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Notations and equations

Table 1: Notation

J	Number of categories
i	Index for a category at an interval's initial time point
j	Index for a category at an interval's final time point
T	Number of time points
Y_t	Year at time point *t*
t	Index for the initial time point of interval $[Y_t, Y_{t+1}]$, where *t* ranges from *1* to *T*-1
P_{ij}	The proportion of the landscape that experiences a transition from category *i* to category *j*
P_{jj}	The proportion of the landscape that shows persistence of category *j*
P_{i+}	The proportion of the landscape in category *i* in time 1, which is the sum over all *j* of P_{ij}
P_{+j}	The proportion of the landscape in category *j* in time 2, which is the sum over all *i* of P_{ij}
S_j	The amount of swap for each category *j*
D_j	The absolute value of net change for category *j*
C_j	The total change for each category *j*
m	Index for the losing category for the selected transition
n	Index for the gaining category for the selected transition
C_{tij}	Number of elements (pixels) that transition from category *i* to category *j* during interval $[Y_t, Y_{t+1}]$
S_t	Annual intensity of change during interval $[Y_t, Y_{t+1}]$
U	Value of uniform line for time intensity analysis
G_{tj}	Annual intensity of gross gain of category *j* during interval $[Y_t, Y_{t+1}]$
L_{ti}	Annual intensity of gross loss of category *i* for time interval $[Y_t, Y_{t+1}]$
R_{tin}	Annual intensity of transition from category *i* to category *n* during interval $[Y_t, Y_{t+1}]$ Where $i \neq n$
W_{tn}	Value of uniform intensity of transition to category *n* from all non-*n* categories at time Y_t During time interval $[Y_t, Y_{t+1}]$.
Q_{tmj}	Annual intensity of transition from category *m* to category *j* during time interval $[Y_t, Y_{t+1}]$ Where $j \neq m$
V_{tm}	Value of uniform intensity of transition from category *m* to all non-*m* categories at time Y_{t+1} During time interval $[Y_t, Y_{t+1}]$

Notation follows Pontius et al.[1] and Aldwaik and Pontius[2]

Equations

The equations follow Pontius et al.[1] and Aldwaik and Pontius[2]. A program to facilitate the Intensity Analysis calculations is available from https://sites.google.com/site/intensityanalysis/ [2]

The amount of swap for each category *j*:

$$S_j = 2 \times MIN\left(P_{j+} - P_{jj,}\, P_{+j} - P_{jj}\right) \quad \text{Equation 1}$$

Absolute value of net change for category *j*:

$$D_j = \left|P_{+j} - P_{j+}\right| \quad \text{Equation 2}$$

Total change for each category:

$$C_j = D_j + S_j \quad \text{Equation 3}$$

Annual intensity of change during interval $[Y_t, Y_{t+1}]$:

$$S_t = \frac{\left\{\sum_{j=1}^{J}\left[\left(\sum_{i=1}^{J} C_{tij}\right) - Ctij\right]\right\} / \left[\sum_{j=1}^{J}\left(\sum_{i=1}^{J} C_{tij}\right)\right]}{Y_{t+1} - Y_t} 100\% \quad \text{Equation 4}$$

Value of uniform line for time intensity analysis:

$$U = \frac{\sum_{t=1}^{T-1}\left\{\sum_{j=1}^{J}\left[\left(\sum_{i=1}^{J} C_{tij}\right) - C_{tij}\right]\right\} / \left[\sum_{j=1}^{J}\left(\sum_{i=1}^{J} C_{tij}\right)\right]}{(Y_T - Y_1)} 100\% \quad \text{Equation 5}$$

Intensity of gross annual gain of category j during interval $[Y_t, Y_{t+1}]$:

$$G_{tj} = \frac{\left[\left(\sum_{i=1}^{J} C_{tij}\right) - C_{tjj}\right] / (Y_{t+1} - Y_t)}{\sum_{i=1}^{J} C_{tij}} 100\% \quad \text{Equation 6}$$

Intensity of gross annual loss of category *i* during interval $[Y_t, Y_{t+1}]$:

$$L_{ti} = \frac{\left[\left(\sum_{j=1}^{J} C_{tij}\right) - C_{tii}\right] / (Y_{t+1} - Y_t)}{\sum_{j=1}^{J} C_{tij}} 100\% \quad \text{Equation 7}$$

Annual intensity of transition from category *i* to category *n* during interval $[Y_t, Y_{t+1}]$:

$$R_{tin} = \frac{C_{tin} / (Y_{t+1} - Y_t)}{\sum_{j=1}^{J} C_{tij}} 100\% \quad \text{Equation 8}$$

Value of uniform intensity of annual transition to category *n* from all non-*n* categories at time Y_t during interval $[Y_t, Y_{t+1}]$:

$$W_{tn} = \frac{\left[\left(\sum_{i=1}^{J} C_{tin}\right) - C_{tnn}\right] / (Y_{t+1} - Y_t)}{\sum_{j=1}^{J}\left[\left(\sum_{i=1}^{J} C_{tij}\right) - C_{tnj}\right]} 100\% \quad \text{Equation 9}$$

