

Supplementary table S1. Area and proportion of the land use types of the study area in 1990, 2000, 2010, 2015, and 2018.

Re- gion	Land use Type		1990		2000		2010		2015		2018	
			Ar- ea/km ²	Propor- tion/%	Ar- ea/km ²	Propor- tion/%	Ar- ea/km ²	Propor- tion/%	Ar- ea/km ²	Propor- tion/%	Area/km ²	Propor- tion/%
HRB	Food secu- rity land	Farmland	9861.13	66.03	9674.89	64.78	9388.57	62.87	9251.77	61.95	9033.73	60.49
		Woodland	1281.43	8.58	1281.25	8.58	1244.24	8.33	1246.25	8.34	1249.41	8.37
	Ecological conserva- tion land	Grassland	1920.05	12.86	1919.16	12.85	1872.81	12.54	1871.92	12.53	1874.61	12.55
		Water	132.82	0.89	132.62	0.89	124.07	0.83	128.28	0.86	137.28	0.92
		Unused land	27.12	0.18	21.00	0.14	1.50	0.01	1.50	0.01	1.50	0.01
	Production and living land	Urban land	308.92	2.07	482.09	3.23	722.68	4.84	793.33	5.31	920.21	6.16
		Rural set- tlement	1334.85	8.94	1345.63	9.01	1428.03	9.56	1445.26	9.68	1475.53	9.88
		Other con- struction land	68.02	0.46	77.72	0.52	152.43	1.02	196.02	1.31	242.06	1.62
HURB	Food secu- rity land	Farmland	63195.49	73.19	63030.26	73.00	62009.76	71.81	61609.66	71.35	60434.00	69.99
		Woodland	8768.31	10.15	8819.80	10.21	9027.16	10.45	9018.55	10.44	9006.28	10.43
	Ecological conserva- tion land	Grassland	2423.71	2.81	1881.01	2.18	1654.02	1.92	1647.94	1.91	1668.91	1.93
		Water	1788.62	2.07	1826.00	2.11	1953.43	2.26	1970.62	2.28	1992.71	2.31
		Unused land	6.83	0.01	5.73	0.01	1.66	0.00	2.20	0.00	2.86	0.00
	Production and living land	Urban land	718.40	0.83	1162.14	1.35	2022.39	2.34	2221.14	2.57	2611.18	3.02
		Rural set- tlement	9322.49	10.80	9372.23	10.85	9297.06	10.77	9367.28	10.85	9823.81	11.38
		Other con- struction land	121.68	0.14	249.62	0.29	381.26	0.44	509.34	0.59	806.74	0.93
YERB	Food secu- rity land	Farmland	20043.68	54.86	20438.80	55.94	20082.97	54.96	19917.28	54.51	19786.92	54.15
		Woodland	8331.05	22.80	8299.92	22.72	8272.24	22.64	8271.66	22.64	8264.48	22.62
	Ecological conserva- tion land	Grassland	4073.79	11.15	3983.76	10.90	3577.08	9.79	3574.30	9.78	3574.99	9.78
		Water	1376.69	3.77	936.73	2.56	1162.56	3.18	1173.56	3.21	1089.05	2.98
		Unused land	139.35	0.38	58.90	0.16	13.81	0.04	13.90	0.04	25.15	0.07
	Production and living land	Urban land	209.33	0.57	350.31	0.96	751.85	2.06	824.97	2.26	889.75	2.44
		Rural set- tlement	2250.81	6.16	2305.45	6.31	2452.42	6.71	2466.32	6.75	2525.74	6.91
		Other con- struction land	112.94	0.31	163.83	0.45	224.81	0.62	295.75	0.81	381.64	1.04
YARB	Food secu- rity land	Farmland	14914.11	54.05	14958.95	54.22	14734.26	53.40	14665.78	53.15	14390.5204	52.16
		Woodland	8455.38	30.64	8536.92	30.94	8563.72	31.04	8562.37	31.03	8549.8052	30.99
	Ecological conserva- tion land	Grassland	1854.91	6.72	1678.66	6.08	1765.20	6.40	1765.21	6.40	1738.5799	6.30
		Water	708.95	2.57	627.40	2.27	736.97	2.67	740.17	2.68	880.6556	3.19
		Unused land	0.00	0.00	0.00	0.00	0.62	0.00	0.62	0.00	0.6684	0.00
	Production and living land	Urban land	86.51	0.31	167.10	0.61	233.55	0.85	271.62	0.98	328.416	1.19
		Rural set- tlement	1561.91	5.66	1597.28	5.79	1520.74	5.51	1530.09	5.55	1589.5856	5.76
		Other con- struction land	10.05	0.04	25.51	0.09	36.74	0.13	55.94	0.20	113.5494	0.41

Supplementary table S2. Quantity and proportion of changes of the land use types of the study area in 1990–2018.

