ANNEX I

Table S1. Correlation matrix– District of Bologna

	1	2	3	4	5	6	7	8	9	10	11	12
Bicarbonate Alkalinity	1	0.9996	0.9619	–0.4028	–0.8757	0.9482	0.9708	0.9288	0.5162	0.5243	0.9252	0.7244
Total Alkalinity	0.9996	1	0.9632	–0.3992	–0.8745	0.9483	0.9711	0.9256	0.5234	0.5217	0.9256	0.7229
Calcium	0.9619	0.9632	1	–0.4110	–0.8817	0.9857	0.9921	0.9015	0.6874	0.6631	0.9738	0.8387
Chloride	–0.4028	–0.3992	–0.4110	1	0.6242	–0.4666	–0.4259	–0.4225	–0.2223	–0.4533	–0.4209	–0.4462
pH	–0.8757	–0.8745	–0.8817	0.6242	1	–0.8996	–0.8865	–0.8304	–0.5373	–0.6452	–0.8864	–0.7862
Conductivity	0.9482	0.9483	0.9857	–0.4666	–0.8996	1	0.9898	0.9299	0.6978	0.7454	0.9902	0.8843
Water Hardness	0.9708	0.9711	0.9921	–0.4259	–0.8865	0.9898	1	0.9470	0.6759	0.6722	0.9800	0.8536
Magnesium	0.9288	0.9256	0.9015	–0.4225	–0.8304	0.9299	0.9470	1	0.5918	0.6417	0.9243	0.8299
Nitrate	0.5162	0.5234	0.6874	–0.2223	–0.5373	0.6978	0.6759	0.5918	1	0.7297	0.7396	0.8533
Potassium	0.5243	0.5217	0.6631	–0.4533	–0.6452	0.7454	0.6722	0.6417	0.7297	1	0.7674	0.8911
Dry Residue	0.9252	0.9256	0.9738	–0.4209	–0.8864	0.9902	0.9800	0.9243	0.7396	0.7674	1	0.9094
Sulphate	0.7244	0.7229	0.8387	–0.4462	–0.7862	0.8843	0.8536	0.8299	0.8533	0.8911	0.9094	1

Table S2. Eigenvalues of each Principal Component and variance explained– District of Bologna.

Principal Component	Eigenvalues	% Variance	Cumulated Variance
PC1	9.563	79.69	79.69
PC2	1.034	8.62	88.31
PC3	0.883	7.36	95.67
PC4	0.237	1.98	97.65
PC5	0.139	1.16	98.81
PC6	0.094	0.79	99.59
PC7	0.026	0.22	99.81
PC8	0.0113	0.09	99.91
PC9	0.0070	0.06	99.97
PC10	0.00336	0.03	99.994
PC11	0.00046	0.004	99.998
PC12	0.00022	0.002	100
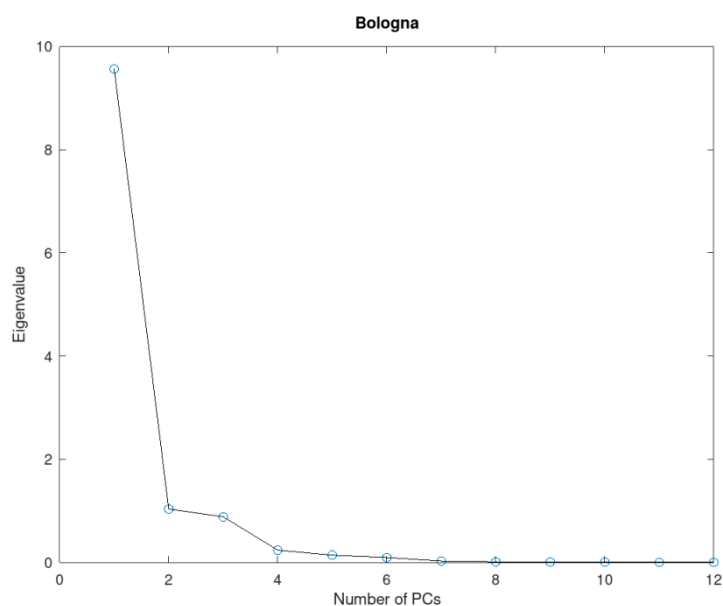
Figure S1. Scree plot – District of Bologna.
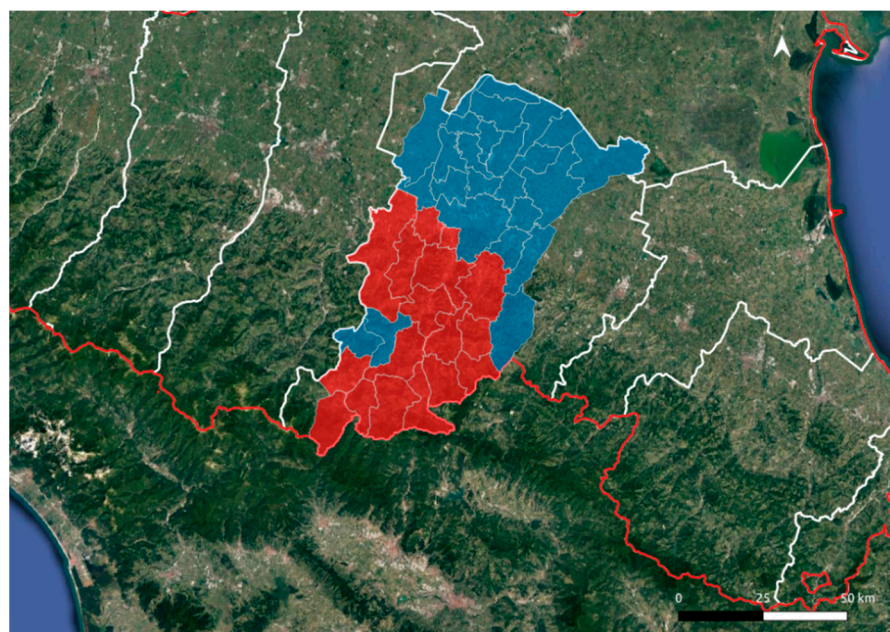
Figure S2. Georeferenced map of the district of Bologna with clusters highlighted (red: municipalities belonging to the first cluster; blue: municipalities belonging to the second cluster).
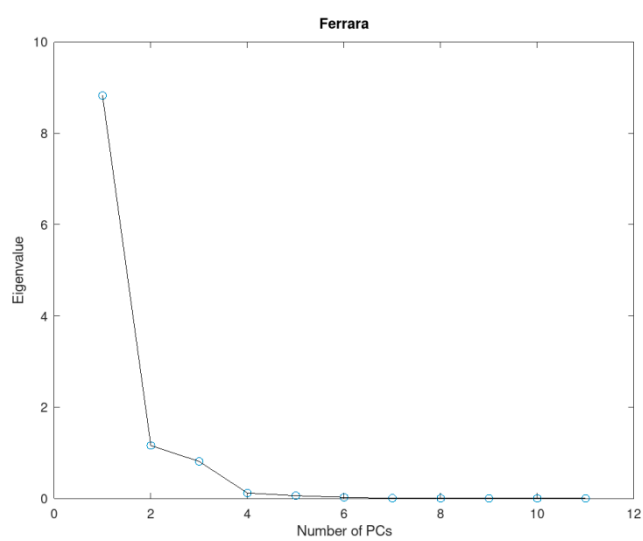
ANNEX II

