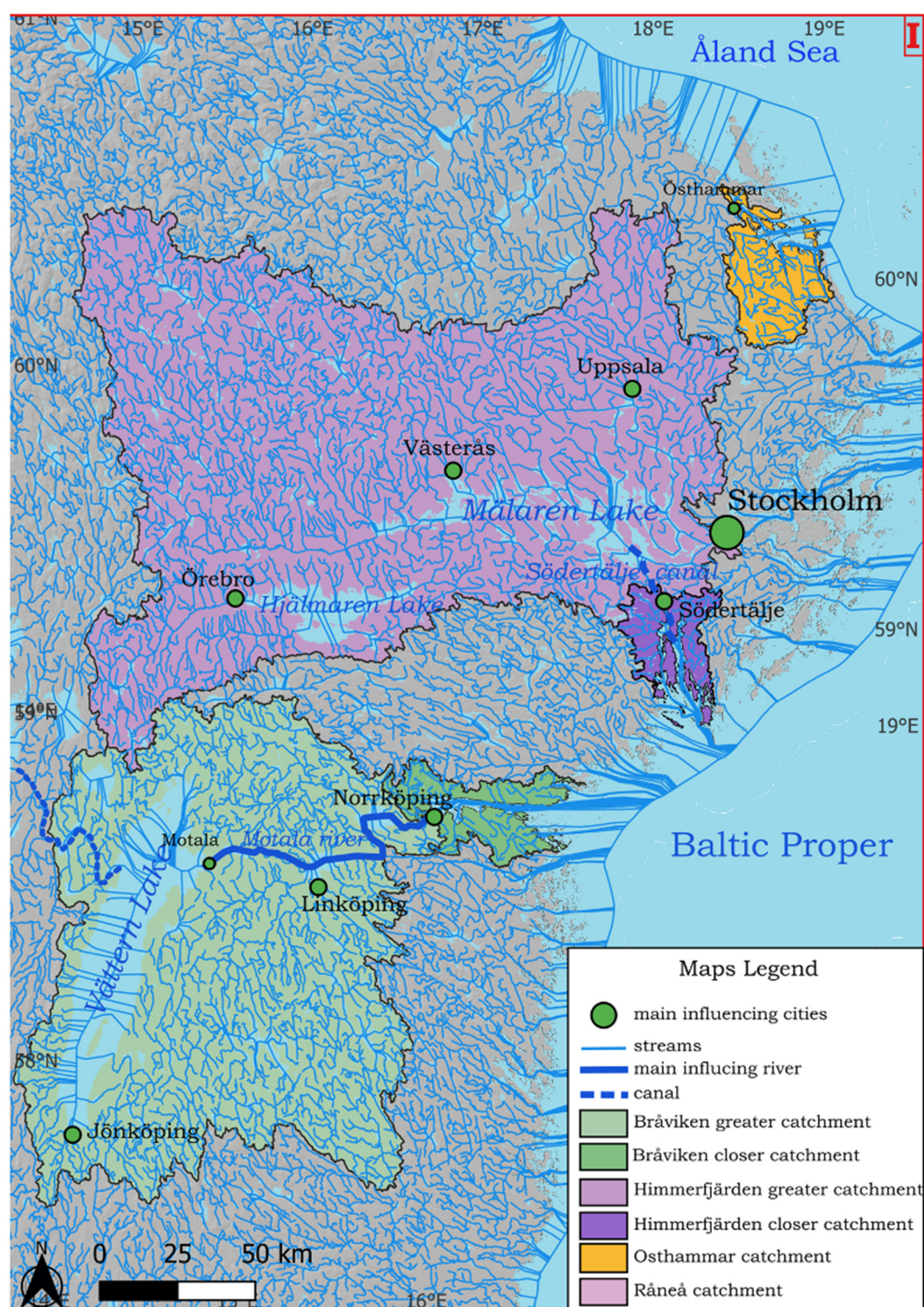


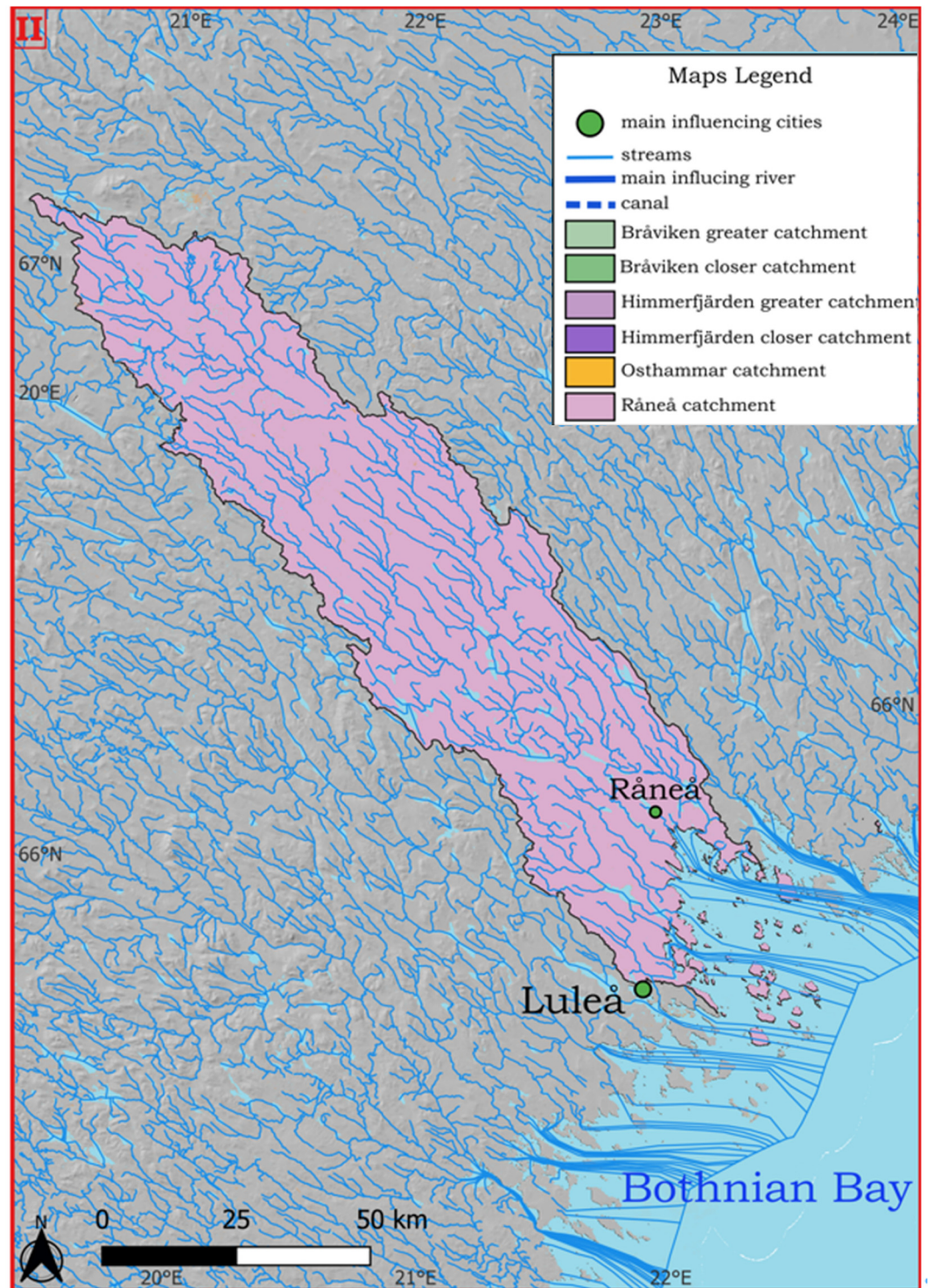


Supplementary Figures



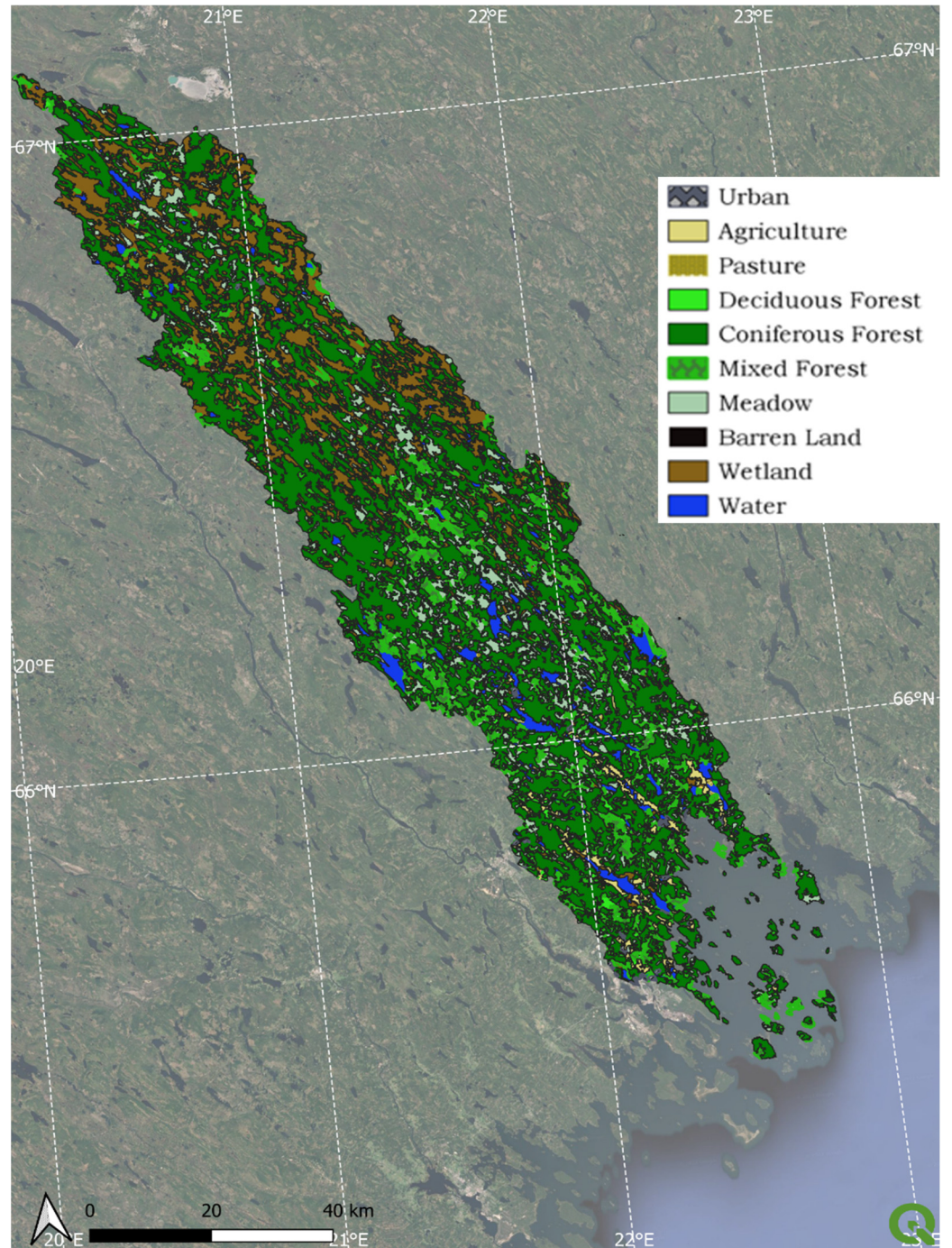
**Supplementary Figure S1a.** Water course network and catchments of Zone I: Bråviken bay (light and dark green), Himmerfjärden bay (light and dark purple), Östhammar bay (orange); please note that this figure corresponds to Figure 4a in the main paper and is redrawn here enlarged for better visual inspection of the water course network. All maps generated in QGIS using predefined shapefiles (Europe-an coastline shapefile [22]). Recurrence layer – Global Surface Water, Surface elevation – Copernicus EU-DEM- v1.1; Sentinel Hub [25]. Water course network (vattendragslinjer nätverk), SVAR (Svenskt VattenARKiv, [26]).





