

Supplementary Material for

An assessment of the Ecological Conservation Redline: Unlocking priority areas for conservation

Author

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Supplementary Method

In this paper, water conservation was calculated by precipitation and evapotranspiration according to the InVEST model (Wang et al., 2021). First, we estimated precipitation from the year 2000-2018. Second, PET(x) was calculated using the Hargreaves formula to indicate potential evapotranspiration, based on daily temperatures and solar radiation in 2018. Finally, PAWC(x) was calculated based on the content of sand, powder, clay and organic matter in the soil data. Meanwhile, Z was taken as 10 after debugging with reference to previous studies (Zhang, Dawes, & Walker, 2001). The formula is as follows:

$$S_{water} = (1 - \frac{AET_{(x)}}{P_{(x)}}) * P_{(x)}$$
$$\frac{AET_{(x)}}{P_{(x)}} = 1 + \frac{PET_{(x)}}{P_{(x)}} - [1 + (\frac{PET_{(x)}}{P_{(x)}})^w]^{\frac{1}{w}}$$
$$PET_{(x)} = K_{c(x)} * ET_{o(x)}$$
$$W_{(x)} = \frac{PAWC_{(x)} * Z}{P_{(x)}} + 1.25$$

Soil conservation was calculated using the NPP index to estimate the capacity to maintain the soil. We calculated the Net Primary Productivity (NPP) on the ENVI platform. Then, F_{slo} was calculated in ArcGIS based on the elevation data. K was calculated based on the content of sand, powder, clay and organic matter in the soil data. The calculation formula is as follows:

$$S_{soil} = NPP_{mean} * (1 - K) * (1 - F_{slo})$$

We calculated biodiversity by NPP index (Costanza, Fisher, Mulder, Liu, & Christopher, 2007). Input data includes mean precipitation (F_{pre}), the average mean (F_{tem}) in 2000-2018, and elevation factors (F_{alt}). The calculation formula is as follows:

$$S_{bio} = NPP_{mean} * F_{pre} * F_{tem} * (1 - F_{alt})$$

Carbon storage was calculated according to the InVEST model, by summing the carbon stocks of the four-carbon pools including above-ground (C_{above}) and below-ground biomass (C_{below}), organics in soil (C_{soil}), and dead organics (C_{dead}) (Chuai et al., 2013).

$$S_{carbon} = C_{below} + C_{above} + C_{soil} + C_{dead}$$

Soil erosion was calculated using the Revised Universal Soil Loss Equation for ecological vulnerability (Renard, Foster, Weesies, & Porter, 1991). R was estimated based on the average rainfall from 2000-2018 to reveal the degree of precipitation erosion, K was calculated by the different content in the soil survey to estimate the soil erodibility, L and S were used to reflect the influence of topographic features on soil erosion, and C and P were used to estimate the influence of land cover and management measures (Benavidez, Jackson, Maxwell, & Norton, 2018; Panagos et al., 2015). The equation is as follows:

$$V_{soil} = R * K * L * S * C * P$$

Supplementary Tables

Table S1. Land use in each city.

City	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Hangzhou	2943.24	11443.87	393.77	879.58	1220.84	5.92	16887.22
Huzhou	2446.01	2490.64	83.90	236.12	570.20	2.57	5829.44
Jiaxing	2542.68	40.53	34.10	252.08	1261.13	0.11	4130.63
Jinhua	2949.46	6666.63	231.31	155.50	928.25	3.66	10934.81
Lishui	1489.44	14882.38	326.93	175.93	384.32	11.58	17270.58
Ningbo	3058.79	4009.43	200.19	708.64	1497.55	6.44	9481.04
Quzhou	1860.03	6160.33	311.11	143.74	363.58	3.34	8842.13
Shaoxing	2385.60	4584.48	158.74	283.11	835.22	0.34	8247.49
Taizhou	2397.38	5878.49	318.59	336.01	750.20	21.27	9701.94
Wenzhou	2056.72	7946.59	396.68	401.52	868.20	6.50	11676.21
Zhoushan	253.55	733.81	22.46	75.65	290.37	0	1375.84
Total	24382.90	64837.18	2477.78	3647.88	8969.86	61.73	104377.33

Table S2. ECR areas in each city.