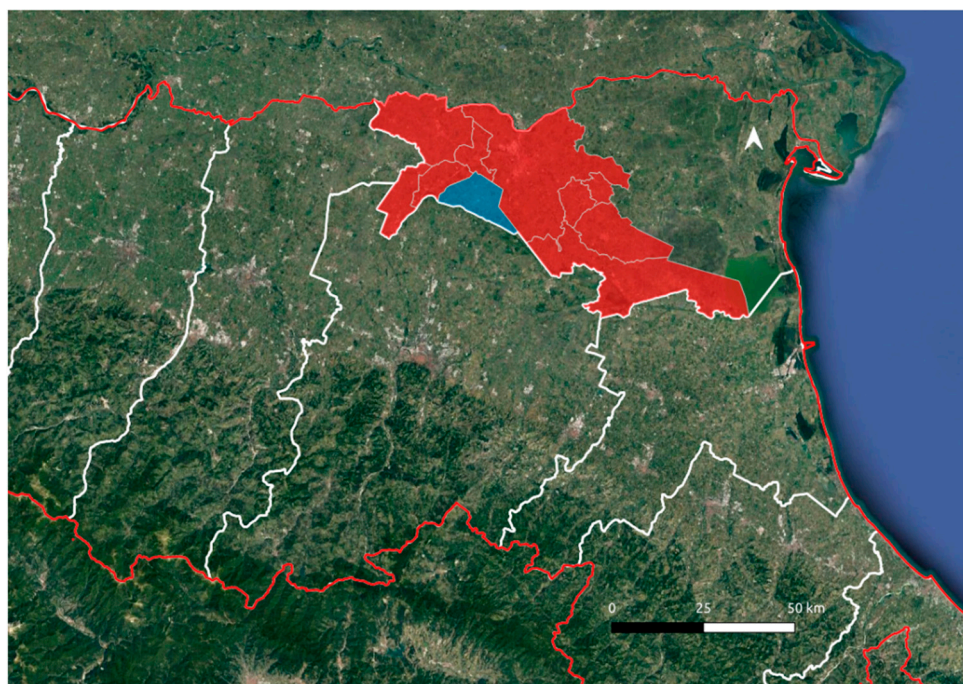**Table S3.** Correlation matrix– District of Ferrara.

	1	2	3	4	5	6	7	8	9	10	11
Bicarbonate alkalinity	1	0.9989	0.9839	−0.7971	0.9500	0.9883	0.9908	−0.4037	−0.6487	0.9529	0.9044
Total Alkalinity	0.9989	1	0.9861	−0.7840	0.9464	0.9890	0.9873	−0.3883	−0.6316	0.9538	0.9175
Calcium	0.9839	0.9861	1	−0.7440	0.9204	0.9986	0.9862	−0.3650	−0.5327	0.9298	0.9524
pH	−0.7971	−0.7840	−0.7440	1	−0.6974	−0.7686	−0.8098	0.7361	0.6291	−0.7323	−0.6028
Conductivity	0.9500	0.9464	0.9204	−0.6974	1	0.9296	0.9451	−0.1771	−0.7528	0.9813	0.7940
Water Hardness	0.9883	0.9890	0.9986	−0.7686	0.9296	1	0.9930	−0.3833	−0.5566	0.9387	0.9372
Magnesium	0.9908	0.9873	0.9862	−0.8098	0.9451	0.9930	1	−0.4070	−0.6242	0.9483	0.8966
Nitrate (NO_3)	−0.4037	−0.3883	−0.3650	0.7361	−0.1771	−0.3833	−0.4070	1	0.1879	−0.2057	−0.2895
Potassium	−0.6487	−0.6316	−0.5327	0.6291	−0.7528	−0.5566	−0.6242	0.1879	1	−0.6726	−0.3362
Dry Residue	0.9529	0.9538	0.9298	−0.7323	0.9813	0.9387	0.9483	−0.2057	−0.6726	1	0.8225
Sulphate	0.9044	0.9175	0.9524	−0.6028	0.7940	0.9372	0.8966	−0.2895	−0.3362	0.8225	1

