Supplementary Material 1. N outputs and crop yields for the Ebro crops considered in this study (See some comments at the end)

Type	Crop	N output (%)	Yield ± SD Rainfed cultures(kg/ha)	Yield ± SD Irrigated cultures(kg/ha)	Yield ± SD Greenhouse cultures(kg/ha)
Cereal	Wheat	1.81	3362 ± 1272	4746 ± 2101	
Cereal	Barley	1.51	3174 ± 1189	4500 ± 2003	
Cereal	Oats	1.51	2508 ± 1108	3965 ± 2392	
Cereal	Rye	1.51	2349 ± 1144	3255 ± 1731	
Cereal	Titricale	1.58	2810 ± 1425	4627 ± 1780	
Cereal	Maize	1.36	4008 ± 2197	8201 ± 2991	
Cereal	Sorghum	1.66	1921 ± 1021	6007 ± 3138	
Cereal	Rice	1.48		5687 ± 1425	
Legumes	Beans	4.50	853 ± 514	1759 ± 966	
Legumes	Broad bean	4.00	1302 ± 439	2369 ± 1252	
Legumes	Lentil	3.40	821 ± 420	1309 ± 717	
Legumes	Chickpea	3.40	897 ± 414	1383 ± 783	
Legumes	Pea	3.80	1451 ± 1070	2153 ± 1207	
Legumes	Vicia sativa	3.80	818 ± 434	1464 ± 905	
Legumes	Vicia ervilia	3.00	987 ± 655	1766 ± 845	
Legumes	Lupin	3.40	941 ± 306	1200 ± 282	
Roots	Potatoes	0.26	16503 ± 8553	29888 ± 12984	
Industrial crops	Sugar beet	0.19	46356 ± 18370	67928 ± 34489	
Industrial crops	Flax	3.29	950 ± 548	2095 ± 1221	
Industrial crops	Hemp	3.29	1580 ± 1204	2990 ± 1671	
Industrial crops	Sunflower	2.60	969 ± 541	2202 ± 1133	
Industrial crops	Soy	6.00	1119 ± 263	4357 ± 1026	

Cont 1

Type	Crop	N output (%)	Yield ± SD Rainfed cultures(kg/ha)	Yield ± SD Irrigated cultures(kg/ha)	Yield ± SD Greenhouse cultures(kg/ha)
Industrial crops	Rape	4.03	1383 ± 848	2010 ± 1238	
Industrial crops	Padrón Pepper	0.26	1000 ± 235		
Industrial crops	Saffron	1.20	2 ± 0	10 ± 2	
Industrial crops	Hop	2.00	1400 ± 329		
Industrial crops	Tobacco	4.00		2508 ± 964	
Permanent	Table grape	0.34	4243 ± 2537	9000 ± 3378	
Permanent	Vine grape	0.34	5810 ± 2620	10078 ± 5676	
Permanent	Table olive	0.81	926 ± 559	2019 ± 846	
Permanent	Oil olive	0.81	825 ± 651	1750 ± 1070	
Permanent	Apple	0.15	7442 ± 5022	19251 ± 9128	
Permanent	Pear	0.15	5866 ± 3335	15610 ± 8304	
Permanent	Loquat	0.32	6000 ± 1414	10113 ± 4080	
Permanent	Other pip	0.15	3800 ± 2079	7877 ± 4515	
Permanent	Apricot	0.22	5724 ± 3065	10886 ± 6501	
Permanent	Cherry	0.39	3115 ± 1080	5757 ± 3090	
Permanent	Peach	0.22	5653 ± 3594	16150 ± 9332	
Permanent	Plum	0.22	3776 ± 2537	9321 ± 6557	
Permanent	Fig	0.22	4577 ± 2427	7212 ± 4131	
Permanent	Pomegranate	0.30	1200 ± 282	5700 ± 1863	
Permanent	Kiwi	0.30	849 ± 200	15166 ± 10301	
Permanent	Other fleshy	0.30	7800 ± 1838	12322 ± 5229	

