

Supplementary Materials: Mapping Decadal Land Cover Changes in the Woodlands of North Eastern Namibia from 1975 to 2014 Using the Landsat Satellite Archived Data

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Table S1. Google Earth Engine code.

1984	https://code.earthengine.google.com/fdf45ca49c3e591ad21d4d2bf2b42ee4
1994	https://code.earthengine.google.com/63ce41b65b7e0d5d25001409b57a5fa9
2004	https://code.earthengine.google.com/990d662d4413283a8b71a30ccb752c18
2014	https://code.earthengine.google.com/ecf3acf4cd21c9674690bf3d488dd72e

Table S2. Evaluation error matrixes indicating overall accuracy, errors of commission and omission, and total training data pixels.

1975	Water	Clay Pan	Agriculture	Sand	Woodland	Wetland	Urban	Total	Error C
Water	49	1	0	0	0	0	0	50	0.0
Clay pan	0	42	0	0	8	0	0	50	0.2
Agriculture	0	0	36	0	14	0	0	50	0.3
Sand	0	1	2	28	19	0	0	50	0.4
Woodland	0	0	5	0	45	0	0	50	0.1
Wetland	0	0	1	0	0	49	0	50	0.0
Urban	5	4	15	1	0	0	21	46	0.5
Total	54	48	59	29	86	49	21	346	
Error O	0.09	0.13	0.39	0.03	0.48	0.00	0.00		
Overall accuracy									0.7804
1984	Water	Clay pan	Agriculture	Sand	Woodland	Wetland	Total	Error C	
Water	896	0	0	0	0	0	896	0	
Clay pan	0	540	0	0	1	0	541	0.00	
Agriculture	0	0	1915	0	40	0	1955	0.02	
Sand	0	0	0	99	0	0	99	0	
Woodland	0	0	11	0	14475	0	14486	0.00	
Wetland	0	0	0	0	1	284	285	0.00	
Total	896	540	1926	99	14517	284	18262		
Error O	0	0	0.01	0.00	0.00	0			
Overall accuracy									0.9971
1994	Water	Clay pan	Agriculture	Sand	Woodland	Wetland	Total	Error C	
Water	108	0	0	0	0	0	108	0	
Clay pan	0	300	0	0	0	0	300	0	
Agriculture	0	0	2390	4	47	0	2441	0.02	
Sand	0	0	0	96	0	0	96	0	
Woodland	0	0	17	0	37459	1	37477	0.00	
Wetland	0	0	0	0	0	853	853	0	
Total	108	300	2407	100	37506	854	41275		
Error O	0	0	0.01	0.04	0.00	0.00			
Overall accuracy									0.9983
2004	Water	Clay pan	Agriculture	Sand	Woodland	Wetland	Total	Error C	
Water	297	0	0	0	0	0	297	0	
Clay pan	0	182	0	0	0	0	182	0	
Agriculture	0	0	1913	0	50	0	1963	0.03	
Sand	0	0	0	118	0	0	118	0	
Woodland	0	0	26	0	13678	0	13704	0.00	
Wetland	0	0	0	0	0	206	206	0	
Total	297	182	1939	118	13728	206	16470		
Error O	0	0	0.01	0	0.00	0			
Overall accuracy									0.9954
2014	Water	Clay pan	Agriculture	Sand	Woodland	Wetland	Total	Error C	
Water	378	0	0	0	0	0	378	0	
Clay pan	0	175	0	0	0	0	175	0	
Agriculture	0	0	2130	1	38	0	2169	0.02	

Sand	0	0	0	307	0	0	307	0
Woodland	0	0	13	0	30196	0	30209	0.00
Wetland	0	0	0	0	9	166	175	0.05
Total	378	175	2143	308	30243	166	33413	
Error O	0	0	0.01	0.003247	0.00	0		
Overall accuracy								0.9982

Table S3. Error matrices for each period showing adjusted change area and confidence intervals. The transition from woodland to non-woodland is labeled deforestation. Error matrix entries are expressed as the estimated area proportion. Map classes represent rows and reference classes the columns.