Table S4. Eigenvalues of each Principal Component and variance explained– District of Ferrara.

Principal Component	Eigenvalues	% Variance	Cumulated Variance
PC1	8.825	80.229	80.229
PC2	1.159	10.538	90.767
PC3	0.809	7.359	98.126
PC4	0.118	1.071	99.198
PC5	0.059	0.537	99.735
PC6	0.024	0.221	99.956
PC7	0.003	0.026	99.982
PC8	0.002	0.016	99.997
PC9	0.0002	0.002	99.999
PC10	0.0001	0.001	100
PC11	0.0000	0.000	100

Figure S3. Scree plot – District of Ferrara.

Figure S4. Georeferenced map of the district of Ferrara with clusters highlighted (red: municipalities belonging to the first cluster; blue: municipality belonging to the second cluster).

ANNEX III

Table S5. Correlation matrix– District of Forlì–Cesena.

	1	2	3	4	5	6	7	8	9	10	11
Bicarbonate alkalinity	1	0.9928	0.9140	−0.6142	0.9115	0.9591	0.7120	0.9526	0.8343	0.8627	0.7693
Total Alkalinity	0.9928	1	0.9162	−0.5946	0.9109	0.9609	0.7134	0.9539	0.8384	0.8591	0.7661
Calcium	0.9140	0.9162	1	−0.6330	0.9479	0.9770	0.6417	0.8866	0.8133	0.9291	0.8829
pH	−0.6142	−0.5946	−0.6330	1	−0.6144	−0.6075	−0.2479	−0.5372	−0.6155	−0.5951	−0.4693
Conductivity	0.9115	0.9109	0.9479	−0.6144	1	0.9722	0.7109	0.9437	0.8794	0.9810	0.9145
Water Hardness	0.9591	0.9609	0.9770	−0.6075	0.9722	1	0.6863	0.9645	0.8500	0.9492	0.8864
Fluoride	0.7120	0.7134	0.6417	−0.2479	0.7109	0.6863	1	0.7000	0.6206	0.6471	0.6884
Magnesium	0.9526	0.9539	0.8866	−0.5372	0.9437	0.9645	0.7000	1	0.8443	0.9166	0.8356
Potassium	0.8343	0.8384	0.8133	−0.6155	0.8794	0.8500	0.6206	0.8443	1	0.8705	0.7991
Dry Residue	0.8627	0.8591	0.9291	−0.5951	0.9810	0.9492	0.6471	0.9166	0.8705	1	0.9461
Sulphate	0.7693	0.7661	0.8829	−0.4693	0.9145	0.8864	0.6884	0.8356	0.7991	0.9461	1

Table S6. Eigenvalues of each Principal Component and variance explained– District of Forlì–Cesena.

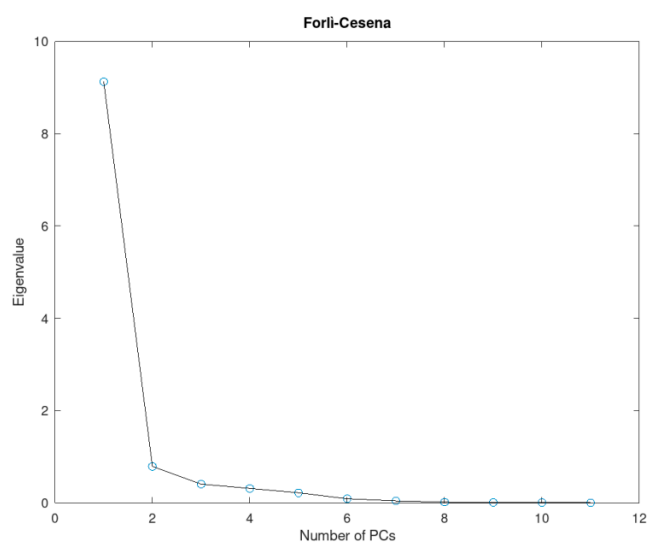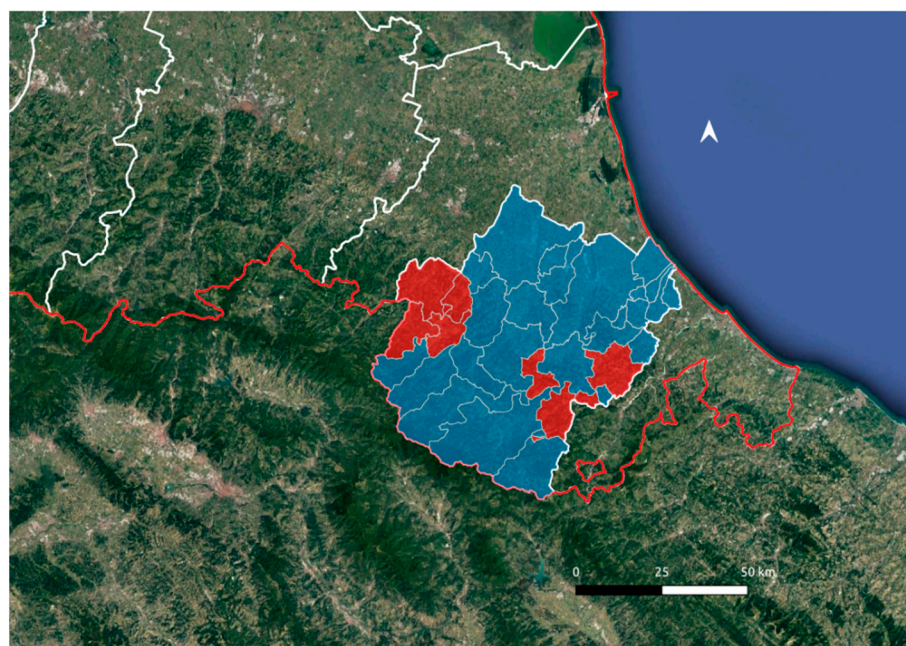| Principal Component	Eigenvalues	% Variance	Cumulated Variance
PC1	9.128	82.98	82.98
PC2	0.788	7.16	90.14
PC3	0.404	3.67	93.82
PC4	0.311	2.82	96.64
PC5	0.216	1.97	98.60
PC6	0.086	0.79	99.39
PC7	0.041	0.37	99.76
PC8	0.014	0.13	99.89
PC9	0.006	0.06	99.95
PC10	0.006	0.05	99.999
PC11	0.0001	0.001	100