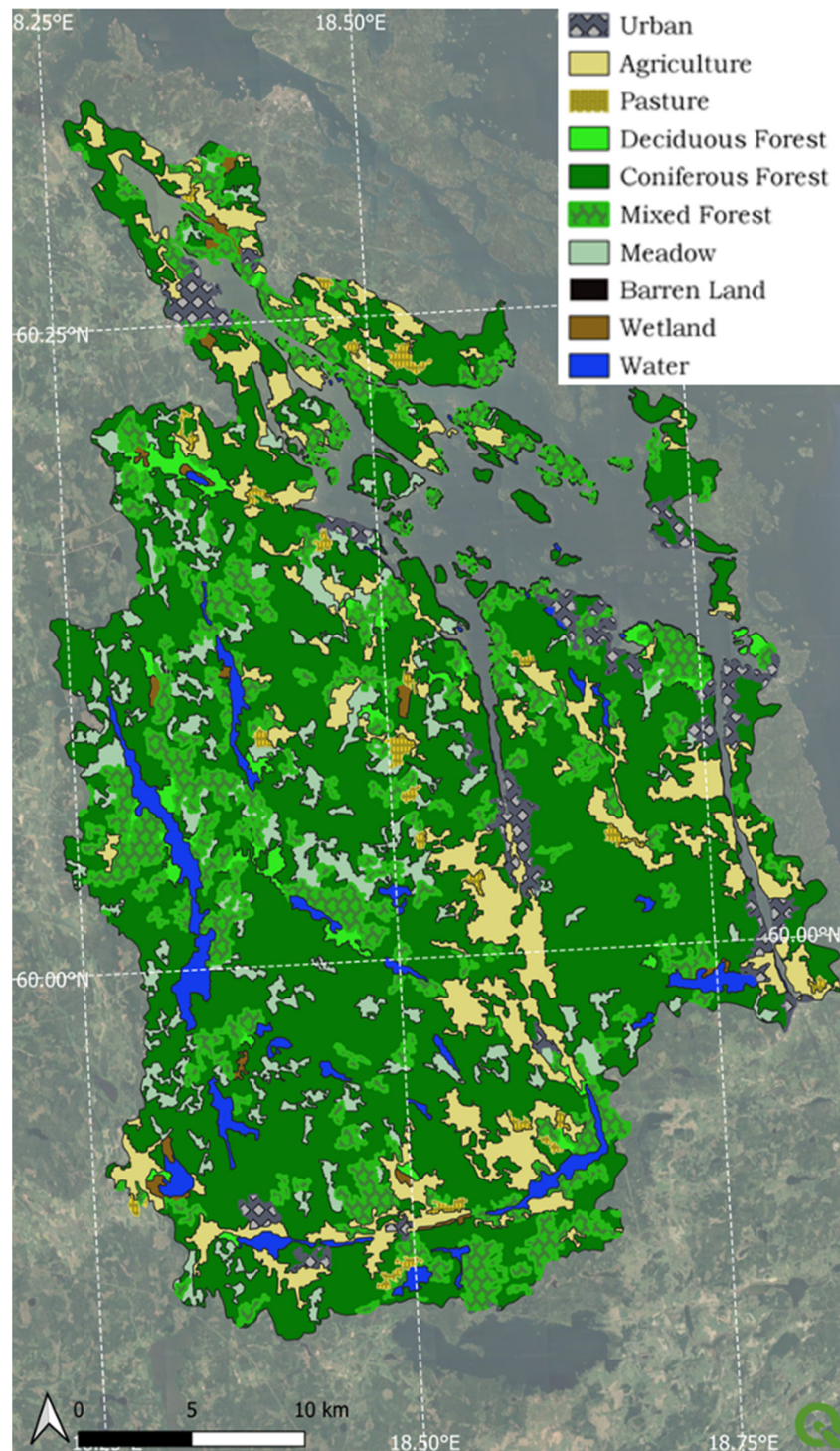
**Supplementary Figure S1b.** Water course network and catchments of Råneå bay located in Zone II (in Swedish Lapland); please note that this figure corresponds to Figure 4b in the main paper and is redrawn here enlarged for better visual inspection of the water course network.