City	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Hangzhou	178.04	4750.95	153.29	525.24	16.68	1.55	5625.75
Huzhou	51.03	726.12	31.09	44.87	4.68	0.39	858.18
Jiaxing	46.30	12.63	0.79	26.92	15.71	0	102.35
Jinhua	150.96	2488.61	87.08	41.65	13.54	1.24	2783.08
Lishui	178.70	5113.68	119.04	35.35	38.18	4.79	5489.74
Ningbo	190.41	1329.39	27.12	81.96	14.76	0.60	1644.24
Quzhou	78.71	2267.10	64.96	46.48	4.70	0.94	2462.89
Shaoxing	110.53	1274.09	30.18	110.67	13.65	0	1539.12
Taizhou	142.55	1590.15	67.38	61.37	8.04	0.04	1869.53
Wenzhou	117.31	2128.61	65.99	40.91	17.85	0.67	2371.34
Zhoushan	8.50	89.51	0.77	5.06	2.63	0	106.47
Total	1253.04	21770.84	647.69	1020.48	150.42	10.22	24852.69

Table S3. Dataset descriptions

Category	Data	Year	Unit	Data source
Land use	Land use	2018	classes	Resource and Environmental Science and Data Center (https://www.resdc.cn/)
Terrain	DEM	2018	m	Geospatial Data Cloud (http://www.gscloud.cn/)
Biophysical	NDVI	2018	/	Landsat-8
	NPP	2018	/	Landsat-8
	Soil factors	2018	/	World Soil Database (http://www.fao.org/soils-portal/soil-survey/soil-maps-and-databases/harmonized-world-soil-database-v12/en/)
	Temperature	1995–2018	°C	China Meteorological Data Service Center (http://data.cma.cn/)
	Precipitation	1995–2018	mm	China Meteorological Data Service Center (http://data.cma.cn/)
Socioeconomic	Roads	2018	km	Open Street Map (http://www.openstreetmap.org/)
	ECR	2018	/	Zhejiang government
	Protected areas	2018	/	Zhejiang government
	Major function zones	2010	/	Zhejiang government

Table S4. Ecological Resistance Factors

Factors	Weight	Classification index	Resistance value
Land use	0.22	Forest	1
		Croplands	3
		Grassland	3
		Water bodies	5
		Unclassified lands	7
		Urban and build-up	9
Elevation	0.14	<50	1
		50–150	3
		150–250	5
		250–350	7
		>350	9
Slope	0.17	<3	1
		3–8	3
		8–15	5
		15–25	7
		>25	9
Distance from roads	0.29	>3500	1
		2500–3500	3
		1500–2500	5
		500–1500	7
		<500	9
Distance from constructed land	0.18	>3500	1
		2500–3500	3
		1500–2500	5
		500–1500	7
		<500	9

Table S5. Land use in Protected Areas (PAs) for each city.

City	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Hangzhou	54.94	1968.61	51.91	497.56	11.87	0.34	2585.23
Huzhou	32.60	216.80	10.95	19.63	2.86	0.14	282.98
Jiaxing	10.32	12.71	4.01	11.91	3.08	0	42.03
Jinhua	40.79	932.07	34.3	27.95	7.83	0.87	1043.81
Lishui	28.81	1155.09	31.1	11.53	3.70	1.40	1231.63
Ningbo	56.66	346.90	7.05	85.22	3.69	0.34	499.86
Quzhou	24.51	725.46	19.07	23.59	0.64	0.14	793.41
Shaoxing	50.63	457.42	12.32	35.16	4.74	0	560.27
Taizhou	46.95	546.19	22.35	15.22	3.65	0	634.36
Wenzhou	206.47	2053.07	73.2	29.06	17.82	0.58	2380.20
Zhoushan	0.33	51.81	0.53	1.52	2.13	0	56.32
Total	553.01	8466.13	266.79	758.35	62.01	3.81	10110.10

Table S6. Land use in Ecological Function Zones (EFZs) for each city.

City	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Hangzhou	27.13	5025.82	19.4	6.15	2.12	0.16	5080.78
Huzhou	0.75	329.58	4.41	0.06	0.06	0	334.86
Jiaxing	0.02	3.94	0.07	0.19	0.13	0	4.35
Jinhua	9.28	1355.41	5.83	0.07	1.06	0.21	1371.86
Lishui	57.59	8961.76	53.34	1.43	12.77	1.23	9088.12
Ningbo	18.72	974.22	3.53	2.11	3.94	0.06	1002.58
Quzhou	8.43	2012.42	8.56	0.11	0.44	0.18	2030.14
Shaoxing	7.76	782.03	3.81	0.2	1.07	0	794.87
Taizhou	19.17	1258.82	11.21	1.09	1.28	0.01	1291.58
Wenzhou	57.43	3677.47	21.6	1.17	6.4	0.12	3764.19
Zhoushan	1	101.1	0.29	0.41	2.07	0	104.87
Total	207.28	24482.57	132.05	12.99	31.34	1.97	24868.2

Table S7. Land use in ecological corridors for each city.