Figure S5. Scree plot – District of Forlì–Cesena.

Figure S6 Georeferenced map of the district of Forlì–Cesena with clusters highlighted (red: municipalities belonging to the first cluster; blue: municipality belonging to the second cluster)

ANNEX IV

Table S7. Correlation Matrix– District of Modena

	1	2	3	4	5	6	7	8	9	10	11
Bicarbonate Alkalinity	1	0.9998	0.7836	−0.6694	0.6382	0.9203	0.5928	0.7110	0.6302	0.2780	0.3187
Total Alkalinity	0.9998	1	0.7820	−0.6679	0.6368	0.9212	0.5892	0.7124	0.6289	0.2761	0.3179
Calcium	0.7836	0.7820	1	−0.7971	0.9737	0.8899	0.8571	0.8298	0.9700	0.8067	0.8285
pH	−0.6694	−0.6679	−0.7971	1	−0.7478	−0.6729	−0.8392	−0.8057	−0.7511	−0.5909	−0.5998
Conductivity	0.6382	0.6368	0.9737	−0.7478	1	0.8179	0.8483	0.8000	0.9981	0.9159	0.9304
Magnesium	0.9203	0.9212	0.8899	−0.6729	0.8179	1	0.6905	0.7698	0.8153	0.5412	0.5833
Nitrate	0.5928	0.5892	0.8571	−0.8392	0.8483	0.6905	1	0.7504	0.8445	0.7471	0.7409
Potassium	0.7110	0.7124	0.8298	−0.8057	0.8000	0.7698	0.7504	1	0.8055	0.6376	0.6645
Dry Residue	0.6302	0.6289	0.9700	−0.7511	0.9981	0.8153	0.8445	0.8055	1	0.9178	0.9335
Sodium	0.2780	0.2761	0.8067	−0.5909	0.9159	0.5412	0.7471	0.6376	0.9178	1	0.9944
Sulphate	0.3187	0.3179	0.8285	−0.5998	0.9304	0.5833	0.7409	0.6645	0.9335	0.9944	1

Table S8. Eigenvalues of each Principal Component and variance explained– District of Modena.