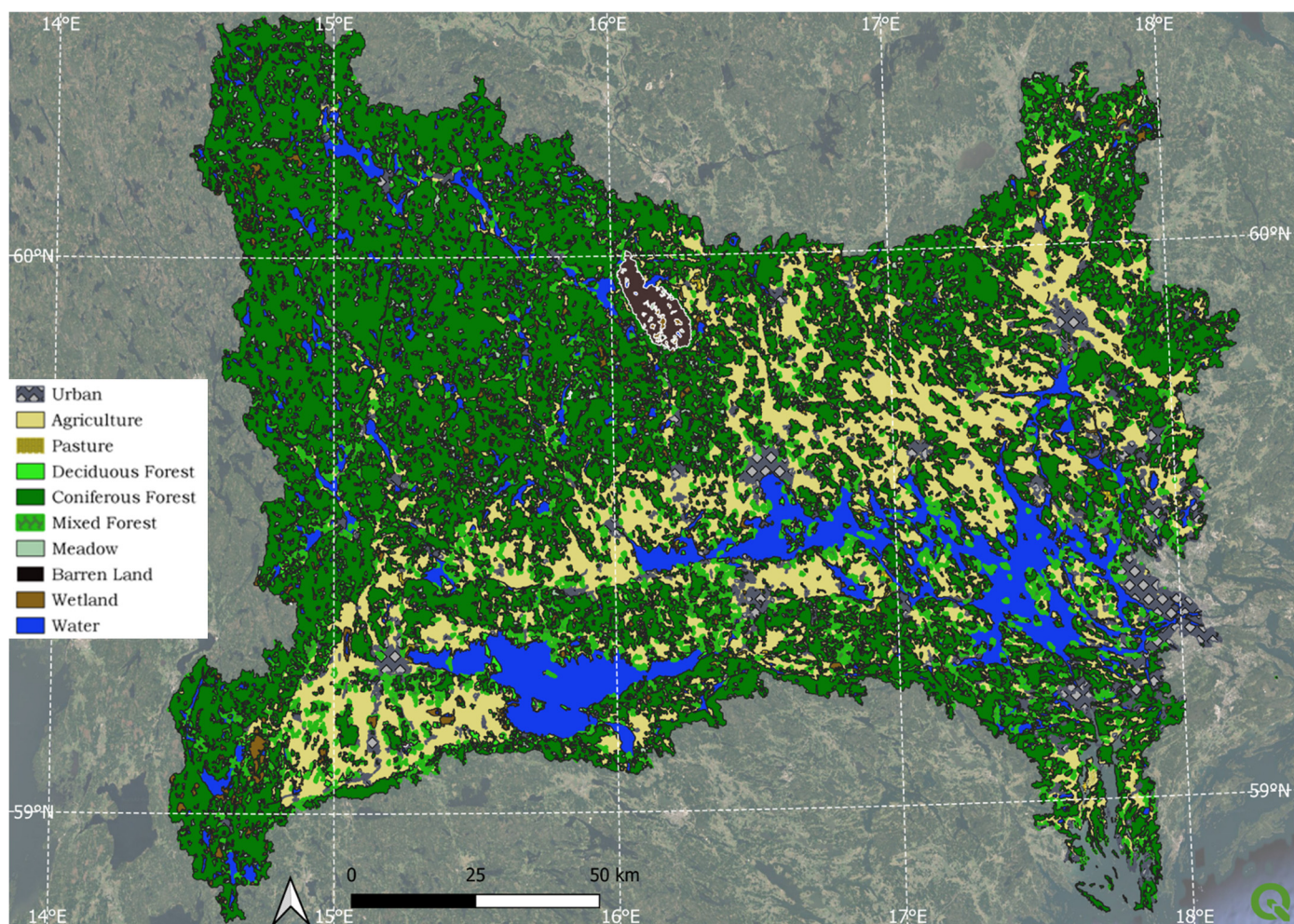
**Supplementary Figure S2a.** Landcover map for the greater catchment area of Râneå bay; please note that this figure corresponds to Figure 7a in the main paper and is redrawn here enlarged for better visual inspection of the land use and land cover.