City	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Hangzhou	147.06	192.81	7.1	62.84	43.49	0.22	453.52
Huzhou	48.74	51.96	1.02	13.05	5.06	0.18	120.01
Jiaxing	12.16	0	0	17.74	2.89	0	32.79
Jinhua	308.5	307.65	11.26	19.23	42.24	0.2	689.08
Lishui	10.39	52.16	1.08	2.33	6.44	0	72.4
Ningbo	46.46	34.59	0.69	4.16	11.3	0	97.2
Quzhou	89.98	147.86	15.3	4.71	8.26	0	266.11
Shaoxing	151.62	258.86	12.58	44.48	40.94	0	508.48
Taizhou	18.59	32.26	3.41	0.49	5.38	0	60.13
Wenzhou	11.52	30.69	0.45	6.86	2.46	0	51.98
Zhoushan	0	0	0	0	0	0	0
Total	845.02	1108.84	52.89	175.89	168.46	0.6	2351.7

Table S8. Land use in major function-oriented zones for each county.

Major function-oriented zones	County	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Key eco-function areas	Anji	444.05	1282.75	54.27	25.29	80.77	0.40	1887.53
Key eco-function areas	Changshan	257.84	708.38	78.30	16.42	36.45	0.20	1097.59
Key eco-function areas	Chun'an	304.45	3468.08	147.45	458.40	41.27	0.73	4420.38
Key eco-function areas	Jiande	283.70	1834.00	97.85	53.60	58.04	0.33	2327.52
Key eco-function areas	Jingning	111.82	1738.11	29.68	31.60	28.88	0.33	1940.42
Key eco-function areas	Jinyun	207.77	1217.22	15.19	7.92	52.73	0.10	1500.93
Key eco-function areas	kaihua	269.56	1841.43	94.75	4.49	20.01	0.37	2230.61
Key eco-function areas	Lin'an	370.51	2610.20	49.30	17.39	64.10	0.09	3111.59
Key eco-function areas	Longquan	205.46	2713.95	50.62	12.76	51.25	1.70	3035.74
Key eco-function areas	Pan'an	154.41	971.27	34.01	0.58	26.89	0	1187.16
Key eco-function areas	Pujiang	181.63	633.20	14.35	7.24	56.08	0.34	892.84
Key eco-function areas	Qingtian	254.23	2088.80	43.69	52.82	38.35	0.65	2478.54
Key eco-function areas	Qingyuan	129.76	1698.05	33.36	3.37	28.60	1.33	1894.47
Key eco-function areas	Shengsi	0	53.19	9.48	2.77	19.88	0	85.32
Key eco-function areas	Songyang	194.17	1135.91	19.88	11.73	40.25	2.30	1404.24
Key eco-function areas	Suichang	139.44	2264.19	80.60	16.42	27.52	4.00	2532.17
Key eco-function areas	Taishun	163.68	1540.57	21.18	19.03	25.07	0.06	1769.59
Key eco-function areas	Tiantai	340.13	970.85	40.97	8.92	64.58	0.18	1425.63
Key eco-function areas	Tonglu	259.79	1444.14	29.37	36.72	68.76	0	1838.78
Key eco-function areas	Wencheng	116.50	1104.49	35.64	19.99	18.17	0.82	1295.61
Key eco-function areas	Wuyi	289.48	1191.62	15.92	8.89	76.00	1.13	1583.04
Key eco-function areas	Xianju	333.87	1583.44	30.31	11.72	44.80	0.03	2004.17
Key eco-function areas	Xinchang	283.91	834.13	37.75	10.90	56.33	0	1223.02
Key eco-function areas	Yongjia	384.21	2132.10	59.01	36.74	68.33	3.55	2683.94
Key eco-function areas	Yunhe	71.47	829.88	19.13	22.81	34.36	0.87	978.52
Main agricultural production areas	Haiyan	352.53	22.54	20.59	26.93	117.67	0.11	540.37
Main agricultural production areas	Jiangshan	418.28	1477.59	26.57	22.00	71.21	1.10	2016.75
Main agricultural production areas	Longyou	387.35	621.87	32.86	32.44	68.31	0.69	1143.52
Main agricultural production areas	Pinghu	350.45	4.87	4.53	17.37	175.12	0	552.34
Main agricultural production areas	Qujiang	360.74	1194.53	49.30	57.41	86.72	0.81	1749.51

