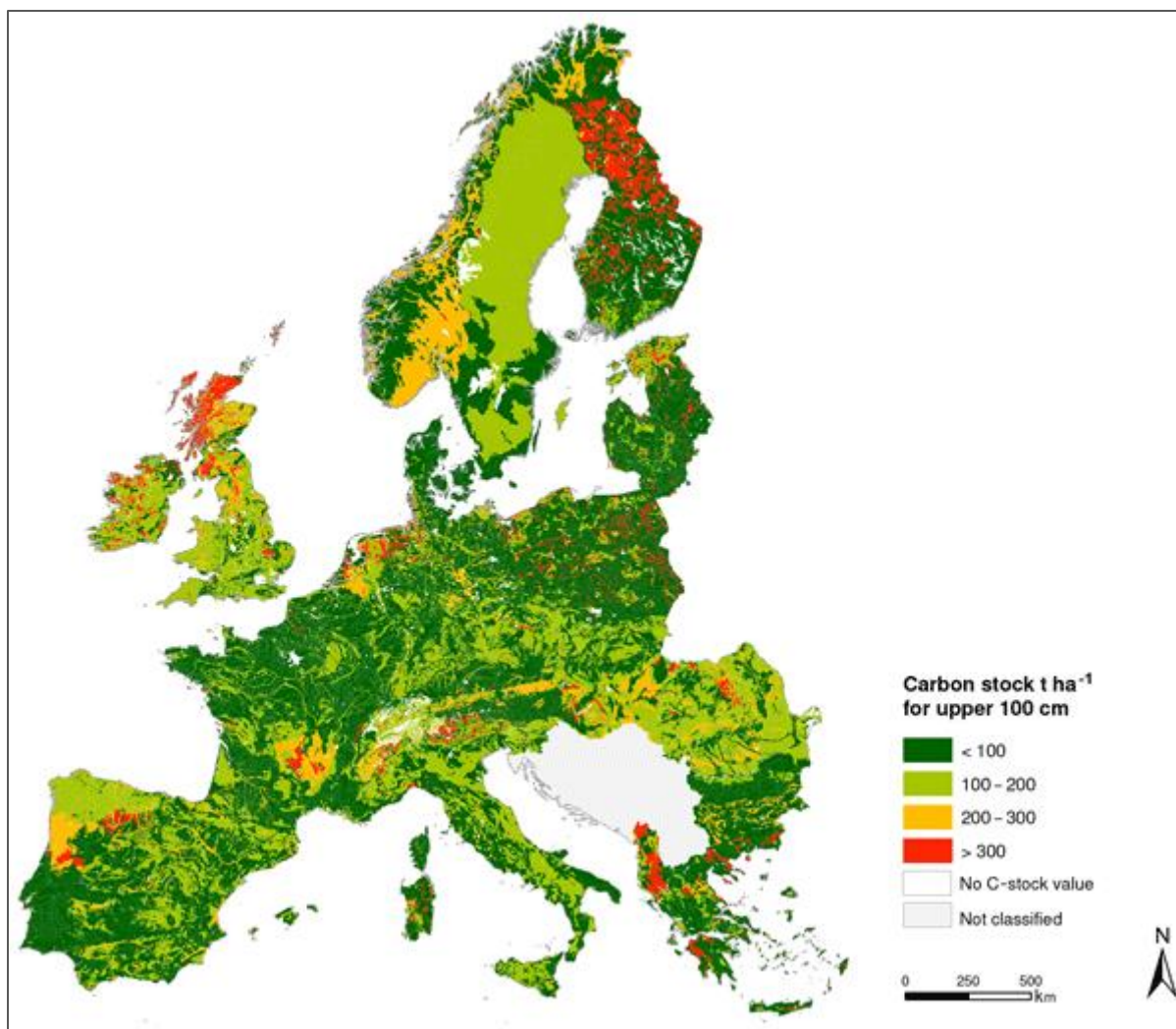


Figure S15: Carbon stock (t/ha) estimate based on the soil profile database for Europe (SPADE) – Source: Aagaard Kristensen et al., 2019.