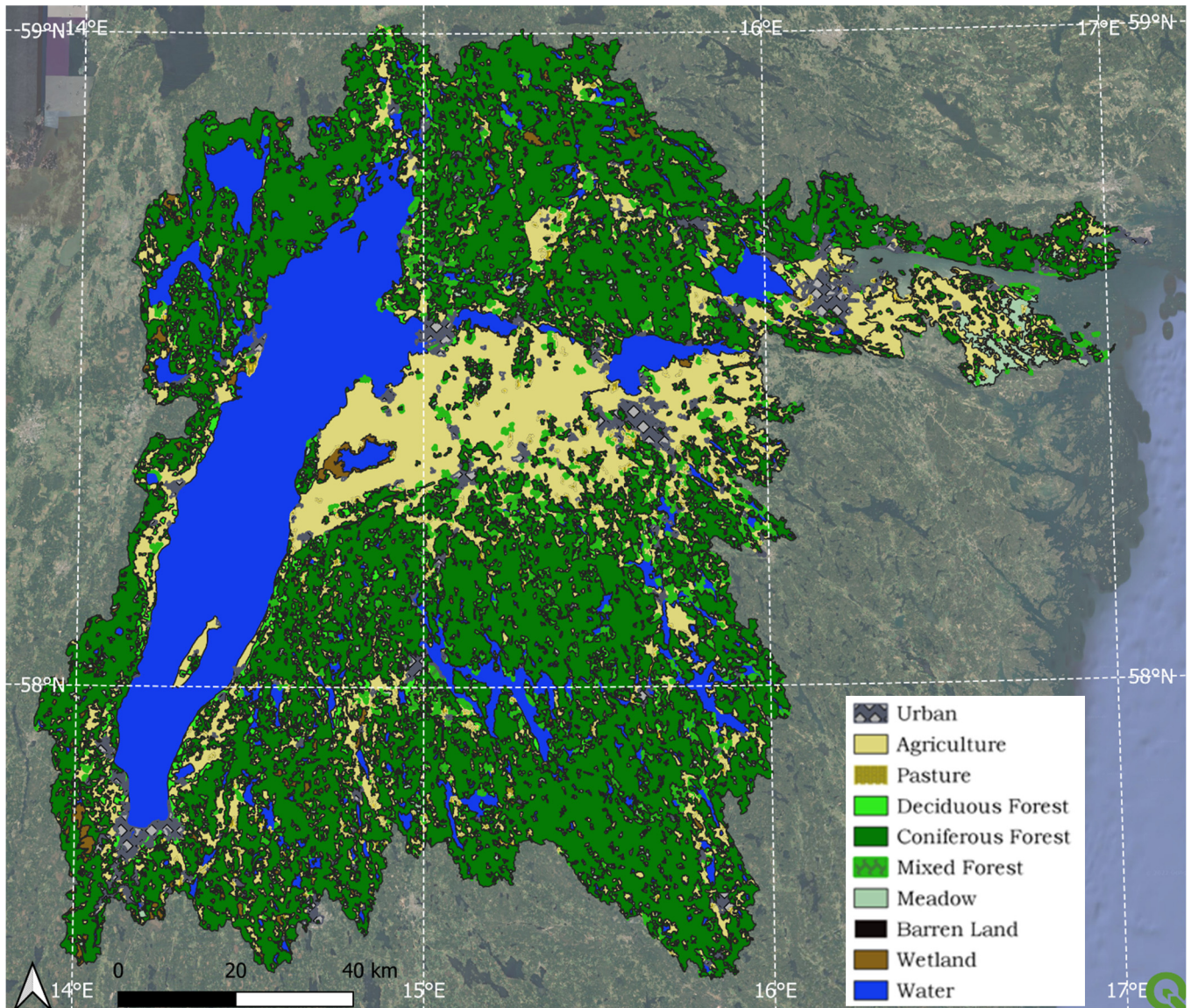
**Supplementary Figure S2b.** Landcover map for the greater catchment area of Östhammar bay; please note that this figure corresponds to Figure 7b in the main paper and is redrawn here enlarged for better visual inspection of the land use and land cover.





**Supplementary Figure S2c.** Landcover map for the greater catchment area of Himmerfjärden bay; please note that this figure corresponds to Figure 7c in the main paper and is redrawn here enlarged for better visual inspection of the land use and land cover.





**Supplementary Figure S2d.** Landcover map for the greater catchment of Brä Viken bay; please note that this figure corresponds to Figure 7d in the main paper and is redrawn here enlarged for better visual inspection of the land use and land cover.





**Supplementary Table S1.** Corine nomenclature - Code18; Nomenclature adapted from Copernicus Land Monitoring service, available online [22].





## Corine land cover classes

### 1. Artificial surfaces




#### 1.1 Urban fabric

-  1.1.1. Continuous urban fabric
-  1.1.2. Discontinuous urban fabric



#### 1.2 Industrial, commercial and transport units

-  1.2.1. Industrial or commercial units
-  1.2.2. Road and rail networks and associated land
-  1.2.3. Port areas
-  1.2.4. Airports

#### 1.3 Mine, dump and construction sites




-  1.3.1. Mineral extraction sites
-  1.3.2. Dump sites
-  1.3.3. Construction sites

#### 1.4 Artificial, non-agricultural vegetated areas




-  1.4.1. Green urban areas
-  1.4.2. Sport and leisure facilities

### 2. Agricultural areas


#### 2.1 Arable land

-  2.1.1. Non-irrigated arable land
-  2.1.2. Permanently irrigated land
-  2.1.3. Rice fields





#### 2.2 Permanent crops

-  2.2.1. Vineyards
-  2.2.2. Fruit trees and berry plantations
-  2.2.3. Olive groves

#### 2.3 Pastures




-  2.3.1. Pastures

#### 2.4 Heterogeneous agricultural areas





-  2.4.1. Annual crops associated with permanent crops
-  2.4.2. Complex cultivation patterns
-  2.4.3. Land principally occupied by agriculture
-  2.4.4. Agro-forestry areas

### 3. Forest and seminatural areas






#### 3.1 Forests

-  3.1.1. Broad-leaved forest
-  3.1.2. Coniferous forest
-  3.1.3. Mixed forest

#### 3.2 Shrub and/or herbaceous vegetation associations



-  3.2.1. Natural grassland
-  3.2.2. Moors and heathland
-  3.2.3. Sclerophyllous vegetation
-  3.2.4. Transitional woodland shrub

#### 3.3 Open spaces with little or no vegetation




-  3.3.1. Beaches, dunes, and sand plains
-  3.3.2. Bare rock
-  3.3.3. Sparsely vegetated areas
-  3.3.4. Burnt areas
-  3.3.5. Glaciers and perpetual snow