Major function-oriented zones	County	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Priority development areas	Beilun	151.45	259.62	2.03	15.38	170.58	0.15	599.21
Priority development areas	Binjiang	9.10	5.63	0	11.36	45.42	0.01	71.52
Priority development areas	Changxing	694.45	566.37	8.61	37.61	126.60	0.66	1434.30
Priority development areas	Cixi	659.71	38.72	50.96	301.78	332.05	3.14	1386.36
Priority development areas	Deqing	404.36	351.13	6.76	61.13	116.89	0.40	940.67
Priority development areas	Dinghai	116.58	299.20	3.95	20.44	132.82	0	572.99
Priority development areas	Fuyang	329.37	1257.87	53.64	48.33	139.90	0	1829.11
Priority development areas	Gongshu	10.57	8.55	0.46	1.38	77.98	0.05	98.99
Priority development areas	Haining	431.30	12.72	8.96	105.36	256.57	0	814.91
Priority development areas	Haishu	157.22	300.04	4.51	13.43	119.88	0.13	595.21
Priority development areas	Jiangbei	120.63	8.76	0.11	12.65	67.38	0	209.53
Priority development areas	Jiashan	290.84	0	0.02	50.30	165.30	0	506.46
Priority development areas	Keqiao	249.85	582.52	3.38	60.02	169.95	0.04	1065.76
Priority development areas	Linping	154.27	14.73	2.28	7.56	104.36	0.10	283.30
Priority development areas	Nanhu	270.07	0.07	0	7.04	159.79	0	436.97
Priority development areas	Nanxun	549.86	2.07	1.02	45.45	105.78	0	704.18
Priority development areas	Qiantang	296.66	4.57	2.59	128.04	93.50	0	525.36
Priority development areas	Shangcheng	10.35	7.70	0	12.84	89.65	0.22	120.76
Priority development areas	Shangyu	559.29	502.32	7.00	108.93	185.19	0.05	1362.78
Priority development areas	Tongxiang	487.34	0.06	0	7.25	235.13	0	729.78
Priority development areas	Wuxing	353.29	288.32	13.24	66.64	140.16	1.11	862.76
Priority development areas	Xiaoshan	449.04	264.80	4.75	53.71	226.14	0.42	998.86
Priority development areas	Xihu	84.05	112.32	1.69	28.44	83.65	1.40	311.55
Priority development areas	Xiuzhou	360.15	0.27	0	37.83	151.55	0	549.80
Priority development areas	Yinzhou	245.09	325.08	3.64	48.13	176.14	0.14	798.22
Priority development areas	Yuecheng	175.29	120.97	3.60	42.18	150.06	0.02	492.12
Priority development areas	Yuhang	381.38	411.28	4.39	21.81	128.07	2.57	949.50
Priority development areas	Yuyao	515.92	574.49	30.33	71.79	230.19	0.14	1422.86
Priority development areas	Zhenhai	113.75	8.67	7.45	21.07	99.07	0.23	250.24
Urban development areas	Cangnan	261.97	655.73	40.46	6.29	61.51	0.52	1026.48
Urban development areas	Daishan	57.89	147.84	0.33	25.48	63.57	0	295.11
Urban development areas	Dongtou	28.39	35.94	30.24	44.53	55.73	0	194.83

Major function-oriented zones	County	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Urban development areas	Dongyang	396.37	1097.19	68.13	15.70	180.84	0.69	1758.92
Urban development areas	Fenghua	348.85	783.56	17.40	28.36	85.72	1.16	1265.05
Urban development areas	Huangyan	179.01	709.50	5.53	35.30	62.11	0	991.45
Urban development areas	Jiaojiang	112.25	74.82	14.04	35.33	96.47	0	332.91
Urban development areas	Jindong	295.12	258.10	2.80	20.53	88.57	0.07	665.19
Urban development areas	Kecheng	166.26	316.53	29.33	10.98	80.88	0.17	604.15
Urban development areas	Lanxi	598.07	552.55	43.70	37.81	73.28	0.23	1305.64
Urban development areas	Liandu	175.32	1196.27	34.78	16.50	82.38	0.30	1505.55
Urban development areas	Linhai	503.77	1430.68	55.98	64.28	133.83	0	2188.54
Urban development areas	Longgang	67.30	19.74	1.05	31.39	29.72	0	149.20
Urban development areas	Longwan	42.71	44.17	10.12	68.78	111.15	0	276.93
Urban development areas	Lucheng	49.00	126.88	10.34	32.74	73.22	0.36	292.54
Urban development areas	Luqiao	158.79	44.07	4.06	26.22	74.75	0.43	308.32
Urban development areas	Ninghai	416.46	1026.63	54.05	119.04	106.36	0.46	1723.00
Urban development areas	Ouhai	104.73	264.52	17.74	3.15	76.38	0.33	466.85
Urban development areas	Pingyang	233.65	584.18	53.09	14.42	74.21	0	959.55
Urban development areas	Putuo	79.08	233.58	8.70	26.96	74.10	0	422.42
Urban development areas	Rui'an	318.23	705.40	71.21	61.73	122.87	0.71	1280.15
Urban development areas	Sanmen	277.78	563.45	44.20	90.53	70.24	0.29	1046.49
Urban development areas	Shengzhou	538.58	1085.92	38.97	18.90	102.61	0.05	1785.03
Urban development areas	Wenling	401.70	363.28	39.20	36.38	127.05	0	967.61
Urban development areas	Wucheng	408.78	786.40	33.47	33.79	127.13	0.94	1390.51
Urban development areas	Xiangshan	329.71	683.86	29.71	77.01	110.18	0.89	1231.36
Urban development areas	Yiwu	331.24	555.47	15.97	17.74	187.66	0.26	1108.34
Urban development areas	Yongkang	294.36	620.83	2.96	13.22	111.80	0	1043.17
Urban development areas	Yueqing	286.35	732.87	46.60	62.73	151.84	0.15	1280.54
Urban development areas	Yuhuan	90.08	138.40	84.30	27.33	76.37	20.34	436.82
Urban development areas	Zhuji	578.68	1458.62	68.04	42.18	171.08	0.18	2318.78
Total		24382.90	64837.18	2477.78	3647.88	8969.86	61.73	104377.33