Reference:

Aagaard Kristensen, J.; Balstrøm, T.; Jones, R.J.A.; Jones, A.; Montanarella, L.; Panagos, P.; Breuning-Madsen, H. Development of a harmonised soil profile analytical database for Europe: a resource for supporting regional soil management. *SOIL* **2019**, 5, 289–301. 10.5194/soil-5-289-2019.

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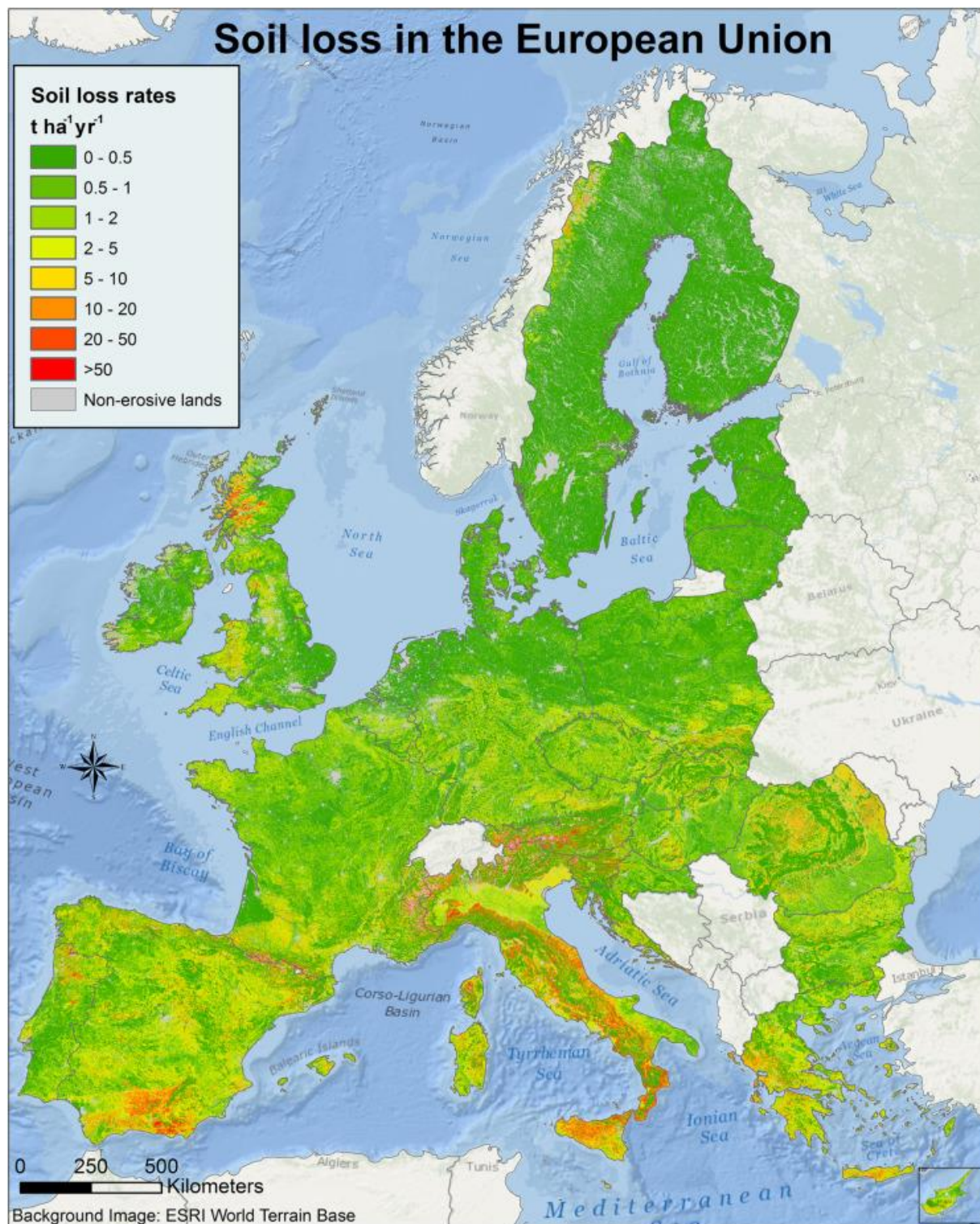