Annual intensity of transition from category *m* to category *j* during interval $[Y_t, Y_{t+1}]$:

$$Q_{tmj} = \frac{\left|C_{tmj} / (Y_{t+1} - Y_t)\right|}{\sum_{i=1}^{J} C_{tij}} 100\% \quad \text{Equation 10}$$

Value of uniform intensity of annual transition from category *m* to all non-*m* categories at time Y_{t+1} during interval $[Y_t, Y_{t+1}]$:

$$V_{tn} = \frac{\left[\left(\sum_{j=1}^{J} C_{tmj}\right) - C_{tmm}\right] / (Y_{t+1} - Y_t)}{\sum_{i=1}^{J}\left[\left(\sum_{j=1}^{J} C_{tij}\right) - C_{tim}\right]} 100\% \quad \text{Equation 11}$$

Systematic KwaZulu-Natal land-cover transitions

Table 2: Transitions to land-cover categories across the two time intervals (2005–2008 and 2008–2011) in KwaZulu-Natal

		2005–2008			2008–2011		
Transitions to	**From**	**Transition intensity (% of 2005 category)**	**Uniform intensity (% of 2005 non-to category)**	**Transition**	**Transition intensity (% of 2008 category)**	**Uniform intensity (% of 2008 non-to category)**	**Transition**
Water							
	Plantations	0.00	0.06	Avoids	0.01	0.04	Avoids
	Agriculture	0.02	0.06	Avoids	0.02	0.04	Avoids
	Mines	0.01	0.06	Avoids	0.00	0.04	Avoids
	Built	0.00	0.06	Avoids	0.00	0.04	Avoids
	Natural vegetation	0.07	0.06	Targets	0.04	0.04	Targets
	Sand or rock	0.40	0.06	Targets	0.45	0.04	Targets
	Erosion	0.03	0.06	Avoids	0.05	0.04	Targets
	Dams	0.07	0.06	Targets	0.24	0.04	Targets
	Abandoned	0.00	0.06	Avoids	0.14	0.04	Targets
Plantations							
	Water	0.02	0.08	Avoids	0.02	0.04	Avoids
	Agriculture	0.09	0.08	Targets	0.03	0.04	Avoids
	Mines	0.00	0.08	Avoids	0.00	0.04	Avoids
	Built	0.04	0.08	Avoids	0.03	0.04	Avoids
	Natural vegetation	0.09	0.08	Targets	0.04	0.04	Targets
	Sand or rock	0.21	0.08	Targets	0.16	0.04	Targets
	Erosion	0.00	0.08	Avoids	0.00	0.04	Avoids
	Dams	0.00	0.08	Avoids	0.00	0.04	Avoids
	Abandoned	0.00	0.08	Avoids	0.42	0.04	Targets

		2005–2008			2008–2011		
Transitions to	**From**	**Transition intensity (% of 2005 category)**	**Uniform intensity (% of 2005 non-to category)**	**Transition**	**Transition intensity (% of 2008 category)**	**Uniform intensity (% of 2008 non-to category)**	**Transition**
Agriculture							
	Water	0.21	3.07	Avoids	1.41	0.55	Targets
	Plantations	0.62	3.07	Avoids	0.22	0.55	Avoids
	Mines	1.82	3.07	Avoids	1.15	0.55	Targets
	Built	0.20	3.07	Avoids	0.78	0.55	Targets
	Natural vegetation	3.53	3.07	Targets	0.49	0.55	Avoids
	Sand or rock	0.64	3.07	Avoids	0.15	0.55	Avoids
	Erosion	3.34	3.07	Targets	0.53	0.55	Avoids
	Dams	0.61	3.07	Avoids	0.48	0.55	Avoids
	Abandoned	0.00	3.07	Avoids	2.34	0.55	Targets
Mines							
	Water	0.00	0.00	Avoids	0.00	0.00	Avoids
	Plantations	0.00	0.00	Avoids	0.00	0.00	Avoids
	Agriculture	0.00	0.00	Avoids	0.00	0.00	Avoids
	Built	0.00	0.00	Avoids	0.00	0.00	Avoids
	Natural vegetation	0.00	0.00	Targets	0.00	0.00	Targets
	Sand or rock	0.00	0.00	Avoids	0.00	0.00	Avoids
	Erosion	0.02	0.00	Targets	0.00	0.00	Avoids
	Dams	0.00	0.00	Targets	0.02	0.00	Targets
	Abandoned	0.00	0.00	Avoids	0.01	0.00	Targets

