

Supplementary Materials

Identification and assessment of potential microplastic emissions within the Lake Tollense catchment area, Mecklenburg Western-Pomerania, Germany

Elke K. Fischer^{‡*}, Tilmann Gahrau[‡], Matthias Tamminga[‡]

[‡]Center for Earth System Research and Sustainability, Working Group Microplastic Research at CEN, University of Hamburg, Bundesstrasse 55, 20146 Hamburg, Germany
elke.fischer@uni-hamburg.de

Table S1. Land-use types coverage in comparison: Study area of Lake Tollense catchment and Germany according to total area (km²) and percentage of coverage (%)

	Study area (Lake Tollense catchment)		Germany	
	%	km ²	%	km ²
Agricultural area	64.0	335.14	50.8	181,625
Forest area	25.3	132.51	29.8	106,546
Water bodies	6.1	31.88	13.9	49,819
Urban area	3.2	16.96	3.2	11,390
Other land	1.4	7.21	2.3	8,202
	100.0	523.70	100	357,582

Table S2. Areas covered according to land-use types (in km² and percentage of coverage of the total catchment)

Corine land cover	land-use type	total	
		%	km ²
211	Non-irrigated arable land	53.18	278.52
311	Broad-leaved forest	15.42	80.75
231	Pastures	10.74	56.26
312	Coniferous forest	8.85	46.36
512	Water bodies	6.09	31.88
112	Discontinuous urban fabric	2.22	11.60
313	Mixed forest	1.03	5.40
322	Moors and heathland	0.55	2.89
142	Sport and leisure facilities	0.53	2.78
121	Industrial or commercial units	0.46	2.43
324	Transitional woodland-shrub	0.39	2.02
131	Mineral extraction sites	0.25	1.29
411	Inland marshes	0.19	1.00
222	Fruit trees and berry plantations	0.07	0.36
141	Green urban areas	0.03	0.15
total		100%	523.7



Figure. S1 Drive-in fodder silo with PE film and rubber tires, near Woldegk and hay bales made of PE nets, near Wulkenzin.



Figure S2 Left: Polyethylene from the net covering hay bales, near Wulkenzin. Right: Polyethylene from the cover film of a drive-in silo, near Woldegk.



Figure S3 Stone Mastic Asphalt with road markings, near Wulkenzin.



Figure S4 Agricultural land-use in the catchment. 1: Maize (*Zea mays*) near the Rehberger See, 2: Rape (*Brassica napus*) in the Lindetal, 3: Sugar beet (*Beta vulgaris*) near Woldegk, 4: Forage meadows near Penzlin, 5: Wheat (*Triticum*) in the Lindetal. 6: Rape (*Brassica napus*) near Ballin, 7: Wheat (*Triticum*) near Ballin.