Table S9. Land use in ECR areas for each county.

Major function-oriented zones	County	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Key eco-function areas	Anji	24.45	415.99	28.38	10.86	1.04	0.23	480.95
Key eco-function areas	Changshan	17.64	305.77	11.52	8.7	1.49	0.18	345.3
Key eco-function areas	Chun'an	108.27	2876.77	117.48	423.47	5.71	0.59	3532.29
Key eco-function areas	Jiande	3.48	474.2	10.31	16.17	0.23	0.2	504.59
Key eco-function areas	Jingning	18.55	706.24	11.53	4.25	6.55	0.05	747.17
Key eco-function areas	Jinyun	15.42	257.78	3.07	1.83	2.04	0	280.14
Key eco-function areas	kaihua	25.52	755.67	29.13	0.92	0.27	0.29	811.8
Key eco-function areas	Lin'an	15.66	628.29	10.85	7.83	1.54	0	664.17
Key eco-function areas	Longquan	35.96	1076.04	21.71	3.02	6.88	0.88	1144.49
Key eco-function areas	Pan'an	26.03	398.52	14.72	0.08	3.05	0	442.4
Key eco-function areas	Pujiang	10.03	222.18	6.5	5	1.21	0.06	244.98
Key eco-function areas	Qingtian	22.13	580.87	6.74	4.9	1.32	0.17	616.13
Key eco-function areas	Qingyuan	27.58	784.97	20.67	0.79	11.93	1.24	847.18
Key eco-function areas	Shengsi	0	2.85	0	0	0.24	0	3.09
Key eco-function areas	Songyang	15.16	333.41	6.87	6.94	2.95	1.38	366.71
Key eco-function areas	Suichang	10.01	764.26	31.23	7.59	2.38	0.94	816.41
Key eco-function areas	Taishun	21.22	546.36	6.55	10.39	1.62	0.06	586.2
Key eco-function areas	Tiantai	32.09	303.83	7.93	5.82	2.29	0.01	351.97
Key eco-function areas	Tonglu	5.98	365.69	2.12	15.8	1.07	0	390.66
Key eco-function areas	Wencheng	7.53	398.58	3.6	12.21	1.16	0.19	423.27
Key eco-function areas	Wuyi	11.48	381.77	5.61	2.36	1.55	0.2	402.97
Key eco-function areas	Xianju	38.74	542.89	17.16	4.76	1.87	0.03	605.45
Key eco-function areas	Xinchang	30.93	255.47	5.47	8.59	2.39	0	302.85
Key eco-function areas	Yongjia	19.41	394.16	12.26	0.93	1.71	0	428.47
Key eco-function areas	Yunhe	21.75	315.95	10.67	3.06	2.28	0.05	353.76
Main agricultural production areas	Haiyan	2.73	3.72	0.51	1.46	0.61	0	9.03
Main agricultural production areas	Jiangshan	16.56	475.89	10.22	6.39	1.56	0.29	510.91
Main agricultural production areas	Longyou	8.89	256.71	6.42	4.74	0.33	0.17	277.26
Main agricultural production areas	Pinghu	8.74	3.64	0.04	1.12	1.69	0	15.23
Main agricultural production areas	Qujiang	8.99	420.6	6.71	25.31	0.88	0.01	462.5
Priority development areas	Beilun	1.5	25.87	0.1	0.93	0.23	0	28.63