Re- gion	Land use Type		1990–2000		2000–2010		2010–015		2015–2018		1990–2018	
			Ar- ea/km²	Propor- tion/%	Ar- ea/km²	Propor- tion/%	Ar- ea/km²	Propor- tion/%	Ar- ea/km²	Propor- tion/%	Ar- ea/km²	Propor- tion/%
HRB	Food secu- rity land	Farmland	−186.23	−1.25	−286.32	−1.92	−136.80	−0.92	−218.04	−1.46	−827.39	−5.54
		Woodland	−0.18	0.00	−37.01	−0.25	2.01	0.01	3.16	0.02	−32.01	−0.21
	Ecological conserva- tion land	Grassland	−0.89	−0.01	−46.35	−0.31	−0.89	−0.01	2.69	0.02	−45.44	−0.30
		Water	−0.20	0.00	−8.55	−0.06	4.21	0.03	8.99	0.06	4.45	0.03
		Unused land	−6.12	−0.04	−19.50	−0.13	0.00	0.00	−0.01	0.00	−25.62	−0.17
	Production and living land	Urban land	173.17	1.16	240.59	1.61	70.65	0.47	126.88	0.85	611.29	4.09
		Rural set- tlement	10.77	0.07	82.40	0.55	17.23	0.12	30.27	0.20	140.68	0.94
HURB	Food secu- rity land	Other con- struction land	9.70	0.06	74.71	0.50	43.59	0.29	46.04	0.31	174.04	1.17
		Farmland	−165.23	−0.19	−1020.51	−1.18	−400.09	−0.46	−1175.66	−1.36	−2761.50	−3.20
	Ecological conserva- tion land	Woodland	51.49	0.06	207.36	0.24	−8.61	−0.01	−12.27	−0.01	237.97	0.28
		Grassland	−542.70	−0.63	−226.99	−0.26	−6.08	−0.01	20.97	0.02	−754.80	−0.87
		Water	37.37	0.04	127.44	0.15	17.19	0.02	22.09	0.03	204.09	0.24
	Production and living land	Unused land	−1.10	0.00	−4.07	0.00	0.54	0.00	0.66	0.00	−3.97	0.00
		Urban land	443.74	0.51	860.25	1.00	198.75	0.23	390.04	0.45	1892.78	2.19
YERB	Food secu- rity land	Rural set- tlement	49.74	0.06	−75.17	−0.09	70.22	0.08	456.53	0.53	501.32	0.58
		Other con- struction land	127.94	0.15	131.64	0.15	128.08	0.15	297.40	0.34	685.06	0.79
	Ecological conserva- tion land	Farmland	395.13	1.08	−355.83	−0.97	−165.69	−0.45	−130.36	−0.36	−256.76	−0.70
		Woodland	−31.13	−0.09	−27.68	−0.08	−0.58	0.00	−7.18	−0.02	−66.57	−0.18
		Grassland	−90.03	−0.25	−406.68	−1.11	−2.78	−0.01	0.69	0.00	−498.80	−1.37
	Production and living land	Water	−439.95	−1.20	225.83	0.62	10.99	0.03	−84.50	−0.23	−287.63	−0.79
		Unused land	−80.46	−0.22	−45.09	−0.12	0.09	0.00	11.25	0.03	−114.21	−0.31
YARB	Food secu- rity land	Urban land	140.98	0.39	401.55	1.10	73.12	0.20	64.78	0.18	680.42	1.86
		Rural set- tlement	54.64	0.15	146.97	0.40	13.90	0.04	59.42	0.16	274.93	0.75
	Ecological conserva- tion land	Other con- struction land	50.90	0.14	60.98	0.17	70.94	0.19	85.89	0.24	268.71	0.74
		Farmland	44.84	0.16	−224.69	−0.81	−68.48	−0.25	−275.26	−1.00	−523.59	−1.90
		Woodland	81.53	0.30	26.80	0.10	−1.34	0.00	−12.57	−0.05	94.42	0.34
	Production and living land	Grassland	−176.25	−0.64	86.54	0.31	0.01	0.00	−26.63	−0.10	−116.33	−0.42
		Water	−81.55	−0.30	109.57	0.40	3.19	0.01	140.49	0.51	171.70	0.62
YARB	Food secu- rity land	Unused land	0.00	0.00	0.62	0.00	0.00	0.00	0.04	0.00	0.67	0.00
		Urban land	80.60	0.29	66.45	0.24	38.07	0.14	56.80	0.21	241.91	0.88
	Ecological conserva- tion land	Rural set- tlement	35.37	0.13	−76.54	−0.28	9.35	0.03	59.49	0.22	27.68	0.10
