

Supplementary Material

Table S1: Description of Landsat datasets scene used for land use land cover change detection.

Path/Row	1986		1989		1994		2000		2005		2010		2017	
	Date	Sensor	Date	Sensor	Date	Sensor	Date	Sensor	Date	Sensor	Date	Sensor	Date	Sensor
	YYMNDD*		YYMNDD*		YYMNDD*		YYMNDD*		YYMNDD*		YYMNDD*		YYMNDD*	
120/043	19861105	TM	19891129	TM	19941111	TM	20001103	ETM+	20050306	ETM+	20101209	TM	20171025	OLI
120/044	19861223	TM	19891129	TM	19941111	TM	20001010	TM	20061222	ETM+	20101209	TM	20171110	OLI
121/043	19861214	TM	19891120	TM	19941102	TM	20001102	TM	20051124	ETM+	20101208	ETM+	20171101	OLI
121/044	19861214	TM	19891120	TM	19941102	TM	20000915	TM	20050116	TM	20101208	ETM+	20171101	OLI
121/045	19861214	TM	19891120	TM	19941102	TM	20000915	TM	20051124	ETM+	20101029	TM	20171101	OLI
122/043	19861103	TM	19891108	TM	19941109	TM	19991225	TM	20051123	TM	20101231	ETM+	20171226	OLI
122/044	19861103	TM	19891213	TM	19941024	TM	20000914	ETM+	20051217	ETM+	20101231	ETM+	20171023	OLI
122/045	19861124	TM	19890228	TM	19941024	TM	20001101	ETM+	20051123	TM	20101231	ETM+	20160326	OLI
123/042	19861217	TM	19891204	TM	19941031	TM	20001124	ETM+	20051208	ETM+	20101222	ETM+	20161128	OLI
123/043	19861217	TM	19891204	TM	19941031	TM	20001226	ETM+	20061219	TM	20111225	ETM+	20180323	OLI
123/044	19861228	TM	19891204	TM	19941223	TM	19991224	ETM+	20061219	TM	20111225	ETM+	20171030	OLI
123/045	19861228	TM	19891204	TM	19941031	TM	19991208	ETM+	20051122	ETM+	20101112	TM	20171030	OLI
124/044	19861219	TM	19891125	TM	19941107	TM	20001030	ETM+	20051129	ETM+	20101111	ETM+	20170122	OLI
124/045	19861206	TM	19891030	TM	19961214	TM	20001030	ETM+	20051121	TM	20091124	ETM+	20171208	OLI
124/046	19861028	TM	19891018	TM	19941022	TM	20001123	TM	20061218	ETM+	20101229	ETM+	20161205	OLI

- YYMNDD = Year Month Day

Table S2: Accuracy assessment of classified images for the years 1986, 1989, 1994, 2000, 2005, 2010, and 2017 (where, F = Forest, G = Grassland, W = Water, FP = Fishpond, BU = Built-up, BL = Bareland, and FL = Farmland).

		Reference Pixels								
		F	G	W	FP	BU	BL	FL	Total	UA* (%)
1986 Classified Pixels										
F		137	5	0	0	0	0	9	151	90.73
G		1	33	0	0	0	1	2	37	89.19
W		0	0	24	3	0	0	0	27	88.89
FP		0	0	1	41	2	0	0	44	93.18
BU		0	0	0	1	51	3	0	55	92.73
BL		0	1	0	0	1	24	1	27	88.89
FL		7	1	0	0	0	0	55	63	87.30
Total		145	40	25	45	54	28	67	404	
PA** (%)		94.48	82.50	96.00	91.11	94.44	85.71	82.09		
OA*** (%)		90.35	Kappa coefficient = 0.88							

		Reference Pixels								
		F	G	W	FP	BU	BL	FL	Total	UA* (%)
1989 Classified Pixels										
F		140	3	0	0	0	0	8	151	92.72
G		1	35	0	0	0	2	3	41	85.37
W		0	0	27	1	0	0	0	28	96.43
FP		0	1	2	37	1	0	0	41	90.24
BU		0	0	0	3	45	1	0	49	91.84
BL		0	1	0	0	1	30	1	33	90.91
FL		7	0	0	0	2	0	52	61	85.25
Total		148	40	29	41	49	33	64	404	
PA** (%)		94.59	87.50	93.10	90.24	91.84	90.91	81.25		
OA*** (%)		90.57	Kappa coefficient = 0.88							