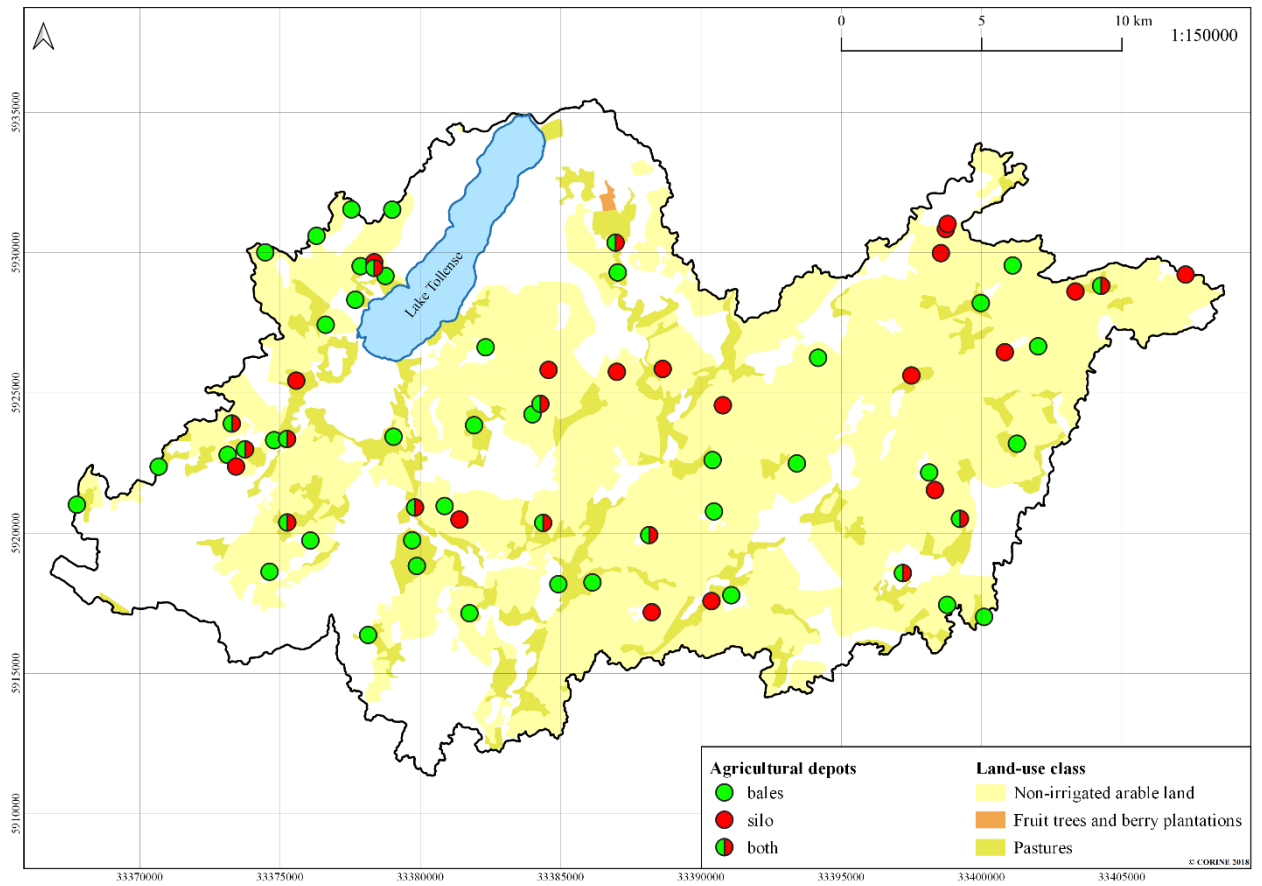


Figure S5. Remote sensing agricultural depots. (Projection: ETRS89/UTM zone 33N. Source: Copernicus Land Monitoring Service 2018)

Table S3. Calculation of the population density within the catchment area of Lake Tollense according to municipalities.

municipality	area.mun km ²	share.catch km ²	pop.mun	avg. pop. density p/km ²	est. pop. in catchment
Blankensee	56.14	55.21	1,635	29	1,601
Blumenholz	41.84	41.51	784	19	789
Burg Stargard, Stadt	76.61	67.3	5,402	71	4,778
Cölpin	21.24	7.12	743	35	249
Carpin	64.11	27.72	874	14	388
Feldberger Seenlandschaft	201.09	23.35	4,433	22	514
Grünow	23.22	0.64	299	13	8
Groß Nemerow	21.02	21.02	1,160	55	1,156
Hohenzieritz	20.54	19.29	444	22	424
Holldorf	15.67	15.67	773	49	768
Klein Vielen	45.64	13.03	621	14	182
Kubblank	13.49	0.02	168	12	0
Kuckssee	19.19	1.36	542	28	38
Lindetal	56.33	48.68	1,133	20	974
Möllenbeck	36.32	34.67	697	19	659
Neetzka	13.57	3.92	225	17	67
Neubrandenburg, Stadt	86.11	22.73	64,086	748	17,002
Neustrelitz, Stadt	139.89	8.47	20,140	146	1,236
Penzlin, Stadt	115.56	18.07	4,159	36	651
Woldegk, Stadt	164.16	66.82	4,392	33	2,205
Wulkenzin	21.59	9.33	1,561	72	671
sum / avg	1,253	523.7	5,441	70	34,361

Table S4. Results of the land-use analysis, by sub-catchment, sector and Corine Land Cover classes (clc), with highlighted values

clc land-use type	Lake Tollense		Lake Tollense e.		Lake Tollense w.		Lieps		Linde		Nonnenbach		total	
	%	km²	%	km²	%	km²	%	km²	%	km²	%	km²	%	km²
Agricultural area	0.59	0.10	39.82	10.44	56.11	15.35	40.01	33.98	78.94	117.10	72.19	158.16	63.99	335.14
211 Non-irrigated arable land	0.01	0.00	30.49	7.99	46.94	12.84	28.29	24.03	69.01	102.38	59.92	131.27	53.18	278.52
222 Fruit trees and berry plantations	-	-	0.0007	0.0002	-	-	-	-	0.24	0.36	-	-	0.07	0.36
231 Pastures	0.58	0.10	9.34	2.45	9.17	2.51	11.72	9.95	9.68	14.36	12.27	26.89	10.74	56.26
Forest area	0.60	0.11	36.14	9.48	41.21	11.27	47.69	40.50	14.63	21.70	22.57	49.45	25.30	132.51
311 Broad-leaved forest	0.56	0.10	32.58	8.54	33.10	9.05	21.96	18.65	11.53	17.10	12.46	27.30	15.42	80.75
312 Coniferous forest	0.03	0.01	-	-	6.94	1.90	24.82	21.08	1.98	2.94	9.33	20.43	8.85	46.36
313 Mixed forest	0.01	0.00	3.57	0.94	1.17	0.32	0.90	0.76	1.12	1.66	0.78	1.72	1.03	5.40
Water bodies	98.75	17.54	0.22	0.06	1.46	0.40	6.08	5.16	1.12	1.67	3.21	7.04	6.09	31.88
512 Water	98.75	17.54	0.22	0.06	1.46	0.40	6.08	5.16	1.12	1.67	3.21	7.04	6.09	31.88
Urban area	0.06	0.01	21.73	5.70	1.22	0.33	0.76	0.64	4.81	7.14	1.43	3.14	3.24	16.96
112 Discontinuous urban fabric	0.02	0.00	11.58	3.04	1.19	0.33	0.76	0.64	3.32	4.93	1.21	2.66	2.22	11.60
121 Industrial or commercial units	-	-	6.72	1.76	-	-	-	-	0.45	0.67	-	-	0.46	2.43
141 Green urban areas	-	-	-	-	-	-	-	-	0.10	0.15	-	-	0.03	0.15
142 Sport and leisure facilities	0.04	0.01	3.44	0.90	0.03	0.01	-	-	0.93	1.38	0.22	0.48	0.53	2.78
Other area	0.00	0.00	2.08	0.54	0.00	0.00	5.47	4.64	0.50	0.74	0.59	1.28	1.38	7.21
322 Moors and heathland	-	-	-	-	-	-	3.41	2.89	-	-	-	-	0.55	2.89
324 Transitional woodland-shrub	-	-	2.08	0.54	-	-	1.06	0.90	0.20	0.30	0.13	0.28	0.39	2.02
411 Inland marshes	-	-	-	-	-	-	-	-	-	-	0.46	1.00	0.19	1.00
131 Mineral extraction sites	-	-	-	-	-	-	1.01	0.85	0.30	0.44	-	-	0.25	1.29