		2005–2008			2008–2011		
Transitions to	**From**	**Transition intensity (% of 2005 category)**	**Uniform intensity (% of 2005 non-to category)**	**Transition**	**Transition intensity (% of 2008 category)**	**Uniform intensity (% of 2008 non-to category)**	**Transition**
Built							
	Water	0.03	0.39	Avoids	0.09	0.47	Avoids
	Plantations	1.24	0.39	Targets	0.36	0.47	Avoids
	Agriculture	0.93	0.39	Targets	0.88	0.47	Targets
	Mines	2.02	0.39	Targets	0.26	0.47	Avoids
	Natural vegetation	0.33	0.39	Avoids	0.39	0.47	Avoids
	Sand or rock	0.08	0.39	Avoids	0.09	0.47	Avoids
	Erosion	0.30	0.39	Avoids	0.47	0.47	Targets
	Dams	0.03	0.39	Avoids	0.18	0.47	Avoids
	Abandoned	0.00	0.39	Avoids	1.70	0.47	Targets
Natural vegetation							
	Water	0.00	0.00	Avoids	0.00	0.00	Avoids
	Plantations	0.00	0.00	Avoids	0.00	0.00	Avoids
	Agriculture	0.00	0.00	Avoids	0.00	0.00	Avoids
	Mines	0.00	0.00	Avoids	0.00	0.00	Avoids
	Built	0.00	0.00	Avoids	0.00	0.00	Avoids
	Sand or rock	0.00	0.00	Avoids	0.00	0.00	Avoids
	Erosion	0.00	0.00	Avoids	0.00	0.00	Avoids
	Dams	0.00	0.00	Avoids	0.00	0.00	Avoids
	Abandoned	0.00	0.00	Avoids	0.00	0.00	Avoids

		2005–2008			2008–2011		
Transitions to	**From**	**Transition intensity (% of 2005 category)**	**Uniform intensity (% of 2005 non-to category)**	**Transition**	**Transition intensity (% of 2008 category)**	**Uniform intensity (% of 2008 non-to category)**	**Transition**
Sand or rock							
	Water	0.01	0.01	Targets	0.02	0.01	Targets
	Plantations	0.00	0.01	Avoids	0.00	0.01	Avoids
	Agriculture	0.00	0.01	Avoids	0.00	0.01	Avoids
	Mines	0.00	0.01	Avoids	0.01	0.01	Avoids
	Built	0.01	0.01	Avoids	0.00	0.01	Avoids
	Natural vegetation	0.01	0.01	Targets	0.02	0.01	Targets
	Erosion	0.00	0.01	Avoids	0.00	0.01	Avoids
	Dams	0.00	0.01	Avoids	0.01	0.01	Targets
	Abandoned	0.00	0.01	Avoids	0.09	0.01	Targets
Erosion							
	Water	0.01	0.10	Avoids	0.03	0.06	Avoids
	Plantations	0.00	0.10	Avoids	0.00	0.06	Avoids
	Agriculture	0.14	0.10	Targets	0.05	0.06	Avoids
	Mines	4.13	0.10	Targets	0.55	0.06	Targets
	Built	0.00	0.10	Avoids	0.00	0.06	Avoids
	Natural vegetation	0.11	0.10	Targets	0.07	0.06	Targets
	Sand or rock	0.22	0.10	Targets	0.03	0.06	Avoids
	Dams	0.00	0.10	Avoids	0.01	0.06	Avoids
	Abandoned	0.00	0.10	Avoids	0.52	0.06	Targets

		2005–2008			2008–2011		
Transitions to	**From**	**Transition intensity (% of 2005 category)**	**Uniform intensity (% of 2005 non-to category)**	**Transition**	**Transition intensity (% of 2008 category)**	**Uniform intensity (% of 2008 non-to category)**	**Transition**
Dams							
	Water	0.45	0.01	Targets	0.01	0.00	Targets
	Plantations	0.00	0.01	Avoids	0.00	0.00	Avoids
	Agriculture	0.01	0.01	Avoids	0.00	0.00	Avoids
	Mines	0.37	0.01	Targets	0.04	0.00	Targets
	Built	0.00	0.01	Avoids	0.00	0.00	Avoids
	Natural vegetation	0.01	0.01	Avoids	0.00	0.00	Targets
	Sand or rock	0.00	0.01	Avoids	0.00	0.00	Avoids
	Erosion	0.02	0.01	Targets	0.00	0.00	Targets
	Abandoned	0.00	0.01	Avoids	0.01	0.00	Targets
Abandoned							
	Water	0.25	0.16	Targets	0.69	0.10	Targets
	Plantations	0.57	0.16	Targets	0.58	0.10	Targets
	Agriculture	1.53	0.16	Targets	0.11	0.10	Targets
	Mines	0.34	0.16	Targets	0.54	0.10	Targets
	Built	0.19	0.16	Targets	0.10	0.10	Targets
	Natural vegetation	0.00	0.16	Avoids	0.00	0.10	Avoids
	Sand or rock	0.48	0.16	Targets	5.86	0.10	Targets
	Erosion	0.58	0.16	Targets	0.33	0.10	Targets
	Dams	0.06	0.16	Avoids	0.23	0.10	Targets

Table 3: Transitions from land-cover categories across the two time intervals (2005–2008 and 2008–2011) in KwaZulu-Natal