Principal Component	Eigenvalues	% Variance	Cumulated Variance
PC1	8.472	77.02	77.02
PC2	1.638	14.89	91.91
PC3	0.487	4.43	96.33
PC4	0.236	2.14	98.47
PC5	0.117	1.06	99.54
PC6	0.043	0.39	99.93
PC7	0.004	0.04	99.96
PC8	0.002	0.02	99.99
PC9	0.001	0.01	100
PC10	0.000	0.00	100
PC11	0.000	0.00	100
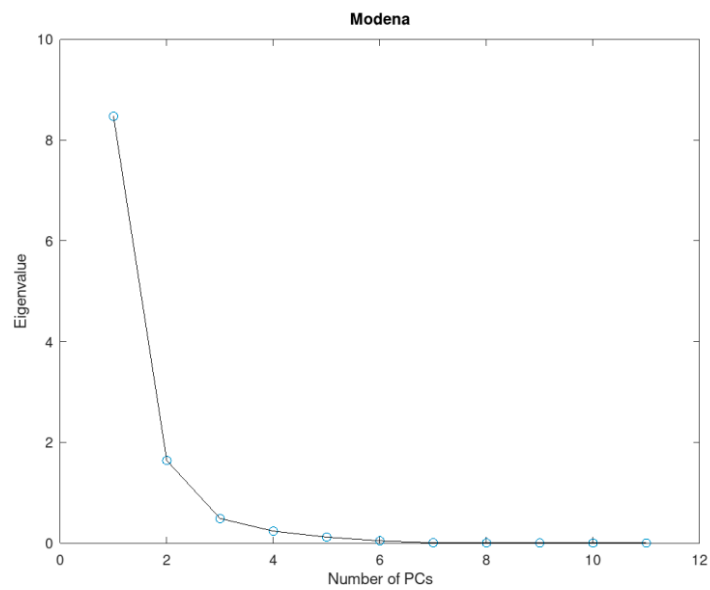
Figure S7. Scree plot – District of Modena.
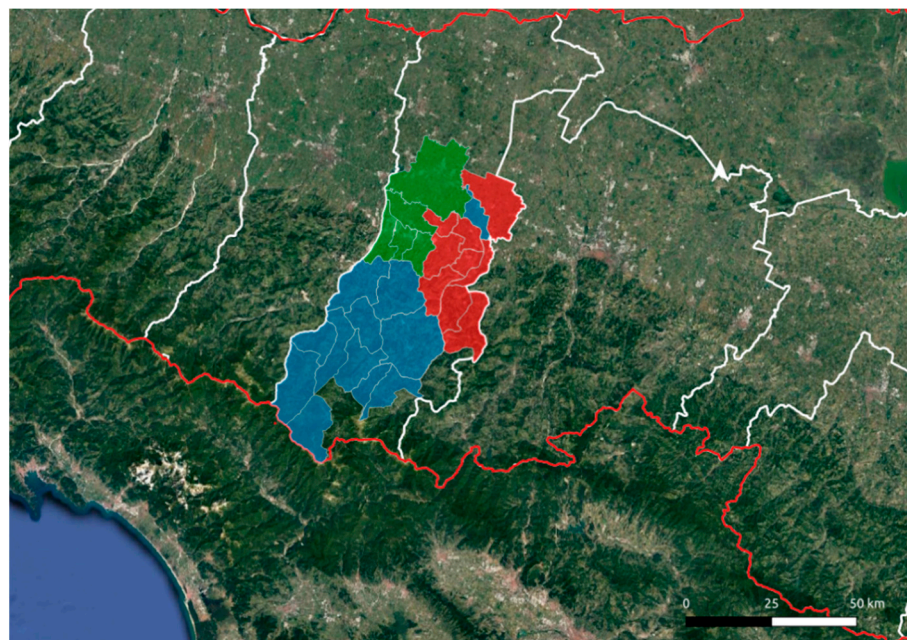
Figure S8. Georeferenced map of the district of Modena with clusters highlighted (red: municipalities belonging to the first cluster; blue: municipality belonging to the second cluster; green: municipalities belonging to the third cluster).

ANNEX V

Table S9. Correlation matrix– District of Rimini.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Bicarbonate Alkalinity	1	0.998	0.962	–0.378	0.494	–0.498	0.845	0.947	0.875	0.741	0.455	0.536	0.839	0.620	0.561
Total Alkalinity	0.998		0.960	–0.388	0.512	–0.512	0.852	0.950	0.868	0.754	0.472	0.535	0.852	0.638	0.564
Calcium	0.962	0.960	1	–0.334	0.520	–0.578	0.874	0.963	0.850	0.721	0.561	0.585	0.848	0.647	0.626
Free Residual Chlorine	–0.378	–0.388	–0.334	1	–0.422	0.547	–0.475	–0.456	–0.368	–0.594	–0.337	–0.442	–0.513	–0.440	–0.525
Chloride	0.494	0.512	0.520	–0.422	1	–0.607	0.833	0.657	0.513	0.794	0.832	0.594	0.824	0.940	0.533
pH	–0.498	–0.512	–0.578	0.547	–0.607	1	–0.683	–0.654	–0.354	–0.673	–0.714	–0.537	–0.688	–0.618	–0.611
Conductivity	0.845	0.852	0.874	–0.475	0.833	–0.683	1	0.954	0.832	0.923	0.749	0.784	0.983	0.916	0.775
Water Hardness	0.947	0.950	0.963	–0.456	0.657	–0.654	0.954	1	0.867	0.870	0.644	0.716	0.945	0.776	0.739
Fluoride	0.875	0.868	0.850	–0.368	0.513	–0.354	0.832	0.867	1	0.733	0.431	0.699	0.818	0.673	0.650
Magnesium	0.741	0.754	0.721	–0.594	0.794	–0.673	0.923	0.870	0.733	1	0.685	0.809	0.948	0.879	0.818
Nitrate	0.455	0.472	0.561	–0.337	0.832	–0.714	0.749	0.644	0.431	0.685	1	0.551	0.768	0.754	0.477
Potassium	0.536	0.535	0.585	–0.442	0.594	–0.537	0.784	0.716	0.699	0.809	0.551	1	0.778	0.731	0.882
Dry Residue	0.839	0.852	0.848	–0.513	0.824	–0.688	0.983	0.945	0.818	0.948	0.768	0.778	1	0.904	0.771
Sodium	0.620	0.638	0.647	–0.440	0.940	–0.618	0.916	0.776	0.673	0.879	0.754	0.731	0.904	1	0.724
Sulphate	0.561	0.564	0.626	–0.525	0.533	–0.611	0.775	0.739	0.650	0.818	0.477	0.882	0.771	0.724	1

Table S10. Eigenvalues of each Principal Component and variance explained– District of Rimini.