Table S5a Lieps: Tire, clutch, brake and wearing course abrasion (PM₁₀)

Lieps								
roadname	km	ID	PKW/24 h	SV/24 h	PKW/a	SV/a	PKW PM ₁₀ (g/a)	LKW PM ₁₀ (g/a)
B104	-	-	-	-	-	-	-	-
B104	-	-	-	-	-	-	-	-
B193	4.6	12	4,451	465	1,624,61	169,72	245,851	1,393,156
B198	-	-	-	-	-	-	-	-
B198	-	-	-	-	-	-	-	-
B96 (north)	9.4	69	8,663	691	3,161,99	252,21	978,702	5,545,980
B96 (south)	-	-	-	-	-	-	-	-
L281	-	-	-	-	-	-	-	-
L33 (east)	-	-	-	-	-	-	-	-
L33 (west)	-	-	-	-	-	-	-	-
L331	-	-	-	-	-	-	-	-
L34 (west)	6.0	12	1,082	89	394,930	32,485	78,795	446,503
L34 (east)	3.0	15	642	33	234,330	12,045	22,894	129,732
L34 (mid)	-	-	-	-	-	-	-	-
sum / avg	23.	-	3,710	320	1,353,96	116,61	1,326,242	7,515,371

Total

8.84 t/a

Table S5d Lake Tollense east: Tire, clutch, brake and wearing course abrasion (PM₁₀)

Lake Tollense east								
roadname	km	ID	PKW/24h	SV/24h	PKW/a	SV/a	PKW PM ₁₀ (g/a)	LKW PM ₁₀ (g/a)
B104 (north)	-	-	-	-	-	-	-	-
B104 (south)	-	-	-	-	-	-	-	-
B193	-	-	-	-	-	-	-	-
B198 (north)	-	-	-	-	-	-	-	-
B198 (south)	-	-	-	-	-	-	-	-
B96 (north)	5.0	edit.	9,580	588	3,496,700	214,620	577,559	200,880
B96 (south)	5.9	149	9,580	588	3,496,700	214,620	675,443	234,924
L281	-	-	-	-	-	-	-	-
L33 (east)	1.3	-	3,532	142	1,289,180	51,830	56,816	12,944
L33 (west)	-	-	-	-	-	-	-	-
L331	-	-	-	-	-	-	-	-
L34 (west)	-	-	-	-	-	-	-	-
L34 (east)	-	-	-	-	-	-	-	-
L34 (mid)	-	-	-	-	-	-	-	-
sum / avg	12.2	-	7,564	439	2,760,860	160,357	1,309,818	448,748

Total 1.76 t/a

Table S6. Summary on tire, clutch, brake and wearing course abrasion (PM₁₀) per sub-catchment (refer to table SI.3a-d for a detailed breakdown (note: in the sub-catchment of Lake Tollense west there is no presence of federal or state roads))

sub-catchment	km (sum)	LV/24h (avg)	HV/24h (avg)	LV/a (avg)	HV/a (avg)	LV PM ₁₀ (g/a) (sum)	HV PM ₁₀ (g/a) (sum)
Lieps	23.0	3,710	320	1,353,968	116,618	1,326,242	7,515,371
Linde	36.1	2,506	220	914,690	80,404	1,167,250	495,742
Nonnenbach	49.8	2,906	233	1,060,690	85,201	1,505,343	749,898
Lake Tollense east	12.2	7,564	439	2,760,860	160,357	1,309,818	448,748
total	121.1	3,337	303	1,316,747	110,645	5,308,652	9,209,759

Total 9.21 t/a

LV (light vehicle – passenger car), HV (heavy vehicle – trucks)