		2005–2008			2008–2011		
Transitions from	**To**	**Transition intensity (% of 2008 category)**	**Uniform intensity (% of 2008 non-to category)**	**Transition**	**Transition intensity (% of 2011 category)**	**Uniform intensity (% of 2011 non-to category)**	**Transition**
Water							
	Plantations	0.01	0.01	Avoids	0.02	0.04	Avoids
	Agriculture	0.02	0.01	Targets	0.14	0.04	Targets
	Mines	0.01	0.01	Avoids	0.00	0.04	Avoids
	Built	0.00	0.01	Avoids	0.01	0.04	Avoids
	Natural vegetation	0.00	0.01	Avoids	0.00	0.04	Avoids
	Sand or rock	0.02	0.01	Targets	0.06	0.04	Targets
	Erosion	0.01	0.01	Avoids	0.04	0.04	Targets
	Dams	2.49	0.01	Targets	0.03	0.04	Avoids
	Abandoned	0.80	0.01	Targets	1.64	0.04	Targets
Plantations							
	Water	0.00	0.04	Avoids	0.01	0.02	Avoids
	Agriculture	0.06	0.04	Targets	0.02	0.02	Targets
	Mines	0.19	0.04	Targets	0.00	0.02	Avoids
	Built	0.20	0.04	Targets	0.06	0.02	Targets
	Natural vegetation	0.00	0.04	Avoids	0.00	0.02	Avoids
	Sand or rock	0.00	0.04	Avoids	0.01	0.02	Avoids
	Erosion	0.00	0.04	Avoids	0.00	0.02	Avoids
	Dams	0.01	0.04	Avoids	0.00	0.02	Avoids
	Abandoned	1.93	0.04	Targets	1.46	0.02	Targets

		2005–2008			2008–2011		
Transitions from	**To**	**Transition intensity (% of 2008 category)**	**Uniform intensity (% of 2008 non-to category)**	**Transition**	**Transition intensity (% of 2011 category)**	**Uniform intensity (% of 2011 non-to category)**	**Transition**
Agriculture							
	Water	0.12	0.25	Avoids	0.15	0.21	Avoids
	Plantations	0.39	0.25	Targets	0.25	0.21	Targets
	Mines	0.95	0.25	Targets	0.29	0.21	Targets
	Built	0.75	0.25	Targets	1.29	0.21	Targets
	Natural vegetation	0.00	0.25	Avoids	0.00	0.21	Avoids
	Sand or rock	0.02	0.25	Avoids	0.03	0.21	Avoids
	Erosion	1.07	0.25	Targets	0.71	0.21	Targets
	Dams	0.28	0.25	Targets	0.05	0.21	Avoids
	Abandoned	25.25	0.25	Targets	2.59	0.21	Targets
Mines							
	Water	0.00	0.00	Avoids	0.00	0.00	Avoids
	Plantations	0.00	0.00	Avoids	0.00	0.00	Avoids
	Agriculture	0.00	0.00	Targets	0.00	0.00	Targets
	Built	0.00	0.00	Targets	0.00	0.00	Avoids
	Natural vegetation	0.00	0.00	Avoids	0.00	0.00	Avoids
	Sand or rock	0.00	0.00	Avoids	0.00	0.00	Avoids
	Erosion	0.04	0.00	Targets	0.01	0.00	Targets
	Dams	0.01	0.00	Targets	0.00	0.00	Targets
	Abandoned	0.01	0.00	Targets	0.01	0.00	Targets

		2005–2008			2008–2011		
Transitions from	**To**	**Transition intensity (% of 2008 category)**	**Uniform intensity (% of 2008 non-to category)**	**Transition**	**Transition intensity (% of 2011 category)**	**Uniform intensity (% of 2011 non-to category)**	**Transition**
Built							
	Water	0.01	0.04	Avoids	0.01	0.10	Avoids
	Plantations	0.19	0.04	Targets	0.17	0.10	Targets
	Agriculture	0.11	0.04	Targets	0.46	0.10	Targets
	Mines	1.40	0.04	Targets	0.36	0.10	Targets
	Natural vegetation	0.00	0.04	Avoids	0.00	0.10	Avoids
	Sand or rock	0.09	0.04	Targets	0.03	0.10	Avoids
	Erosion	0.02	0.04	Avoids	0.02	0.10	Avoids
	Dams	0.07	0.04	Targets	0.03	0.10	Avoids
	Abandoned	3.52	0.04	Targets	1.39	0.10	Targets
Natural vegetation							
	Water	3.33	10.43	Avoids	1.77	2.18	Avoids
	Plantations	4.16	10.43	Avoids	1.56	2.18	Avoids
	Agriculture	17.69	10.43	Targets	2.05	2.18	Avoids
	Mines	15.77	10.43	Targets	6.89	2.18	Targets
	Built	2.65	10.43	Avoids	2.50	2.18	Targets
	Sand or rock	1.06	10.43	Avoids	1.79	2.18	Avoids
	Erosion	8.62	10.43	Avoids	4.39	2.18	Targets
	Dams	1.80	10.43	Avoids	0.37	2.18	Avoids
	Abandoned	0.00	10.43	Avoids	0.00	2.18	Avoids