Cont 2

Type	Crop	N output (%)	Yield ± SD Rainfed cultures(kg/ha)	Yield ± SD Irrigated cultures(kg/ha)	Yield ± SD Greenhouse cultures(kg/ha)
Permanent	Almond	0.57	731 ± 587	1761 ± 1011	
Permanent	Hazelnut	0.57	701 ± 420	1016 ± 480	
Permanent	Walnut	0.57	1538 ± 1374	3002 ± 2682	
Permanent	Carob	0.57	1942 ± 886	2510 ± 591	
Permanent	Orange	0.44		16479 ± 7621	
Permanent	Bitter orange	0.44		7000 ± 1649	
Permanent	Manderin	0.44		20127 ± 8152	
Permanent	Lemon	0.44		15139 ± 8837	
Permanent	Grapefruit	0.44		14000 ± 3299	
Permanent	Avocado	1.10		11500 ± 2710	
Vegetables	Cabbage	0.63	17107 ± 9710	28911 ± 9836	
Vegetables	Aspargus	0.30	2852 ± 1335	4723 ± 2605	
Vegetables	Lettuce	0.27	16326 ± 8920	31293 ± 19601	55721 ± 32730
Vegetables	Escarole	0.36	13291 ± 5980	23794 ± 10385	34333 ± 13167
Vegetables	Spinach	0.27	8800 ± 4584	18447 ± 8780	
Vegetables	Swiss chard	0.45	11997 ± 5965	25611 ± 14052	73750 ± 36774
Vegetables	Watermelon	0.18	9566 ± 5723	28577 ± 14793	35500 ± 11481
Vegetables	Melon	0.21	7253 ± 3799	22418 ± 12085	24396 ± 8001
Vegetables	Cucumber	0.14	15250 ± 7293	29151 ± 15277	76464 ± 44319
Vegetables	Courgette	0.35	12708 ± 5589	29486 ± 17051	59566 ± 26759
Vegetables	Aubergine	0.52	5916 ± 2301	25970 ± 13907	30000 ± 7071
Vegetables	Tomato	0.22	13032 ± 8208	37957 ± 10899	72473 ± 39037

Cont 3

Type	Crop	N output (%)	Yield ± SD Rainfed cultures(kg/ha)	Yield ± SD Irrigated cultures(kg/ha)	Yield ± SD Greenhouse cultures(kg/ha)
Vegetables	Pepper	0.26	10173 ± 5148	17859 ± 6094	41679 ± 23385
Vegetables	Strawberry	0.39	4666 ± 1800	10166 ± 5437	25133 ± 11809
Vegetables	Artichoke	0.32	5383 ± 1742	13846 ± 7555	
Vegetables	Cauliflower	0.69	15284 ± 8138	20782 ± 8783	
Vegetables	Garlic	0.69	5620 ± 3418	10727 ± 5327	
Vegetables	Onion	0.29	12497 ± 6802	33838 ± 8272	
Vegetables	Carrot	0.49	15228 ± 7644	40665 ± 25992	
Vegetables	Mushroom	0.68	1293 ± 570		
Vegetables	Green bean	0.41	6366 ± 1860	12559 ± 4896	26321 ± 14547
Vegetables	Green pea	0.50	4796 ± 2367	8024 ± 4090	13000 ± 3064
Vegetables	Green broad been	0.77	5398 ± 2723	9046 ± 4743	
Fodder	Winter cereals (Forage)	0.19	13355 ± 8216	22915 ± 12988	
Fodder	Maize (Forage)	0.20	34393 ± 21711	56616 ± 26188	
Fodder	Sorghum (Forage)	0.20	16462 ± 8374	42723 ± 20178	
Fodder	Alfalfa	0.56	24728 ± 9255	55095 ± 10330	
Fodder	Vicia sativa (Forage)	0.45	17131 ± 8594	26596 ± 13654	
Fodder	Hedysarum coronarium	0.45	7000 ± 1649		
Fodder	Other legume (Forage)	0.45	12539 ± 7074	19633 ± 9731	
Fodder	Turnip	0.23	21533 ± 12065	33197 ± 16861	
Fodder	Beet (Forage)	0.15	25309 ± 15202	41500 ± 21200	
Fodder	Cabbage (Forage)	0.23	16011 ± 8659	32269 ± 15731	
Fodder	Avena fatua	0.21	28191 ± 17378	51165 ± 20466	

Cont 4

Type	Crop	N output (%)	Yield ± SD Rainfed cultures(kg/ha)	Yield ± SD Irrigated cultures(kg/ha)	Yield ± SD Greenhouse cultures(kg/ha)
Fodder	Other gramineae (Forage)	0.21	11774 ± 4296	25486 ± 9312	
Fodder	Clover	0.45	19472 ± 10915	27878 ± 8197	
Fodder	Onobrychis viciifolia	0.45	12918 ± 5470	24733 ± 5483	
Pasture	Cultivated grassland	1.44	3733 ± 1201	6239 ± 1979	
Pasture	Natural pasture	0.86	1629 ± 480		

Notes:

N output (%) corresponds to the proportion of N that has been considered as output. It is expressed in terms of % of the yield. This information is based on Urbano (2002) and, when necessary, it has been completed with MMARM (2010)

Yield corresponds to the averaged yield of each crop in the 18 provinces present in the Ebro River Basin. Data is split into rainfed, irrigated and greenhouse cultures. The information was provided by the Spanish Ministry of Agriculture (http://www.mapa.es/). To create the spatialized output map, we used the information on yields for each corresponding province. SD: Standard Deviation.

N outputs in harvested **straw** have also been calculated for Cereals and Legumes (0.35% and 0.75%, respectively).

In the **permanent crops,** 100% of trunks, 50% of roots and 50% of leaves (if perennial) have been considered as outputs.

Yields in **fodder** crops are expressed as humid weight.

Yields in **pastures** are expressed as dry-weight. N output in natural pastures is lower than that in cultivated grassland because not all the production is finally harvested (a value of 60% consumption has been considered).