### 4. Wetlands

#### 4.1 Inland wetlands



-  4.1.1. Inland marshes
-  4.1.2. Peat bogs

#### 4.2 Coastal wetlands




-  4.2.1. Salt marshes
-  4.2.2. Salines
-  4.2.3. Intertidal flats

### 5. Water bodies

#### 5.1 Inland waters

-  5.1.1. Water courses
-  5.1.2. Water bodies

#### 5.2 Marine waters

-  5.2.1. Coastal lagoons
-  5.2.2. Estuaries
-  5.2.3. Sea and ocean



**Supplementary Table S2.** Bio-optical dataset used in this study.

Area	Distance					total					CDOM		
	(group)	Location	(km)	Date	UTC+2hrs	Position	Chl-a	SPM	SPIM	SPOM	Turbidity	linear fitting (700*)	
			from	Time		Lat	Long	µg/l	g/m3	g/m3	g/m3	FNU	<i>a</i> <sub>CDOM</sub>
			outlet	SE_(summer)	<i>S</i> <sub>CDOM</sub>								
Bråviken	BR7b	21.73	28/04/2022	15:20	58.62014	16.68841	4.38	2.12	1.60	0.52	1.71	0.55	-0.019
(MRSG)	BR3	10.62	28/04/2022	17:20	58.64501	16.49279	9.32	3.98	1.43	2.55	3.21	1.02	-0.018
	BR4	3.99	29/04/2022	09:15	58.64374	16.37258	8.03	4.00	1.74	2.25	3.11	1.10	-0.018
	BR7	21.34	29/04/2022	10:55	58.61834	16.68158	6.06	3.48	1.46	2.02	2.85	0.98	-0.018
	BR2	30.04	29/04/2022	12:15	58.59690	16.82914	2.90	3.82	1.54	2.28	2.08	0.69	-0.019
(MRSG)	BR5	0.00	25/04/2018	08:58	58.62553	16.31293	8.77	4.11	3.15	0.96	4.38	1.36	-0.018
	BR2	30.05	25/04/2018	13:55	58.59676	16.82916	12.74	2.74	1.85	0.89	2.23	0.92	-0.017
	BR3	10.46	25/04/2018	15:57	58.63990	16.49166	12.65	4.24	3.26	0.98	4.38	1.26	-0.018
	BR4	4.00	25/04/2018	17:20	58.64368	16.37263	9.66	4.91	3.78	1.13	5.07	1.62	-0.018
(MRSG)	BR1	41.69	24/04/2018	11:52	58.56440	17.02323	25.05	3.64	1.98	1.67	2.53	1.02	-0.017
	BR6	4.59	24/04/2018	10:11	58.63999	16.38735	9.24	4.47	3.42	1.05	4.56	1.50	-0.018
	BR7	21.35	24/04/2018	11:53	58.61839	16.68164	12.43	3.72	2.86	0.86	3.87	1.01	-0.018
	BR8	36.23	24/04/2018	13:30	58.58236	16.93324	12.65	2.26	1.41	0.85	1.81	0.72	-0.018
(MG)	GB20	3.99	17/06/2013	N/A	58.61330	16.77492	6.70	2.41	2.14	0.27	N/A	0.75	N/A
	GB16w2	26.77	17/06/2013	N/A	58.63953	16.38868	6.40	4.30	3.80	0.50	N/A	0.83	N/A
(MG)	GB16w2	3.99	18/06/2012	N/A	58.61330	16.77492	3.10	3.14	2.31	0.83	3.74	0.55	N/A
	GB20	26.77	18/06/2012	N/A	58.63953	16.38868	9.70	4.36	3.18	1.18	5.48	1.09	N/A
(MRSG)	BR5	0.00	02/07/2021	09:55	58.62560	16.31295	6.62	N/A	N/A	N/A	5.51	1.27	-0.018
	BR2;												
	GB16	30.04	01/07/2021	13:52	58.59678	16.82910	7.02	N/A	N/A	N/A	1.83	0.82	-0.018
	BR3;												
	BG22	10.45	01/07/2021	14:30	58.63992	16.49152	4.74	N/A	N/A	N/A	4.00	0.79	-0.018



(MG)	BR4;												
	BG20	3.99	01/07/2021	17:40	58.64372	16.37249	5.20	N/A	N/A	N/A	2.61	0.76	-0.018
	BR7b	21.73	02/07/2021	12:12	58.62039	16.68846	3.46	N/A	N/A	N/A	1.78	0.77	-0.017
	BR9	36.46	02/07/2021	16:10	58.59784	16.94074	3.65	N/A	N/A	N/A	1.24	0.42	-0.018
	GB20	3.99	09/07/2013	N/A	58.61330	16.77492	18.00	6.77	4.90	1.87	N/A	1.26	N/A
	GB16w2	26.77	09/07/2013	N/A	58.63953	16.38868	4.00	5.51	4.77	0.74	N/A	0.82	N/A
	GB20	3.99	12/08/2013	N/A	58.61330	16.77492	9.70	6.05	4.44	1.61	N/A	0.89	N/A
	GB16w2	26.77	12/08/2013	N/A	58.63953	16.38868	6.90	4.45	3.52	0.94	N/A	0.73	N/A
	GB16w2	3.99	20/08/2012	N/A	58.61330	16.77492	4.90	3.66	2.85	0.81	4.80	0.92	N/A
Himmerfjärden (MRSG)	GB20	26.77	20/08/2012	N/A	58.63953	16.38868	5.40	5.20	4.33	0.86	7.48	0.96	N/A
	H5	0.00	17/04/2018	12:52	59.03783	17.72600	N/A	N/A	N/A	N/A	1.39	0.62	-0.019
	H3	11.50	17/04/2018	10:55	58.93433	17.72600	N/A	N/A	N/A	N/A	1.32	0.58	-0.019
(MRSG)	H4	6.00	17/04/2018	10:05	58.98383	17.72433	7.08	N/A	N/A	N/A	1.55	0.60	-0.019
	B1	26.71	17/04/2018	08:20	58.80333	17.62367	3.37	N/A	N/A	N/A	0.77	0.34	-0.021
	H4	6.22	27/04/2012	13:20	58.98393	17.72516	13.70	2.53	1.01	1.51	1.96	0.54	-0.017
(MRSG)	H3	11.51	27/04/2012	14:15	58.84250	17.79033	5.05	1.51	0.61	0.91	1.11	0.50	-0.017
	H2	21.80	27/04/2012	15:00	58.93433	17.72600	3.39	1.15	0.52	0.64	1.09	0.34	-0.018
	H5	0.00	10/05/2012	13:50	59.03727	17.72016	3.66	1.22	0.43	0.79	1.26	0.60	-0.016
	H2	22.10	10/05/2012	11:35	58.84156	17.78891	1.81	0.75	0.27	0.48	0.75	0.33	-0.019
	H4	5.93	10/05/2012	12:55	58.98394	17.72540	4.69	1.48	0.62	0.86	1.13	0.53	-0.017
(MRSG)	B1	26.56	10/05/2012	10:17	58.80341	17.62467	1.60	0.96	0.40	0.57	0.80	0.43	-0.016
	H5	0.00	20/06/2001	08:00	59.03650	17.72333	3.61	1.93	1.24	0.69	N/A	0.58	-0.019
	H4	5.78	20/06/2001	09:05	58.98450	17.72667	4.17	2.20	1.36	0.84	N/A	0.52	-0.019
(MRSG)	H3	11.40	20/06/2001	11:00	58.93400	17.73017	1.81	1.70	1.20	0.51	N/A	0.50	-0.019
	H2	22.17	20/06/2001	11:35	58.84000	17.79033	1.34	0.88	0.43	0.45	N/A	0.39	-0.019
	B1	26.35	20/06/2001	12:40	58.80467	17.62667	1.32	0.48	0.21	0.28	N/A	0.39	-0.019
	H5	0.00	21/07/2017	10:30	59.03657	17.72120	2.98	1.64	0.72	0.92	1.55	0.59	-0.017
	H4	5.86	21/07/2017	12:15	58.98390	17.72423	6.11	1.80	0.62	1.19	1.58	0.45	-0.019
	H3	11.39	21/07/2017	13:10	58.93407	17.72675	5.10	1.60	0.56	1.04	1.33	0.47	-0.017