		2005–2008			2008–2011		
Transitions from	**To**	**Transition intensity (% of 2008 category)**	**Uniform intensity (% of 2008 non-to category)**	**Transition**	**Transition intensity (% of 2011 category)**	**Uniform intensity (% of 2011 non-to category)**	**Transition**
Sand or rock							
	Water	0.19	0.02	Targets	0.21	0.05	Targets
	Plantations	0.09	0.02	Targets	0.07	0.05	Targets
	Agriculture	0.03	0.02	Targets	0.01	0.05	Avoids
	Mines	0.02	0.02	Avoids	0.00	0.05	Avoids
	Built	0.01	0.02	Avoids	0.01	0.05	Avoids
	Natural vegetation	0.00	0.02	Avoids	0.00	0.05	Avoids
	Erosion	0.16	0.02	Targets	0.02	0.05	Avoids
	Dams	0.01	0.02	Avoids	0.00	0.05	Avoids
	Abandoned	0.78	0.02	Targets	6.30	0.05	Targets
Erosion							
	Water	0.01	0.04	Avoids	0.03	0.01	Targets
	Plantations	0.00	0.04	Avoids	0.00	0.01	Avoids
	Agriculture	0.18	0.04	Avoids	0.03	0.01	Targets
	Mines	1.04	0.04	Avoids	0.01	0.01	Avoids
	Built	0.03	0.04	Avoids	0.05	0.01	Targets
	Natural vegetation	0.00	0.04	Avoids	0.00	0.01	Avoids
	Sand or rock	0.00	0.04	Avoids	0.01	0.01	Avoids
	Dams	0.05	0.04	Avoids	0.01	0.01	Avoids
	Abandoned	1.01	0.04	Avoids	0.49	0.01	Targets

		2005–2008			2008–2011		
Transitions from	**To**	**Transition intensity (% of 2008 category)**	**Uniform intensity (% of 2008 non-to category)**	**Transition**	**Transition intensity (% of 2011 category)**	**Uniform intensity (% of 2011 non-to category)**	**Transition**
Dams							
	Water	0.01	0.00	Targets	0.04	0.00	Targets
	Plantations	0.00	0.00	Avoids	0.00	0.00	Avoids
	Agriculture	0.01	0.00	Targets	0.01	0.00	Targets
	Mines	0.06	0.00	Targets	0.30	0.00	Targets
	Built	0.00	0.00	Avoids	0.00	0.00	Targets
	Natural vegetation	0.00	0.00	Avoids	0.00	0.00	Avoids
	Sand or rock	0.00	0.00	Avoids	0.01	0.00	Targets
	Erosion	0.00	0.00	Avoids	0.00	0.00	Targets
	Abandoned	0.03	0.00	Targets	0.09	0.00	Targets
Abandoned							
	Water	0.00	0.00	Avoids	0.04	0.02	Targets
	Plantations	0.00	0.00	Avoids	0.11	0.02	Targets
	Agriculture	0.00	0.00	Avoids	0.07	0.02	Targets
	Mines	0.00	0.00	Avoids	0.33	0.02	Targets
	Built	0.00	0.00	Avoids	0.08	0.02	Targets
	Natural vegetation	0.00	0.00	Avoids	0.00	0.02	Avoids
	Sand or rock	0.00	0.00	Avoids	0.07	0.02	Targets
	Erosion	0.00	0.00	Avoids	0.21	0.02	Targets
	Dams	0.00	0.00	Avoids	0.01	0.02	Avoids