Figure S16: Soil loss across the EU as simulated with the RUSLE equation. - Source: Panagos et al. (2015)

Reference:

Panagos, P.; Borrelli, P.; Poesen, J.; Ballabio, C.; Lugato, E.; Meusburger, K.; Montanarella, L.; Alewell, C. The new assessment of soil loss by water erosion in Europe. *Environ. Sci. Policy* **2015**, *54*, 438–447. <https://doi.org/10.1016/j.envsci.2015.08.012>.

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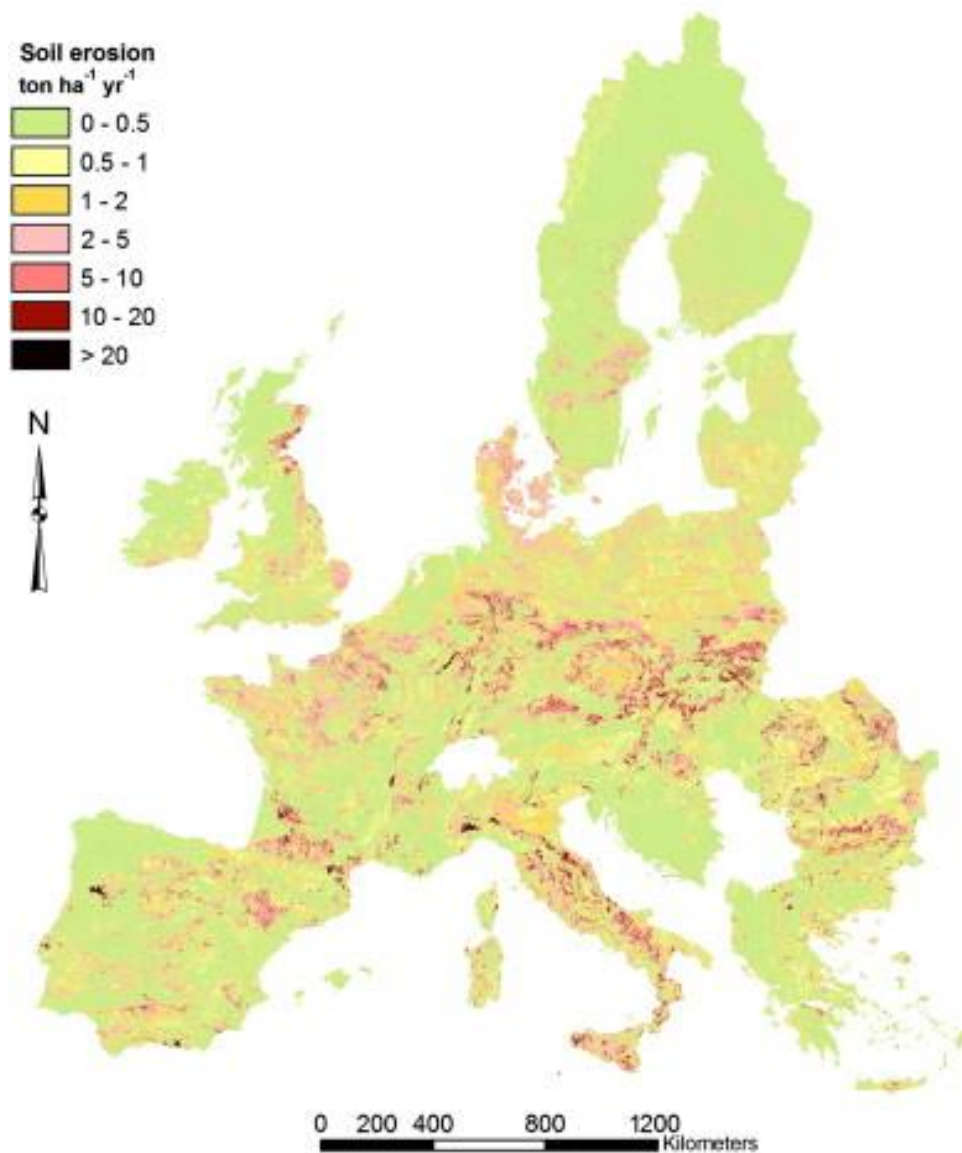