(MRSO)	Averaged trans	3	B1	26.57	21/07/2017	13:15		58.80280	17.62400	2.63	0.77	0.18	0.59	0.58	0.39	-0.018
			H4	5.68	15,18,28			58.98386	17.72388	7.16	2.69	1.10	1.59	N/A	0.75	-0.014
			H3	11.21				58.93408	17.72676	5.68	2.39	1.04	1.35	N/A	0.43	-0.018
			H2	22.95				58.82847	17.73230	4.44	1.51	0.47	1.05	N/A	0.49	-0.017
(MRSO)			H3	5.62	02/07/2001	09:25		58.93400	17.73017	4.96	2.48	1.33	1.15	N/A	0.46	-0.018
			H2	16.47	02/07/2001	10:45		58.84000	17.79033	3.49	1.21	0.31	0.90	N/A	0.50	-0.018
			B1	20.79	02/07/2001	11:05		58.80467	17.62667	3.40	1.71	0.63	1.08	N/A	0.41	-0.018
			H5	0.00	21/08/2017	13:36		59.03780	17.72598	6.66	N/A	N/A	N/A	1.86	N/A	N/A
(MG)			H2	11.50	21/08/2017	09:10		58.84250	17.79033	3.85	N/A	N/A	N/A	0.77	0.31	-0.021
			H3	6.00	21/08/2017	11:08		58.93433	17.72600	4.59	N/A	N/A	N/A	1.37	0.38	-0.019
			H4	26.70	21/08/2017	10:15		58.98378	17.72435	4.72	1.72	0.89	0.84	1.01	0.39	-0.020
			B1	22.01	21/08/2017	07:45		58.80317	17.62533	1.82	1.25	0.25	1.00	1.50	0.30	-0.021
(MRSO)			H4	5.93	20/08/2010	08:20		58.98394	17.72428	5.70	1.76	1.08	0.67	N/A	0.80	-0.014
			H2	22.06	20/08/2010	10:10		58.84134	17.78222	4.25	1.65	0.57	1.09	N/A	0.44	-0.017
			B1	26.63	20/08/2010	11:30		58.80265	17.62538	6.32	1.72	0.43	1.29	N/A	0.40	-0.017
			H5	0.00	12,22			59.03693	17.72186	4.06	1.92	0.90	1.01	N/A	0.66	-0.018
Average transects		2	H4	5.91				58.98374	17.72397	4.74	1.77	0.70	1.06	N/A	0.60	-0.017
			H3	11.47				58.93374	17.72915	4.16	1.67	0.55	1.12	N/A	0.46	-0.017
			H2	22.16				58.84055	17.78911	3.80	1.14	0.22	0.92	N/A	0.42	-0.017
			U11	22.96	17/07/2021	08:23		60.16031	18.58518	2.65	N/A	N/A	N/A	1.01	0.81	-0.017
(MG)			U13	18.17	17/07/2021	07:08		60.17682	18.48382	4.09	N/A	N/A	N/A	2.50	1.00	-0.017
			U18	9.41	17/07/2021	06:09		60.24931	18.41649	23.47	N/A	N/A	N/A	7.00	2.32	-0.016
			U14	14.43	17/07/2021	06:24		60.21550	18.47713	8.85	N/A	N/A	N/A	3.43	1.23	-0.017
			U11	22.96	11/07/2020	08:00		60.16031	18.58518	4.19	N/A	N/A	N/A	1.63	0.87	-0.018
(MG)			U13	18.17	11/07/2020	06:46		60.17682	18.48382	2.74	N/A	N/A	N/A	2.61	1.08	-0.018
			U18	9.41	11/07/2020	05:59		60.24931	18.41649	22.90	N/A	N/A	N/A	6.12	1.16	-0.018
			U14	14.43	11/07/2020	05:32		60.21550	18.47713	3.41	N/A	N/A	N/A	3.16	1.16	-0.017