Major function-oriented zones	County	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Priority development areas	Binjiang	0.07	0	0	6.7	0.38	0	7.15
Priority development areas	Changxing	9.7	133.62	0.52	12.2	2.04	0	158.08
Priority development areas	Cixi	50.22	3.02	0.76	33.98	0.73	0	88.71
Priority development areas	Deqing	12.83	123.56	0.63	6.29	0.97	0.16	144.44
Priority development areas	Dinghai	6.91	35.14	0	3.47	0.58	0	46.1
Priority development areas	Fuyang	9.68	234.74	11.47	17.84	3.25	0	276.98
Priority development areas	Gongshu	0.14	3.99	0.04	0	0.2	0.06	4.43
Priority development areas	Haining	2.81	5.21	0.22	0.68	3.53	0	12.45
Priority development areas	Haishu	4.24	146.82	1.76	3.59	2.7	0	159.11
Priority development areas	Jiangbei	10.25	2.41	0	2.15	1.03	0	15.84
Priority development areas	Jiashan	4.87	0	0.02	5.7	0.31	0	10.9
Priority development areas	Keqiao	4.78	158.65	0.22	31.13	4.17	0	198.95
Priority development areas	Linping	0.21	2.91	0.01	0.2	0.13	0	3.46
Priority development areas	Nanhu	4.99	0	0	1.92	2.6	0	9.51
Priority development areas	Nanxun	0.76	0	0.04	2.61	0.04	0	3.45
Priority development areas	Qiantang	14.16	0	0	4.84	0.11	0	19.11
Priority development areas	Shangcheng	0.03	0.92	0	2.81	0.45	0	4.21
Priority development areas	Shangyu	6.19	79.58	0.22	44.51	1.41	0	131.91
Priority development areas	Tongxiang	12.48	0.06	0	1.31	2.47	0	16.32
Priority development areas	Wuxing	3.29	52.95	1.52	12.91	0.59	0	71.26
Priority development areas	Xiaoshan	1.26	41.68	0.22	4.95	0.61	0	48.72
Priority development areas	Xihu	10	20.29	0.21	20.05	1.92	0.02	52.49
Priority development areas	Xiuzhou	9.68	0	0	14.73	4.5	0	28.91
Priority development areas	Yinzhou	6.33	118.05	1.49	10.59	1.51	0	137.97
Priority development areas	Yuecheng	3.21	18.97	0	5.92	0.66	0	28.76
Priority development areas	Yuhang	9.1	101.47	0.58	4.58	1.08	0.68	117.49
Priority development areas	Yuyao	26.98	288.59	1.07	12.74	3.74	0.14	333.26
Priority development areas	Zhenhai	9.05	0.01	0	0.04	0.01	0	9.11
Urban development areas	Cangnan	17.76	212.21	6.45	2.75	5.1	0.42	244.69
Urban development areas	Daishan	0.55	14.66	0	0.52	0.51	0	16.24
Urban development areas	Dongtou	0.7	2.73	3.87	4.11	0.29	0	11.7
Urban development areas	Dongyang	49.94	430.28	16.63	8.22	4.02	0.11	509.2

Major function-oriented zones	County	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Urban development areas	Fenghua	49.66	261.55	7.58	7.42	2.24	0.1	328.55
Urban development areas	Huangyan	14.7	122.28	0.67	30.99	0.3	0	168.94
Urban development areas	Jiaojiang	0	2.09	0.21	0	0	0	2.3
Urban development areas	Jindong	4.39	31.24	0.21	0.26	0.12	0	36.22
Urban development areas	Kecheng	1.11	52.46	0.96	0.42	0.17	0	55.12
Urban development areas	Lanxi	14.41	108.76	7.67	3.99	1.74	0	136.57
Urban development areas	Liandu	12.14	294.16	6.55	2.97	1.85	0.08	317.75
Urban development areas	Linhai	19.91	322.43	10.92	12.02	0.6	0	365.88
Urban development areas	Longgang	0.01	2.97	0.16	0.04	0.03	0	3.21
Urban development areas	Longwan	1.97	18.86	2.4	3.89	1.04	0	28.16
Urban development areas	Lucheng	5.66	26.59	1.57	2.21	1.79	0	37.82
Urban development areas	Luqiao	0	0.66	0	0	0	0	0.66
Urban development areas	Ninghai	22.02	304.99	5.48	5.33	1.5	0.32	339.64
Urban development areas	Ouhai	19.72	84.28	7.35	1.22	1.51	0	114.08
Urban development areas	Pingyang	10.91	177.47	9.25	0.76	2.57	0	200.96
Urban development areas	Putuo	1.04	36.86	0.77	1.07	1.3	0	41.04
Urban development areas	Rui'an	4.94	116.11	6.13	0.12	0.15	0	127.45
Urban development areas	Sanmen	19.66	192.61	5.63	2.32	1.75	0	221.97
Urban development areas	Shengzhou	26.72	321.61	7.8	4	2.28	0	362.41
Urban development areas	Wenling	11.79	86	4.03	4.86	1.04	0	107.72
Urban development areas	Wucheng	12.31	480.04	27.9	11.4	0.76	0.85	533.26
Urban development areas	Xiangshan	10.16	178.08	8.88	5.19	1.07	0.04	203.42
Urban development areas	Yiwu	9.43	198.7	7.04	2.44	0.16	0.02	217.79
Urban development areas	Yongkang	12.94	237.12	0.8	7.9	0.93	0	259.69
Urban development areas	Yueqing	7.48	148.29	6.4	2.28	0.88	0	165.33
Urban development areas	Yuhuan	5.66	17.36	20.83	0.6	0.19	0	44.64
Urban development areas	Zhuji	38.7	439.81	16.47	16.52	2.74	0	514.24
Total		1253.04	21770.84	647.69	1020.48	150.42	10.22	24852.69