Figure S17: Estimated sheet and rill erosion rates (t/ha/y) calculated for the areas of Europe covered by the CORINE database. Source: Cerdan et al., 2010

Reference:

Cerdan, O.; Govers, G.; Le Bissonnais, Y.; Van Oost, K.; Poesen, J.; Saby, N.; Gobin, A.; Vacca, A.; Quinton, J.; Auerswald, K.; et al. Rates and spatial variations of soil erosion in Europe: A study based on erosion plot data. *Geomorphology* **2010**, *122*, 167–177.
<https://doi.org/10.1016/j.geomorph.2010.06.011>.

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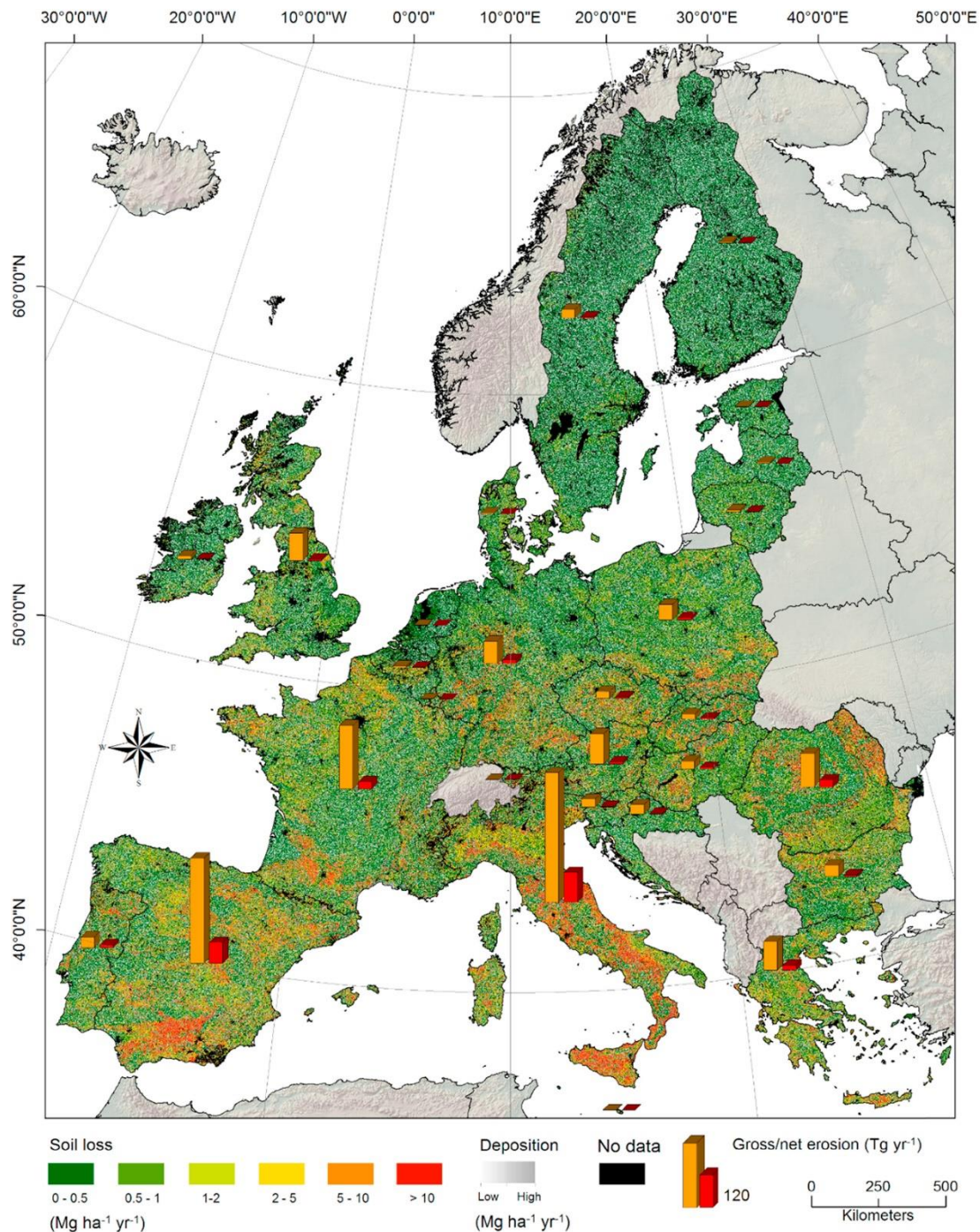