		Reference Pixels								
		F	G	W	FP	BU	BL	FL	Total	UA* (%)
1994 Classified Pixels										
F		133	3	0	0	0	0	6	142	93.66
G		2	39	0	0	0	1	3	45	86.67
W		0	0	32	2	0	0	0	34	94.12
FP		2	0	3	42	1	0	0	48	87.50
BU		0	0	0	2	47	1	0	50	94.00
BL		0	1	0	0	1	24	2	28	85.71
FL		5	0	0	3	1	0	48	57	84.21
Total		142	43	35	49	50	26	59	404	
PA** (%)		93.66	90.70	91.43	85.71	94.00	92.31	81.36		
OA*** (%)		90.35	Kappa coefficient = 0.88							

		Reference Pixels								
		F	G	W	FP	BU	BL	FL	Total	UA* (%)
2000 Classified Pixels										
F		148	3	0	0	0	0	9	160	92.50

G	1	30	0	0	0	2	1	34	88.24
W	0	0	23	1	0	0	0	24	95.83
FP	0	0	2	35	1	0	1	39	89.74
BU	0	0	0	1	50	1	0	52	96.15
BL	0	1	0	0	2	23	0	26	88.46
FL	6	0	0	1	2	0	60	69	86.96
Total	155	34	25	38	55	26	71	404	
PA** (%)	95.48	88.24	92.00	92.11	90.91	88.46	84.51		
OA*** (%)	91.34	Kappa coefficient = 0.89							

Reference Pixels									
	F	G	W	FP	BU	BL	FL	Total	UA* (%)
2005 Classified Pixels									
F	127	3	0	0	0	0	7	137	92.7
G	3	29	0	0	0	2	0	34	85.29
W	0	0	35	3	0	0	0	38	92.11
FP	0	0	2	39	2	0	0	43	90.70
BU	0	0	0	2	55	3	0	60	91.67
BL	0	1	0	0	2	22	1	26	84.62
FL	6	0	0	0	1	0	59	66	89.39
Total	136	33	37	44	60	27	67	404	
PA** (%)	93.38	87.88	94.59	88.64	91.67	81.48	88.06		
OA*** (%)	90.59	Kappa coefficient = 0.88							

Reference Pixels									
	F	G	W	FP	BU	BL	FL	Total	UA* (%)
2010 Classified Pixels									
F	141	4	0	0	0	0	7	152	92.76
G	3	28	0	0	0	0	0	31	90.32
W	0	0	35	3	0	0	0	38	92.11
FP	1	0	2	43	1	0	0	47	91.49
BU	0	0	0	1	53	3	0	57	92.98
BL	0	0	0	0	1	19	1	21	90.48
FL	5	0	0	1	2	0	50	58	86.21
Total	150	32	37	48	57	22	58	404	
PA** (%)	94.00	87.50	94.59	89.58	92.98	86.36	86.21		
OA*** (%)	91.34	Kappa coefficient = 0.89							

Reference Pixels									
	F	G	W	FP	BU	BL	FL	Total	UA* (%)
2017 Classified Pixels									
F	129	3	0	0	0	0	8	140	92.14
G	1	35	0	0	0	2	1	39	89.74
W	0	0	25	2	0	0	0	27	92.59
FP	0	0	1	36	1	0	0	38	94.74
BU	0	0	0	1	57	2	0	60	95.00
BL	0	1	0	0	2	31	1	35	88.57
FL	4	0	0	1	2	0	58	65	89.23
Total	134	39	26	40	62	35	68	404	

PA** (%)	96.27	89.74	96.15	90.00	91.94	88.57	85.29
OA*** (%)	91.83	Kappa coefficient = 0.90					
*UA = User Accuracy, **PA = Producer Accuracy, and ***OA= Overall Accuracy							

Table S3: Change detection matrix of land use land cover during different time period (percentage).