2011 Land-cover map

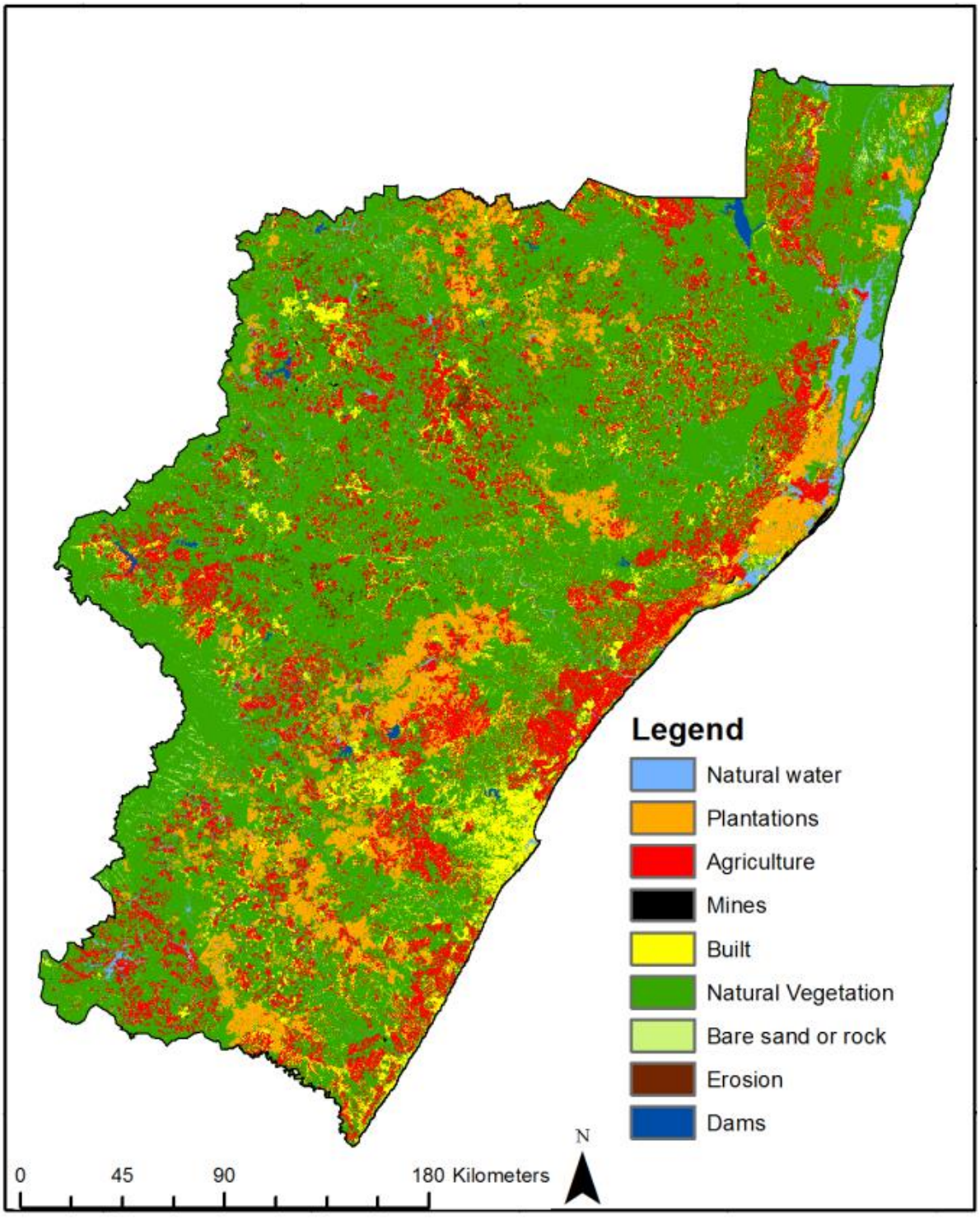

Figure 1: The 2011 KwaZulu-Natal reclassified land-cover map.

Ingonyama Trust Board (ITB) and non-ITB interval and categorical gain and loss graphs

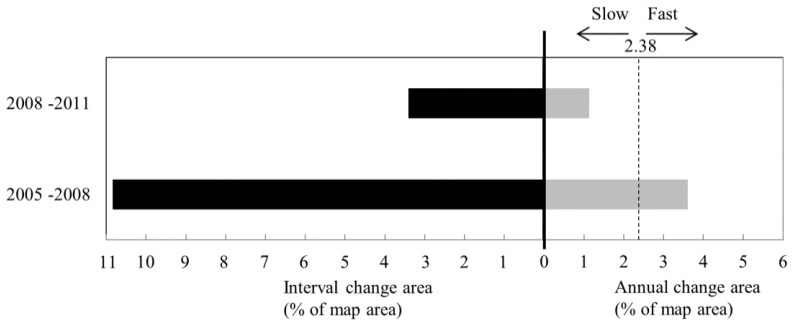

Figure 2: The landscape interval change occurring across the Ingonyama Trust Board (ITB) areas, representing communal areas, between 2005 and 2008 and 2008 and 2011. The bars to the left (black) indicate the percentage area change occurring in the ITB areas in each interval, whilst the bars to the right (grey) represent the intensity of annual area of change within each time interval. Grey bars extending to the right or left of the vertical dashed line indicate a fast or slow change, respectively, relative to a uniform change across the analysis period.

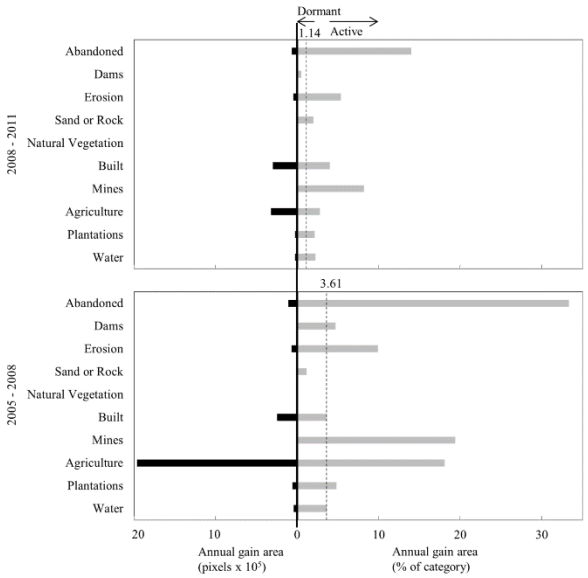

Figure 3: The gains per category for the 2005–2008 and 2008–2011 time intervals in the Ingonyama Trust Board areas. The bars to the left (black) indicate the gross annual area gains per category. The bars to the right (grey) represent the intensity of the annual gains. Grey bars extending to the right or left of the vertical dashed line indicate active or dormant changes, respectively, relative to a uniform intensity across the analysis period.