Table S10. Land use in stepping stones for each county.

Major function-oriented zones	County	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Key eco-function areas	Anji	0	0	0	0	0	0	0
Key eco-function areas	Changshan	0	0	0	0	0	0	0
Key eco-function areas	Chun'an	0	0	0	0	0	0	0
Key eco-function areas	Jiande	0.78	6.36	0.47	0.59	0.75	0	8.95
Key eco-function areas	Jingning	0	0	0	0	0	0	0
Key eco-function areas	Jinyun	0	0	0	0	0	0	0
Key eco-function areas	kaihua	0.70	3.97	0	0	0.02	0	4.69
Key eco-function areas	Lin'an	1.87	6.96	0	0.16	0.03	0	9.02
Key eco-function areas	Longquan	0	0	0	0	0	0	0
Key eco-function areas	Pan'an	0	0	0	0	0	0	0
Key eco-function areas	Pujiang	0	0	0	0	0	0	0
Key eco-function areas	Qingtian	0.27	0.66	0	0.19	0	0	1.12
Key eco-function areas	Qingyuan	0	0	0	0	0	0	0
Key eco-function areas	Shengsi	0	0	0	0	0	0	0
Key eco-function areas	Songyang	0.07	1.46	0	0	0	0	1.53
Key eco-function areas	Suichang	0	0	0	0	0	0	0
Key eco-function areas	Taishun	0	0	0	0	0	0	0
Key eco-function areas	Tiantai	2.77	2.61	0.58	0	0.27	0	6.23
Key eco-function areas	Tonglu	0.35	1.74	0.52	0	0	0	2.61
Key eco-function areas	Wencheng	0	0	0	0	0	0	0
Key eco-function areas	Wuyi	2.29	4.36	0	0	0.04	0.02	6.71
Key eco-function areas	Xianju	0	0	0	0	0	0	0
Key eco-function areas	Xinchang	0	0	0	0	0	0	0
Key eco-function areas	Yongjia	0.82	2.06	0.07	1.68	0.06	0	4.69
Key eco-function areas	Yunhe	0	0	0	0	0	0	0
Main agricultural production areas	Haiyan	0	0	0	0	0	0	0
Main agricultural production areas	Jiangshan	0.15	1.07	0	0	0	0	1.22
Main agricultural production areas	Longyou	1.25	1.14	0.06	0	0.37	0	2.82
Main agricultural production areas	Pinghu	0	0	0	0	0	0	0
Main agricultural production areas	Qujiang	0	0	0	0	0	0	0
Priority development areas	Beilun	0	0	0	0	0	0	0