		Other con- struction land	15.46	0.06	11.23	0.04	19.20	0.07	57.61	0.21	103.50	0.38
		Production and living land	Farmland	−186.23	−1.25	−286.32	−1.92	−136.80	−0.92	−218.04	−1.46	−827.39
	Woodland		−0.18	0.00	−37.01	−0.25	2.01	0.01	3.16	0.02	−32.01	−0.21
	Ecological conserva- tion land	Grassland	−0.89	−0.01	−46.35	−0.31	−0.89	−0.01	2.69	0.02	−45.44	−0.30
Water		−0.20	0.00	−8.55	−0.06	4.21	0.03	8.99	0.06	4.45	0.03	
Unused land		−6.12	−0.04	−19.50	−0.13	0.00	0.00	−0.01	0.00	−25.62	−0.17	
Production and living land	Urban land	173.17	1.16	240.59	1.61	70.65	0.47	126.88	0.85	611.29	4.09	
	Rural set- tlement	10.77	0.07	82.40	0.55	17.23	0.12	30.27	0.20	140.68	0.94	
Other con- struction land	Other con- struction land	9.70	0.06	74.71	0.50	43.59	0.29	46.04	0.31	174.04	1.17	
	Food secu- rity land	Farmland	−165.23	−0.19	−1020.51	−1.18	−400.09	−0.46	−1175.66	−1.36	−2761.50	−3.20
Ecological conserva- tion land	Woodland	51.49	0.06	207.36	0.24	−8.61	−0.01	−12.27	−0.01	237.97	0.28	
	Grassland	−542.70	−0.63	−226.99	−0.26	−6.08	−0.01	20.97	0.02	−754.80	−0.87	
	Water	37.37	0.04	127.44	0.15	17.19	0.02	22.09	0.03	204.09	0.24	
Unused land	Unused land	−1.10	0.00	−4.07	0.00	0.54	0.00	0.66	0.00	−3.97	0.00	
	Urban land	443.74	0.51	860.25	1.00	198.75	0.23	390.04	0.45	1892.78	2.19	
Production and living land	Rural set- tlement	49.74	0.06	−75.17	−0.09	70.22	0.08	456.53	0.53	501.32	0.58	
	Other con- struction land	127.94	0.15	131.64	0.15	128.08	0.15	297.40	0.34	685.06	0.79	
YERB	Food secu- rity land	Farmland	395.13	1.08	−355.83	−0.97	−165.69	−0.45	−130.36	−0.36	−256.76	−0.70
		Woodland	−31.13	−0.09	−27.68	−0.08	−0.58	0.00	−7.18	−0.02	−66.57	−0.18
	Ecological conserva- tion land	Grassland	−90.03	−0.25	−406.68	−1.11	−2.78	−0.01	0.69	0.00	−498.80	−1.37
		Water	−439.95	−1.20	225.83	0.62	10.99	0.03	−84.50	−0.23	−287.63	−0.79
		Unused land	−80.46	−0.22	−45.09	−0.12	0.09	0.00	11.25	0.03	−114.21	−0.31
	Production and living land	Urban land	140.98	0.39	401.55	1.10	73.12	0.20	64.78	0.18	680.42	1.86
		Rural set- tlement	54.64	0.15	146.97	0.40	13.90	0.04	59.42	0.16	274.93	0.75
YARB	Food secu- rity land	Other con- struction land	50.90	0.14	60.98	0.17	70.94	0.19	85.89	0.24	268.71	0.74
		Farmland	44.84	0.16	−224.69	−0.81	−68.48	−0.25	−275.26	−1.00	−523.59	−1.90
	Ecological conserva- tion land	Woodland	81.53	0.30	26.80	0.10	−1.34	0.00	−12.57	−0.05	94.42	0.34
		Grassland	−176.25	−0.64	86.54	0.31	0.01	0.00	−26.63	−0.10	−116.33	−0.42
		Water	−81.55	−0.30	109.57	0.40	3.19	0.01	140.49	0.51	171.70	0.62
	Production and living land	Unused land	0.00	0.00	0.62	0.00	0.00	0.00	0.04	0.00	0.67	0.00
		Urban land	80.60	0.29	66.45	0.24	38.07	0.14	56.80	0.21	241.91	0.88
Other con- struction land	Rural set- tlement	35.37	0.13	−76.54	−0.28	9.35	0.03	59.49	0.22	27.68	0.10	
	Other con- struction land	15.46	0.06	11.23	0.04	19.20	0.07	57.61	0.21	103.50	0.38	