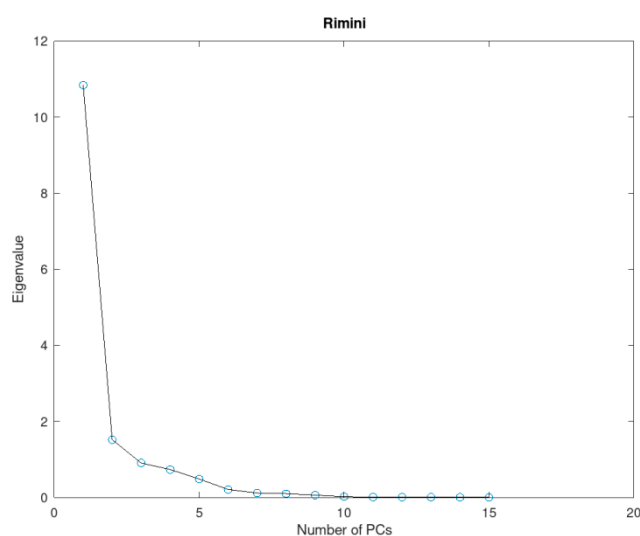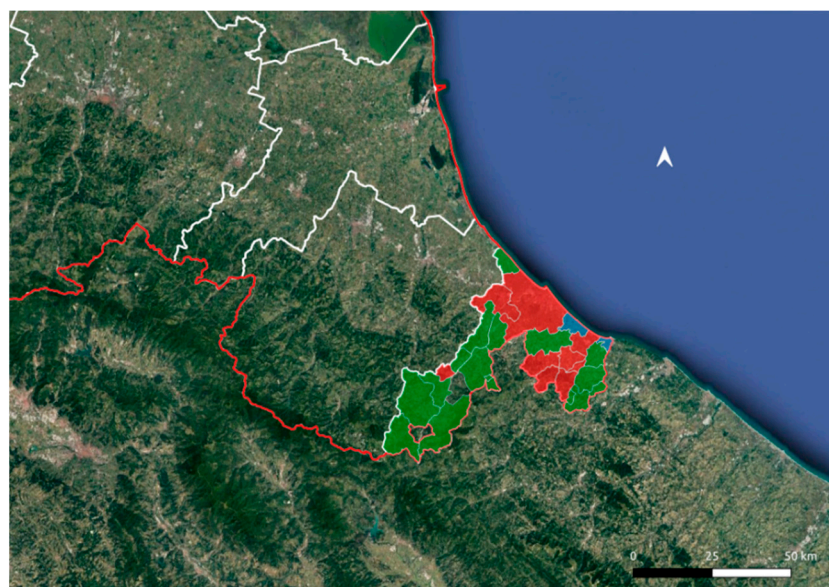| Principal Component	Eigenvalues	% Variance	Cumulated Variance
PC1	10.84	72.26	72.26
PC2	1.52	10.12	82.38
PC3	0.90	6.02	88.40
PC4	0.73	4.88	93.29
PC5	0.48	3.22	96.51
PC6	0.21	1.39	97.89
PC7	0.12	0.77	98.66
PC8	0.10	0.66	99.32
PC9	0.06	0.40	99.71
PC10	0.02	0.12	99.84
PC11	0.01	0.08	99.91
PC12	0.01	0.05	99.96
PC13	0.00	0.02	99.98
PC14	0.00	0.02	100
PC15	0.00	0.00	100

Figure S9. Scree plot – District of Rimini.

Figure S10. Georeferenced map of the district of Rimini with clusters highlighted (red: municipalities belonging to the first cluster; blue: municipality belonging to the second cluster; green: municipalities belonging to the third cluster).

ANNEX VI

Table S11. Correlation matrix–District of Ravenna.

|	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bicarbonate Alkalinity	1	0.999	0.927	0.112	–0.361	0.486	0.854	0.555	0.648	–0.098	0.375	0.515	0.306	0.141
Total Alkalinity	0.999	1	0.927	0.128	–0.370	0.497	0.856	0.556	0.631	–0.084	0.381	0.527	0.321	0.147
Calcium	0.927	0.927	1	0.329	–0.081	0.688	0.975	0.749	0.355	0.208	0.638	0.725	0.488	0.459
Chloride	0.112	0.128	0.329	1	0.603	0.909	0.523	0.832	–0.526	0.926	0.883	0.861	0.979	0.878
pH	–0.361	–0.370	–0.081	0.603	1	0.423	0.087	0.435	–0.640	0.748	0.506	0.350	0.482	0.664
Conductivity	0.486	0.497	0.688	0.909	0.423	1	0.827	0.973	–0.258	0.807	0.967	0.981	0.963	0.887
Water Hardness	0.854	0.856	0.975	0.523	0.087	0.827	1	0.875	0.186	0.409	0.786	0.843	0.660	0.629
Magnesium	0.555	0.556	0.749	0.832	0.435	0.973	0.875	1	–0.170	0.748	0.961	0.939	0.901	0.874
Manganese	0.648	0.631	0.355	–0.526	–0.640	–0.258	0.186	–0.170	1	–0.762	–0.405	–0.229	–0.367	–0.609
Nitrate	–0.098	–0.084	0.208	0.926	0.748	0.807	0.409	0.748	–0.762	1	0.867	0.762	0.858	0.946
Potassium	0.375	0.381	0.638	0.883	0.506	0.967	0.786	0.961	–0.405	0.867	1	0.950	0.913	0.965
Dry Residue	0.515	0.527	0.725	0.861	0.350	0.981	0.843	0.939	–0.229	0.762	0.950	1	0.919	0.864
Sodium	0.306	0.321	0.488	0.979	0.482	0.963	0.660	0.901	–0.367	0.858	0.913	0.919	1	0.856
Sulphate	0.141	0.147	0.459	0.878	0.664	0.887	0.629	0.874	–0.609	0.946	0.965	0.864	0.856	1

Table S12. Eigenvalues of each Principal Component and variance explained– District of Ravenna.