1986/1989	F	G	W	FP	BU	BL	FL	Total/PLSE ¹	L*	Tc**	Nc***	ANc****	S*****
F	32.51	0.03	0.06	0.45	0.16	0.03	0.00	33.24	0.71	4.52	3.09	3.09	1.43
G	0.05	0.09	0.00	0.00	0.01	0.00	0.08	0.23	0.14	0.18	-0.10	0.10	0.08
W	0.04	0.00	10.19	0.23	0.04	0.01	0.08	10.59	0.40	0.86	0.06	0.06	0.80
FP	0.13	0.00	0.29	0.58	0.04	0.01	0.20	1.25	0.68	1.59	0.24	0.24	1.35
BU	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.76	0.00	0.59	0.59	0.59	0.00
BL	0.00	0.00	0.02	0.01	0.03	0.09	0.23	0.38	0.29	0.41	-0.18	0.18	0.23
FL	3.58	0.00	0.10	0.23	0.31	0.07	49.26	53.54	4.26	4.85	-3.67	3.67	1.18
Total/PLSL ²	36.32	0.13	10.65	1.50	1.35	0.20	49.85	100					
G*****	3.81	0.04	0.46	0.92	0.59	0.11	0.59						
Persistence = 93.48%, Total change = 6.51%, Absolute net change = 3.97%, Swap = 2.54%													
1989/1994													
F	35.35	0.07	0.06	0.47	0.27	0.10	0.00	36.32	0.97	4.25	2.30	2.30	1.94
G	0.02	0.10	0.00	0.00	0.01	0.00	0.00	0.13	0.03	0.11	0.04	0.04	0.07
W	0.07	0.00	10.15	0.30	0.06	0.02	0.04	10.65	0.50	0.98	-0.01	0.01	0.97
FP	0.21	0.00	0.23	0.77	0.11	0.02	0.15	1.50	0.72	1.87	0.42	0.42	1.45
BU	0.00	0.00	0.00	0.00	1.35	0.00	0.00	1.35	0.00	1.43	1.43	1.43	0.00
BL	0.01	0.00	0.02	0.01	0.07	0.05	0.05	0.20	0.15	0.49	0.18	0.18	0.30
FL	2.96	0.00	0.17	0.36	0.92	0.20	45.25	49.85	4.60	4.85	-4.36	4.36	0.48
Total/PLSL ²	38.62	0.18	10.64	1.92	2.77	0.39	45.49	100					
G*****	3.27	0.08	0.49	1.14	1.43	0.33	0.24						
Persistence = 93.02%, Total change = 6.98%, Absolute net change = 4.38%, Swap = 2.61%													
1994/2000													
F	38.05	0.02	0.08	0.22	0.23	0.02	0.00	38.62	0.57	2.50	1.37	1.37	1.14
G	0.08	0.08	0.00	0.00	0.01	0.00	0.00	0.18	0.09	0.12	-0.07	0.07	0.05
W	0.04	0.00	10.12	0.36	0.05	0.01	0.06	10.64	0.52	0.93	-0.11	0.11	0.82
FP	0.19	0.00	0.27	1.06	0.18	0.00	0.21	1.92	0.86	1.57	-0.15	0.15	1.42
BU	0.00	0.00	0.00	0.00	2.77	0.00	0.00	2.77	0.00	1.50	1.50	1.50	0.00
BL	0.01	0.00	0.01	0.01	0.16	0.05	0.14	0.39	0.33	0.43	-0.24	0.24	0.18
FL	1.61	0.00	0.05	0.12	0.86	0.06	42.79	45.48	2.70	3.11	-2.29	2.29	0.82
Total/PLSL ²	39.99	0.11	10.53	1.77	4.27	0.14	43.2	100					
G*****	1.93	0.03	0.41	0.71	1.50	0.09	0.41						
Persistence = 94.92%, Total change = 5.08%, Absolute net change = 2.86%, Swap = 2.22%													
2000/2005													
F	38.98	0.07	0.07	0.26	0.39	0.21	0.00	39.99	1.00	2.85	0.85	0.85	2.00
G	0.04	0.06	0.00	0.00	0.01	0.00	0.00	0.11	0.05	0.20	0.09	0.09	0.11
W	0.10	0.01	9.82	0.40	0.08	0.02	0.09	10.52	0.70	1.14	-0.26	0.26	0.89
FP	0.22	0.03	0.31	0.81	0.16	0.01	0.23	1.77	0.96	1.75	-0.17	0.17	1.58
BU	0.00	0.00	0.00	0.00	4.27	0.00	0.00	4.27	0.00	1.58	1.58	1.58	0.00
BL	0.01	0.00	0.01	0.00	0.02	0.04	0.07	0.14	0.11	0.55	0.33	0.33	0.21
FL	1.48	0.04	0.06	0.13	0.91	0.20	40.38	43.20	2.82	3.20	-2.43	2.43	0.78

Total/PLSL²	40.83	0.20	10.27	1.61	5.85	0.48	40.77	100					
G*****	1.85	0.15	0.44	0.79	1.58	0.44	0.39						

Persistence = 94.36%, Total change = 5.64%, Absolute net change = 2.85%, Swap = 2.78%