Figure S18: Estimated average annual soil loss and deposition rate for the European Union based on WaTEM/SEDEM. The vertical bars show the annual gross (orange) and net (red) soil losses in each country. Source: Borelli et al., 2018

Reference: Borrelli, P.; Van Oost, K.; Meusburger, K.; Alewell, C.; Lugato, E.; Panagos, P. A step towards a holistic assessment of soil degradation in Europe: Coupling on-site erosion with sediment transfer and carbon fluxes. *Environ. Res.* **2018**, *161*, 291–298.
<https://doi.org/10.1016/j.envres.2017.11.009>.

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SOC calibration data per land use / crop type and climate zone

Aggregated from the LUCAS database: <https://esdac.jrc.ec.europa.eu/projects/lucas>

Table S6: SOC content (g kg⁻¹) per land use and crop type for the four climate zones. N = number of data points in the class.

Land use / crop type	Dominant climate											
	Humid continental			Mediterranean			Oceanic			Subartic		
	Mean	St. dev.	n	Mean	St. dev.	n	Mean	St. dev.	n	Mean	St. dev.	n
Broadleaved forest	48.1	66.9	788	39.8	36.8	876	62.3	67.8	377	122.6	153.0	239
Coniferous forest	63.1	79.7	647	48.3	48.9	474	95.9	100.0	157	118.0	154.0	1227
Mixed forest	73.0	96.1	514	54.1	62.2	150	77.5	71.7	155	123.8	158.1	977
Shrubland	45.4	46.2	96	35.6	33.9	568	98.8	124.0	107	85.3	132.8	75
Grassland	37.0	53.8	2026	26.1	25.0	1196	53.4	57.7	1369	69.1	89.1	160
Artificial land	30.2	16.5	17	18.4	18.3	19	29.5	18.9	8	81.3	108.6	6
Bareland	23.8	54.3	101	13.0	11.7	408	19.3	15.1	71	48.9	61.9	24
Forage	14.5	8.0	421	13.7	10.0	213	22.3	13.2	83	31.3	34.7	29
Fruit trees and berries	20.7	11.2	77	17.8	14.0	234	32.3	22.2	15			
Maize	16.9	13.5	652	18.4	15.5	196	16.7	7.8	348	12.6		1
Oilseed	18.4	18.9	274	7.6	2.9	14	18.3	9.3	217	22.4	9.5	14
Olive groves	21.4		1	16.7	11.8	470	14.3	4.9	4			
Pulses	19.8	31.7	87	15.8	11.0	111	16.5	7.0	52	43.3	50.8	4
Rice				15.9	6.5	12						
Root crop - Potato	15.8	10.0	127	14.3	19.7	40	16.8	14.2	132	16.1	7.6	13
Veg & Flowers	17.8	9.4	180	10.7	5.8	199	14.7	8.0	104	13.1		1
Vineyards	17.1	6.1	39	12.6	12.9	224	14.9	7.4	63			
Winter/Spring cereal	17.8	15.5	1503	13.1	9.7	1306	18.2	11.1	914	37.7	42.6	185