Table S1 Sources of remote sensing images

Time	Sensor type	Data source
2000/10/7	Landsat7 ETM	
2005/9/11	Landsat5 mass	
2010/6/21	Landsat5 mass	（http://www.gscloud.cn/search）
2015/10/25	Landsat8 OLI	
2020/4/29	Landsat8 OLI	

Table S2a LULC confusion matrix in 2000−2005（km^2）

2005 / 2000	UGS	Water	Construction land	Bare land	Total	User precision/%
UGS	1059.20	78.97	24.88	26.15	1189.21	89.07
Water	27.18	295.23	0.36	0.64	323.41	91.29
Construction land	106.77	8.54	142.52	21.57	279.39	51.01
Bare land	103.99	9.56	2.71	15.83	132.09	11.99
Total	1297.15	392.29	170.47	64.19	1924.10	-
Producer precision/%	81.66	75.26	83.60	24.66	-	K=59.96%

Table S2b LULC confusion matrix in 2005−2010（km^2）

2010 / 2005	UGS	Water	Construction land	Bare land	Total	User precision/%
UGS	951.87	58.96	21.14	59.62	1091.59	87.20
Water	18.01	255.04	2.41	1.67	277.12	92.03
Construction land	137.54	6.49	248.98	53.56	446.57	55.75
Bare land	81.61	2.82	6.85	17.24	108.53	15.89
Total	1189.02	323.31	279.39	132.09	1923.81	
Producer precision/%	80.05	78.88	89.12	13.06		K=60.13%

Table S2c LULC confusion matrix in 2010−2015（km^2）

2015 / 2010	UGS	Water	Construction land	Bare land	Total	User precision/%
UGS	845.20	21.68	102.90	52.42	1022.20	82.68
Water	27.65	235.60	0.98	0.20	264.42	89.10
Construction land	143.69	18.60	334.41	42.97	539.67	61.97
Bare land	75.17	1.23	8.30	12.95	97.64	13.26
Total	1091.71	277.12	446.59	108.53	1923.94	
Producer precision/%	77.42	85.02	74.88	11.93		K=57.81%

Table S2d LULC confusion matrix in 2005−2010（km^2）

2020 / 2015	UGS	Water	Construction land	Bare land	Total	User precision/%
UGS	682.45	8.75	49.86	30.60	771.65	88.44
Water	6.88	208.42	4.56	0.07	219.94	94.76
Construction land	305.86	47.09	483.73	61.04	897.72	53.88
Bare land	27.20	0.19	1.59	5.94	34.92	17.02
Total	1022.39	264.46	539.73	97.65	1924.23	

Producer precision/%	66.75	78.81	89.62	6.09	K=55.81%

Note: The underlined data indicates the LULC and its area that have remained unchanged for 5 years, and other data indicate the area of the LULC converted to other LULCs in the longitudinal direction and the opposite in the horizontal direction (km^2).

Table S3 Interpretation degree of UGS transformation space on $PM_{2.5}$ change at 2 km scale/%

	2000−2005	2005−2010	2010−2015	2015−2020
minimum	0.208	0.226	0.231	0.535
Average	0.602	0.62	0.705	0.764
standard deviation	0.132	0.139	0.01	0.04
Maximum	0.844	0.868	0.813	0.889
Proportion of R^2 higher than 0.6 (%)	51.04	52.67	83.06	98.38