Major function-oriented zones	County	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Priority development areas	Binjiang	0.26	0.28	0	0.21	0.58	0	1.33
Priority development areas	Changxing	0	0	0	0	0	0	0
Priority development areas	Cixi	0	0	0	0	0	0	0
Priority development areas	Deqing	0.08	1.38	0.09	0.05	0	0	1.60
Priority development areas	Dinghai	0	0	0	0	0	0	0
Priority development areas	Fuyang	0	0	0	0	0	0	0
Priority development areas	Gongshu	0	0	0	0	0	0	0
Priority development areas	Haining	4.52	0	0	0.81	1.04	0	6.37
Priority development areas	Haishu	0	0	0	0	0	0	0
Priority development areas	Jiangbei	0	0	0	0	0	0	0
Priority development areas	Jiashan	0	0	0	0	0	0	0
Priority development areas	Keqiao	1.24	2.31	0	1.30	0.36	0	5.21
Priority development areas	Linping	0	0	0	0	0	0	0
Priority development areas	Nanhu	0	0	0	0	0	0	0
Priority development areas	Nanxun	0	0	0	0	0	0	0
Priority development areas	Qiantang	0.02	0	0	3.88	0	0	3.90
Priority development areas	Shangcheng	0	0	0	0	0	0	0
Priority development areas	Shangyu	2.91	0.82	0	0.44	0.30	0	4.47
Priority development areas	Tongxiang	0	0	0	0	0	0	0
Priority development areas	Wuxing	0	0	0	0	0	0	0
Priority development areas	Xiaoshan	1.17	1.67	0	0.10	0.26	0	3.20
Priority development areas	Xihu	0	0	0	0	0	0	0
Priority development areas	Xiuzhou	0	0	0	0	0	0	0
Priority development areas	Yinzhou	0	0	0	0	0	0	0
Priority development areas	Yuecheng	0	0	0	0	0	0	0
Priority development areas	Yuhang	1.44	3.23	0	0.01	0.09	0	4.77
Priority development areas	Yuyao	1.10	3.01	0.06	0.01	0.26	0	4.44
Priority development areas	Zhenhai	0	0	0	0	0	0	0
Urban development areas	Cangnan	0	0	0	0	0	0	0
Urban development areas	Daishan	0	0	0	0	0	0	0
Urban development areas	Dongtou	0	0	0	0	0	0	0
Urban development areas	Dongyang	0.41	2.38	0.94	0	0.74	0	4.47

Major function-oriented zones	County	Cultivated land (km ²)	Forest land (km ²)	Grassland (km ²)	Open water (km ²)	Constructed land (km ²)	Barren land (km ²)	Total
Urban development areas	Fenghua	1.21	2.72	0.16	0	0.24	0	4.33
Urban development areas	Huangyan	0	0	0	0	0	0	0
Urban development areas	Jiaojiang	0	0	0	0	0	0	0
Urban development areas	Jindong	3.04	4.01	0	0.17	0.17	0	7.39
Urban development areas	Kecheng	0.29	0.66	0.09	0	0	0	1.04
Urban development areas	Lanxi	0	0	0	0	0	0	0
Urban development areas	Liandu	0	0	0	0	0	0	0
Urban development areas	Linhai	2.24	8.16	0.90	0	0.14	0	11.44
Urban development areas	Longgang	0	0	0	0	0	0	0
Urban development areas	Longwan	0	0	0	0	0	0	0
Urban development areas	Lucheng	0.25	3.47	0	1.81	0.73	0	6.26
Urban development areas	Luqiao	0	0	0	0	0	0	0
Urban development areas	Ninghai	0.23	1.90	0	0	0	0	2.13
Urban development areas	Ouhai	1.12	1.78	0	0.06	0.61	0	3.57
Urban development areas	Pingyang	0	0	0	0	0	0	0
Urban development areas	Putuo	0	0	0	0	0	0	0
Urban development areas	Rui'an	0	0	0	0	0	0	0
Urban development areas	Sanmen	0	0	0	0	0	0	0
Urban development areas	Shengzhou	4.64	4.68	0	0.67	0.15	0	10.14
Urban development areas	Wenling	0	0	0	0	0	0	0
Urban development areas	Wucheng	0	0	0	0	0	0	0
Urban development areas	Xiangshan	0	0	0	0	0	0	0
Urban development areas	Yiwu	0	0	0	0	0	0	0
Urban development areas	Yongkang	1.41	2.93	0	0.09	0.08	0	4.51
Urban development areas	Yueqing	0	0	0	0	0	0	0
Urban development areas	Yuhuan	0	0	0	0	0	0	0
Urban development areas	Zhuji	2.46	5.44	0	0.38	0.85	0	9.13
Total		41.36	83.22	3.94	12.61	8.14	0.02	149.29

Table S11. Land use in stepping stones for each city.

City	Cultivated land (km²)	Forest land (km²)	Grassland (km²)	Open water (km²)	Constructed land (km²)	Barren land (km²)	Total
Hangzhou	5.89	20.24	0.99	4.95	1.71	0	33.78
Huzhou	0.08	1.38	0.09	0.05	0	0	1.60
Jiaxing	4.52	0	0	0.81	1.04	0	6.37
Jinhua	7.15	13.68	0.94	0.26	1.03	0.02	23.08
Lishui	0.34	2.12	0	0.19	0	0	2.65
Ningbo	2.54	7.63	0.22	0.01	0.50	0	10.90
Quzhou	2.39	6.84	0.15	0	0.39	0	9.77
Shaoxing	11.25	13.25	0	2.79	1.66	0	28.95
Taizhou	5.01	10.77	1.48	0	0.41	0	17.67
Wenzhou	2.19	7.31	0.07	3.55	1.40	0	14.52
Zhoushan	0	0	0	0	0	0	0
Total	41.36	83.22	3.94	12.61	8.14	0.02	149.29

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