2005/2010

F	40.21	0.02	0.09	0.17	0.30	0.04	0.00	40.83	0.62	2.8	1.55	1.55	1.25
G	0.06	0.05	0.01	0.01	0.01	0.00	0.06	0.20	0.16	0.18	-0.13	0.13	0.05
W	0.10	0.00	9.80	0.25	0.06	0.00	0.05	10.26	0.46	0.95	0.03	0.03	0.92
FP	0.18	0.00	0.31	0.69	0.27	0.00	0.15	1.61	0.92	1.48	-0.36	0.36	1.12
BU	0.00	0.00	0.00	0.00	5.85	0.00	0.00	5.85	0.00	2.41	2.41	2.41	0.00
BL	0.03	0.00	0.01	0.01	0.14	0.03	0.25	0.48	0.44	0.52	-0.36	0.36	0.16
FL	1.80	0.00	0.07	0.11	1.63	0.03	37.13	40.77	3.64	4.16	-3.13	3.13	1.02
Total/PLSL²	42.38	0.07	10.29	1.25	8.26	0.11	37.64	100					
G*****	2.17	0.03	0.49	0.56	2.41	0.08	0.51						

Persistence = 93.75%, Total change = 6.25%, Absolute net change = 3.98%, Swap = 2.26%

2010/2017

F	41.59	0.03	0.20	0.16	0.34	0.06	0.00	42.38	0.79	4.21	2.63	2.63	1.58
G	0.03	0.03	0.00	0.00	0.01	0.00	0.00	0.07	0.04	0.11	0.02	0.02	0.08
W	0.11	0.00	9.85	0.21	0.09	0.00	0.03	10.29	0.44	1.10	0.22	0.22	0.88
FP	0.22	0.00	0.37	0.40	0.15	0.01	0.10	1.25	0.85	1.31	-0.40	0.40	0.91
BU	0.00	0.00	0.00	0.00	8.26	0.00	0.00	8.26	0.00	2.05	2.05	2.05	0.00
BL	0.02	0.00	0.00	0.00	0.03	0.02	0.03	0.11	0.09	0.21	0.03	0.03	0.18
FL	3.05	0.02	0.08	0.08	1.44	0.05	32.9	37.64	4.73	4.90	-4.57	4.57	0.34
Total/PLSL²	45.02	0.10	10.51	0.85	10.31	0.14	33.07	100					
G*****	3.42	0.07	0.66	0.46	2.05	0.12	0.17						

Persistence = 93.06%, Total change = 6.94%, Absolute net change = 4.96%, Swap = 1.98%

¹PLSE = Percentage of earlier landscape, ²PLSL = Percentage of later landscape, *L = Loss, **Tc = Total change,

Nc = Net change, *ANc = Absolute net change, *****S = Swap, and *****G= Gain

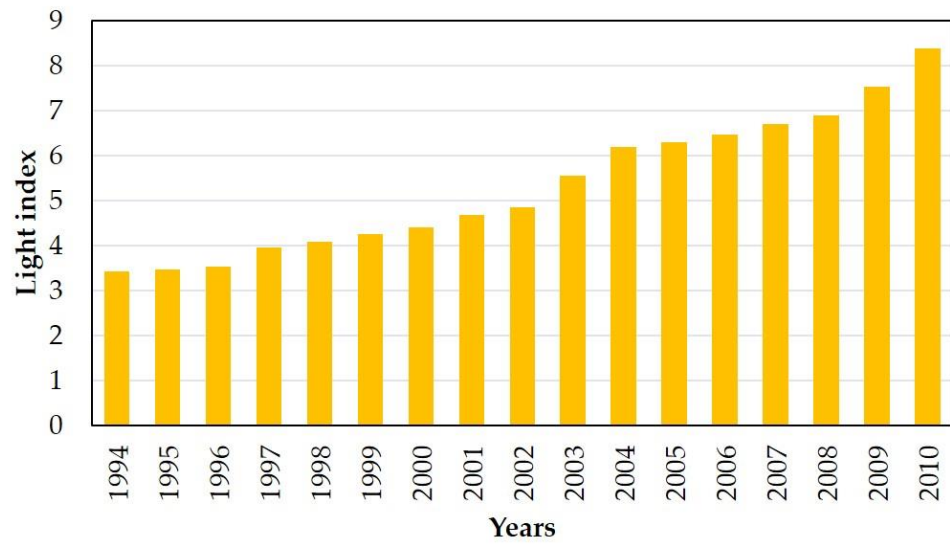


Figure S1: Light index of Guangdong, Hong Kong, and Macao from 1994 to 2010.