Principal Component	Eigenvalues	% Variance	Cumulated Variance
PC1	9.031	64.504	64.504
PC2	4.110	29.356	93.859
PC3	0.432	3.087	96.947
PC4	0.326	2.329	99.276
PC5	0.053	0.376	99.652
PC6	0.044	0.313	99.966
PC7	0.005	0.034	100.000
PC8	0.000	0.000	100.000
PC9	0.000	0.000	100.000
PC10	0.000	0.000	100.000
PC11	0.000	0.000	100.000
PC12	0.000	0.000	100.000
PC13	0.000	0.000	100.000
PC14	0.000	0.000	100.000
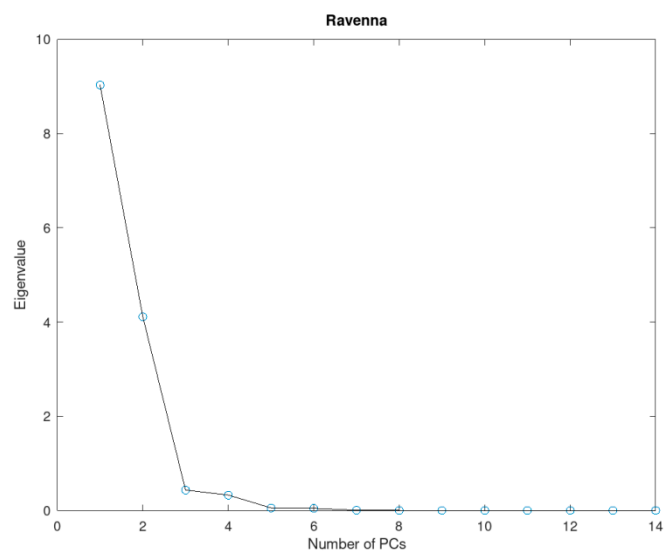
Figure 11. Scree plot – District of Ravenna.
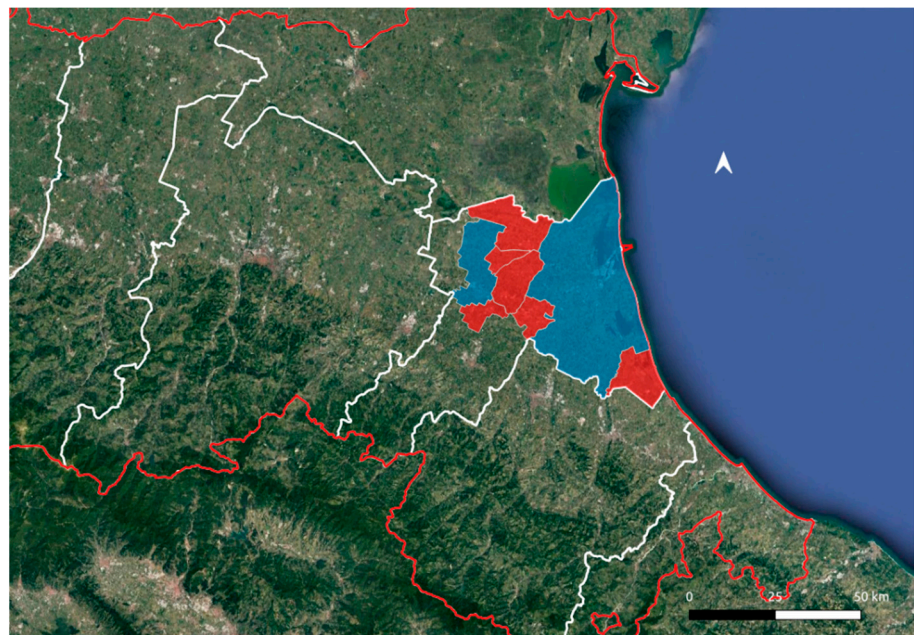
Figure S12. Georeferenced map of the district of Ravenna with clusters highlighted (red: municipalities belonging to the first cluster; blue: municipality belonging to the second cluster; green: municipalities belonging to the third cluster).