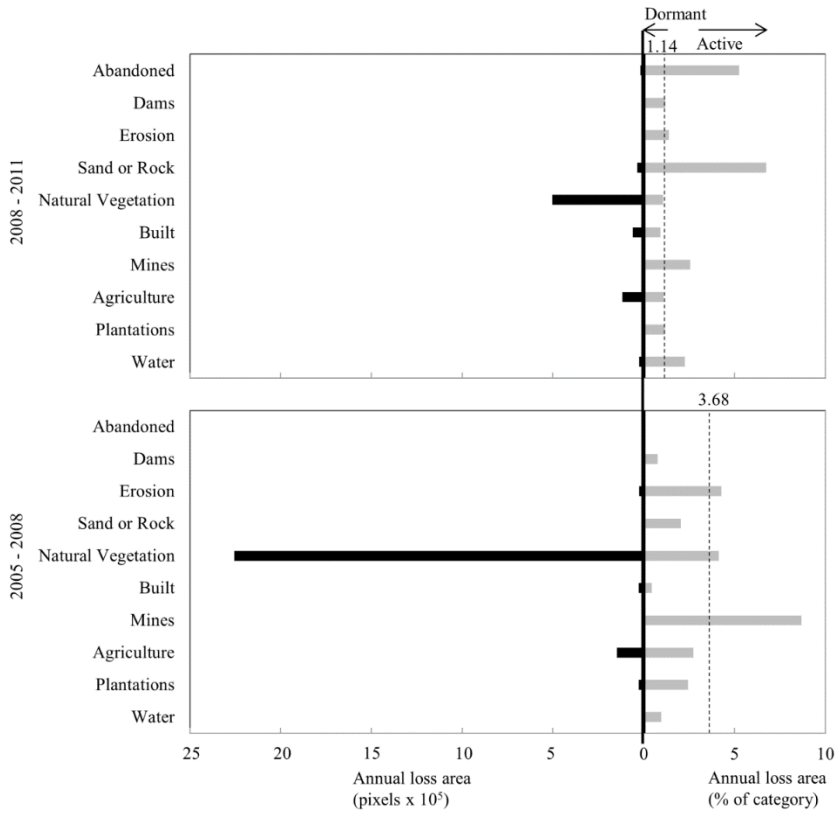

Figure 4: The losses per category for the 2005–2008 and 2008–2011 time intervals in the Ingonyama Trust Board areas. The bars to the left (black) indicate the gross annual area losses per category. The bars to the right (grey) represent the intensity of the annual losses. Grey bars extending to the right or left of the vertical dashed line indicate active or dormant changes, respectively, relative to a uniform intensity across the analysis period.

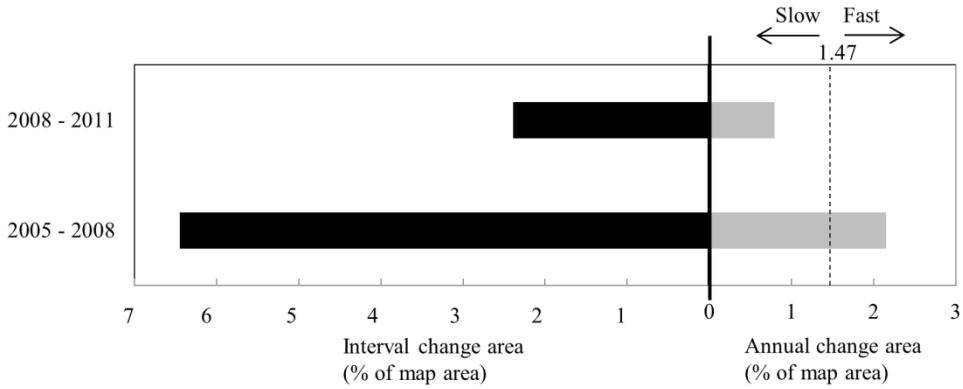

Figure 5: The landscape interval change occurring across non-Ingonyama Trust Board (non-ITB) areas, representing privately owned areas, between 2005 and 2008 and 2008 and 2011. The bars to the left (black) indicate the percentage area change occurring in the non-ITB areas in each interval, whilst the bars to the right (grey) represent the intensity of annual area of change within each time interval. Grey bars extending to the right or left of the vertical dashed line indicate a fast or slow change, respectively, relative to a uniform change across the analysis period.