2004–2014	Agriculture	Woodland	Deforestation	Total	Map Area	User's	Producers	Overall
Agriculture	0.10	0.002	0.000	0.10	10741	0.98	0.44	0.72
Woodland	0.12	0.605	0.000	0.72	92629	0.84	0.99	
Deforestation	0.00	0.006	0.014	0.02	4624	0.58	1.00	
Total	0.22	0.613	0.014	0.84	107994			
1994–2004	Agriculture	Woodland	Deforestation	Total	Map area	User's	Producers	Overall
Agriculture	0.05	0.016	0.000	0.07	9263	0.76	0.32	0.67
Woodland	0.10	0.617	0.000	0.72	90077	0.86	0.96	
Deforestation	0.00	0.013	0.006	0.02	8653	0.28	1.00	
Total	0.15	0.645	0.006	0.80	107994			
1984–1994	Agriculture	Woodland	Deforestation	Total	Map area	User's	Producers	Overall
Agriculture	0.06	0.005	0.000	0.06	7163	0.92	0.59	0.87
Woodland	0.03	0.797	0.000	0.83	93421	0.96	0.98	
Deforestation	0.01	0.011	0.020	0.04	7411	0.54	1.00	
Total	0.10	0.813	0.020	0.93	107994			
	Agriculture	Woodland	Deforestation	Total	Map area	User's	Producers	Overall
Agriculture	0.09	0.010	0.000	0.10	12532	0.90	0.34	0.50
Woodland	0.18	0.397	0.000	0.57	89555	0.69	0.96	
Deforestation	0.01	0.005	0.005	0.02	5906	0.31	1.00	
Total	0.28	0.413	0.005	0.70	107994			

Table S4. Cross tabulation matrices showing change trajectories as a percentage of the study area [1].

1975	1984						
	Water	Claypan	Agriculture	Sand	Woodland	Wetland	Urban
Water	0.10	0.00	0.06	0.01	0.25	0.02	0.00
Claypan	0.04	0.46	0.23	0.01	1.24	0.01	0.00
Agriculture	0.01	0.43	3.55	0.06	3.06	0.00	0.00
Sand	0.01	0.01	0.08	0.07	0.00	0.00	0.00
Woodland	0.10	0.66	3.54	0.15	84.57	0.15	0.00
Wetland	0.03	0.00	0.01	0.00	0.72	0.06	0.00
Urban	0.00	0.00	0.08	0.01	0.19	0.01	0.00
1984	1994						
	Water	Claypan	Agriculture	Sand	Woodland	Wetland	Urban
Water	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Claypan	0.03	0.57	0.11	0.04	1.46	0.01	0.00
Agriculture	0.05	0.55	4.42	0.06	4.98	0.02	0.00
Sand	0.00	0.00	0.13	0.07	0.00	0.00	0.00
Woodland	0.27	0.88	2.42	0.00	82.30	0.63	0.00
Wetland	0.05	0.01	0.02	0.00	0.42	0.16	0.00
Urban	0.00	0.00	0.00	0.00	0.00	0.00	0.30
1994	2004						
	Water	Claypan	Agriculture	Sand	Woodland	Wetland	Urban
Water	0.04	0.03	0.04	0.00	0.87	0.09	0.00
Claypan	0.00	0.39	0.23	0.00	0.93	0.01	0.00
Agriculture	0.00	0.43	5.76	0.04	5.22	0.02	0.01
Sand	0.00	0.02	0.20	0.11	0.00	0.00	0.00
Woodland	0.00	1.32	3.17	0.00	78.49	0.38	0.04
Wetland	0.00	0.00	0.00	0.00	0.58	0.14	0.00
Urban	0.01	0.02	0.67	0.05	0.42	0.01	0.24

2004	2014						
	Water	Claypan	Agriculture	Sand	Woodland	Wetland	Urban
Water	0.15	0.01	0.03	0.00	0.10	0.02	0.00
Claypan	0.00	0.15	0.15	0.01	0.14	0.00	0.00
Agriculture	0.00	0.31	7.02	0.10	3.78	0.00	0.32
Sand	0.00	0.02	0.23	0.22	0.01	0.00	0.06
Woodland	0.88	1.07	3.88	0.00	79.13	0.60	0.23
Wetland	0.03	0.00	0.04	0.00	0.07	0.10	0.00
Urban	0.00	0.00	0.13	0.00	0.19	0.01	0.81

Table S5. Pearson's coefficient (r) showing the relation between the aerial extent of main land cover class transition (i.e., woodland to agriculture) in each 5 km distance zone, and each proximal change variable for each interval assessed.

	1975–1984	1984–1994	1994–2004	2004–2014
Minor towns	−0.89	−0.84	−0.98	−0.96
Major towns	−0.91	−0.87	−0.63	−0.62
Rivers	−0.8	−0.85	−0.92	−0.84
Roads	−0.81	−0.81	−0.81	−0.87

References

1. Pontius, R.G.; Shusas, E.; McEachern, M. Detecting important categorical land changes while accounting for persistence. *Agric. Ecosyst. Environ.* **2004**, *101*, 251–268.



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