(MG)	U11	22.96	13/07/2019	10:00	60.16031	18.58518	4.16	N/A	N/A	N/A	2.67	N/A	N/A
	U13	18.17	13/07/2019	08:45	60.17682	18.48382	3.92	N/A	N/A	N/A	3.11	N/A	N/A
	U18	9.41	13/07/2019	07:58	60.24931	18.41649	30.79	N/A	N/A	N/A	6.60	N/A	N/A
	U14	14.43	13/07/2019	07:29	60.21550	18.47713	7.49	N/A	N/A	N/A	4.11	N/A	N/A
(MG)	U22	2.46	29/07/2010	N/A	60.29772	18.33597	89.88	N/A	N/A	N/A	N/A	N/A	N/A
	U18	9.41	21/07/2010	N/A	60.24931	18.41649	17.37	N/A	N/A	N/A	N/A	1.52	-0.015
	U14	14.43	21/07/2010	N/A	60.21550	18.47713	9.28	4.77	0.72	4.06	N/A	2.46	-0.010
	U13	18.17	21/07/2010	N/A	60.17682	18.48382	3.30	7.42	3.89	3.53	N/A	0.91	-0.016
(MG)	U11	22.96	21/07/2010	N/A	60.16031	18.58518	2.72	N/A	N/A	N/A	N/A	0.95	-0.017
	U15	28.26	21/07/2010	N/A	60.15101	18.70181	2.30	1.75	0.26	1.49	N/A	1.17	-0.015
	U11	22.96	14/08/2021	07:49	60.16031	18.58518	5.52	N/A	N/A	N/A	0.93	0.60	-0.018
	U13	18.17	14/08/2021	06:37	60.17682	18.48382	8.44	N/A	N/A	N/A	2.58	0.61	-0.018
(MG)	U18	9.41	14/08/2021	05:45	60.24931	18.41649	46.51	N/A	N/A	N/A	7.25	0.86	-0.018
	U14	14.43	14/08/2021	06:14	60.21550	18.47713	15.47	N/A	N/A	N/A	4.25	0.81	-0.018
	U11	22.96	08/08/2020	07:56	60.16031	18.58518	2.96	N/A	N/A	N/A	1.05	1.20	-0.017
	U13	18.17	08/08/2020	06:43	60.17682	18.48382	2.56	N/A	N/A	N/A	1.72	0.74	-0.018
(MG)	U18	9.41	08/08/2020	05:55	60.24931	18.41649	31.19	N/A	N/A	N/A	5.48	0.86	-0.018
	U14	14.43	08/08/2020	05:29	60.21550	18.47713	9.59	N/A	N/A	N/A	3.65	0.74	-0.018
	U11	22.96	10/08/2019	09:27	60.16031	18.58518	6.07	N/A	N/A	N/A	1.92	0.77	-0.018
	U13	18.17	10/08/2019	08:12	60.17682	18.48382	9.73	N/A	N/A	N/A	3.16	0.90	-0.018
(MG)	U18	9.41	10/08/2019	07:24	60.24931	18.41649	23.24	N/A	N/A	N/A	6.56	N/A	N/A
	U14	14.43	10/08/2019	06:59	60.21550	18.47713	12.96	N/A	N/A	N/A	4.46	N/A	N/A
	U18	9.41	20/08/2010	N/A	60.24931	18.41649	36.20	N/A	N/A	N/A	N/A	1.24	-0.016
	U14	14.43	20/08/2010	N/A	60.21550	18.47713	15.81	14.54	0.94	13.59	N/A	0.92	-0.017
(MG)	U13	18.17	20/08/2010	N/A	60.17682	18.48382	6.24	7.56	0.64	6.92	N/A	0.90	-0.017
	U11	22.96	20/08/2010	N/A	60.16031	18.58518	2.35	5.07	0.55	4.52	N/A	0.70	-0.017
Râneă	RA6	3.60	16/05/2018	16:05	65.83400	22.43067	0.55	7.10	4.16	2.94	8.90	5.18	-0.016
(MRSG/UMF)	RA7	10.72	16/05/2018	15:30	65.74501	22.49570	2.52	3.49	1.67	1.82	2.49	2.99	-0.016
	RA2	11.15	16/05/2018	16:50	65.72965	22.44760	1.03	11.60	6.79	4.81	2.40	2.65	-0.016

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(MRSB)	RA8	22.14	16/05/2018	19:20	65.64150	22.55783	1.80	3.13	1.50	1.63	2.56	2.93	-0.016
	RA8	22.12	13/06/2018	13:30	65.64193	22.55905	1.89	0.90	0.59	0.31	0.64	1.83	-0.017
	RA6	3.60	13/06/2018	16:00	65.83400	22.43067	4.60	2.72	1.22	1.50	1.76	2.82	-0.016
	RA7	10.85	13/06/2018		65.74377	22.49654	1.71	1.04	0.62	0.42	1.21	1.25	-0.017
(MRSB)	RA2	11.10	13/06/2018	17:40	65.73004	22.44725	1.70	2.09	1.46	0.63	0.72	1.30	-0.017
	RA8	22.16	11/07/2018	14:33	65.64138	22.55826	5.69	3.13	1.21	1.93	0.97	1.15	-0.018
	RA2	11.08	11/07/2018	16:36	65.73017	22.44639	3.47	2.92	1.57	1.35	0.72	1.24	-0.018
	RA6	3.60	11/07/2018	16:20	65.83400	22.43067	2.60	4.31	2.39	1.92	1.46	1.59	-0.018
	RA7	10.78	11/07/2018	19:50	65.74464	22.49641	3.15	3.43	1.97	1.47	0.66	1.23	-0.018