ANNEX VII

Table S13. Correlation matrix– District of Imola–Faenza.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bicarbonate Alkalinity	1	0.999	0.925	0.505	–0.672	0.935	0.950	0.670	0.940	0.632	0.566	0.934	0.590	0.515
Total Alkalinity	0.999	1	0.925	0.500	–0.673	0.933	0.951	0.666	0.940	0.628	0.564	0.933	0.585	0.515
Calcium	0.925	0.925	1	0.346	–0.840	0.869	0.989	0.416	0.894	0.774	0.424	0.886	0.382	0.740
Chloride	0.505	0.500	0.346	1	–0.287	0.745	0.398	0.791	0.478	0.338	0.948	0.710	0.981	–0.011
pH	–0.672	–0.673	–0.840	–0.287	1	–0.677	–0.784	–0.223	–0.605	–0.824	–0.272	–0.692	–0.261	–0.610
Conductivity	0.935	0.933	0.869	0.745	–0.677	1	0.904	0.734	0.914	0.667	0.796	0.995	0.783	0.504
Water Hardness	0.950	0.951	0.989	0.398	–0.784	0.904	1	0.471	0.950	0.732	0.499	0.924	0.445	0.741
Fluoride	0.670	0.666	0.416	0.791	–0.223	0.734	0.471	1	0.568	0.133	0.723	0.685	0.874	–0.084
Magnesium	0.940	0.940	0.894	0.478	–0.605	0.914	0.950	0.568	1	0.582	0.618	0.937	0.548	0.686
Nitrate	0.632	0.628	0.774	0.338	–0.824	0.667	0.732	0.133	0.582	1	0.371	0.680	0.306	0.582
Potassium	0.566	0.564	0.424	0.948	–0.272	0.796	0.499	0.723	0.618	0.371	1	0.778	0.934	0.178
Dry Residue	0.934	0.933	0.886	0.710	–0.692	0.995	0.924	0.685	0.937	0.680	0.778	1	0.744	0.563
Sodium	0.590	0.585	0.382	0.981	–0.261	0.783	0.445	0.874	0.548	0.306	0.934	0.744	1	–0.033
Sulphate	0.515	0.515	0.740	–0.011	–0.610	0.504	0.741	–0.084	0.686	0.582	0.178	0.563	–0.033	1

Table S14. Eigenvalues of each Principal Component and variance explained– District of Imola–Faenza.

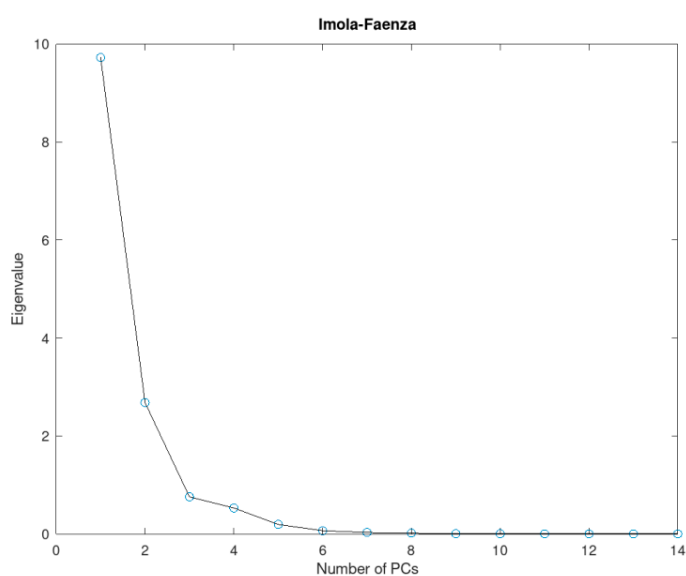| Principal Component.	Eigenvalues	% Variance	Cumulated Variance
PC1	9.725	69.461	69.461
PC2	2.681	19.149	88.609
PC3	0.757	5.405	94.014
PC4	0.529	3.778	97.792
PC5	0.193	1.376	99.168
PC6	0.065	0.465	99.633
PC7	0.029	0.207	99.840
PC8	0.016	0.111	99.951
PC9	0.003	0.019	99.971
PC10	0.002	0.013	99.983
PC11	0.001	0.004	99.988
PC12	0.001	0.004	99.991
PC13	0.000	0.000	100
PC14	0.000	0.000	100

Figure S13. Scree plot – District of Imola–Faenza.
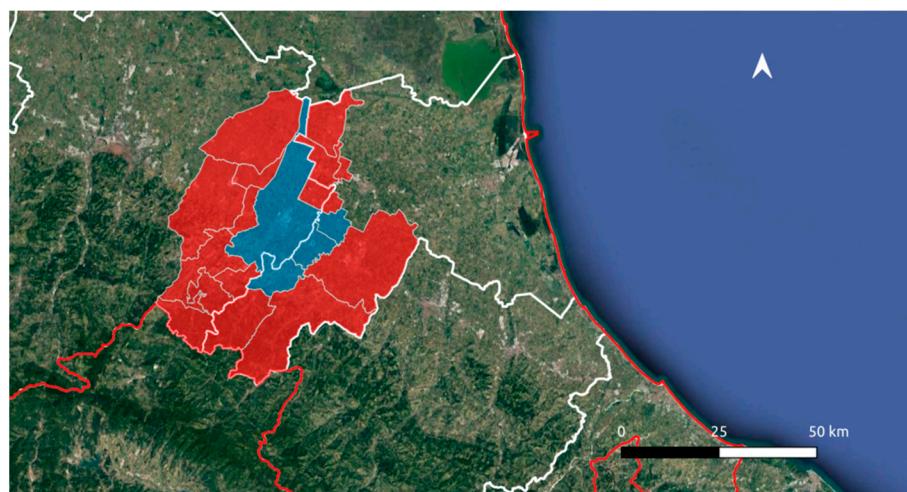
Figure S14. Georeferenced map of the district of Imola–Faenza with clusters highlighted (red: municipalities belonging to the first cluster; blue: municipality belonging to the second cluster; green: municipalities belonging to the third cluster).