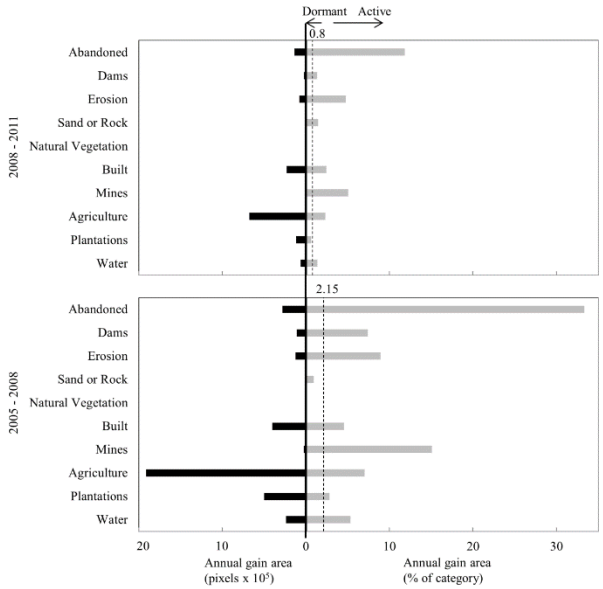

Figure 6: The gains per category for the 2005–2008 and 2008–2011 time intervals in the non-Ingonyama Trust Board areas, representing privately owned areas. The bars to the left (black) indicate the gross annual area gains per category. The bars to the right (grey) represent the intensity of the annual gains. Grey bars extending to the right or left of the vertical dashed line indicate active or dormant changes, respectively, relative to a uniform intensity across the analysis period.

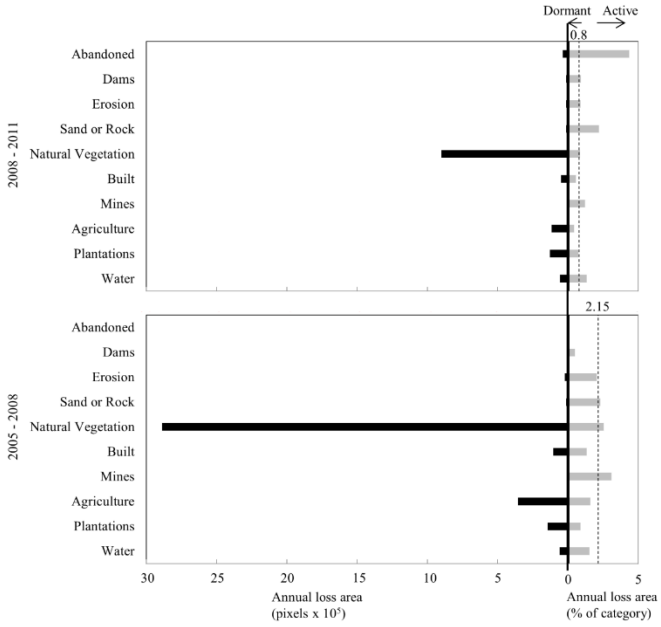

Figure 7: The losses per category for the 2005–2008 and 2008–2011 time intervals in the non-Ingonyama Trust Board areas, representing privately owned areas. The bars to the left (black) indicate the gross annual area losses per category. The bars to the right (grey) represent the intensity of the annual losses. Grey bars extending to the right or left of the vertical dashed line indicate active or dormant changes, respectively, relative to a uniform intensity across the analysis period.

Photographic examples of land-covers and transitions occurring in KwaZulu-Natal

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 8: A mosaic of current and fallow subsistence agricultural fields in KwaZulu-Natal.

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 9: Dune mining occurring along the north coast of KwaZulu-Natal. Active mining is occurring on the far right of the photograph with the dam, whilst rehabilitation of the mined dunes follows behind creating a 'snail-trail' effect as the mining progresses along the dune. The original dune forest is lost and replaced by either plantations, agriculture or natural vegetation dominated by *Acacia* thickets.

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 10: An example of the 'built' category returning to natural vegetation (termed 'abandoned' here) as would be perceived on satellite imagery. This area was an abandoned tea estate (the tea plants are lighter green in colour), which has now been invaded by alien invasive plants such as bugweed (*Solanum mauritianum*) and wattle (*Acacia mearnsii*).

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 11: Extensive road infrastructure is being developed in rural areas, leading to an expansion of dwellings, subsistence agriculture and associated development. This improved accessibility is increasing pressure on natural resources in terms of loss of habitat and extraction of natural resources.

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 12: Numerous sports facilities, including soccer and netball fields, are being developed in rural areas of KwaZulu-Natal.

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 13: A rural subsistence production landscape, consisting of woodlots, sugar cane, maize and vegetable farming.

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 14: Extensive erosion has occurred in parts of KwaZulu-Natal.

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 15: An example of an abandoned orchard. The farmhouse is derelict.

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 16: The new Spring Grove dam which is part of the inter-basin transfer scheme from the Mooi River to the Umgeni River to provide water to the Pietermaritzburg and Durban areas. These schemes alter hydrological flow regimes and impact aquatic diversity.

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 17: A rehabilitated mine dump which could easily be interpreted as natural vegetation on a satellite image. These features are tracked in the time series analysis and remain as part of the accumulated transformation in the landscape and are thus not selected for biodiversity conservation purposes. Erosion associated with the mine can be seen on the right of the mine dump.

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 18: An example of the illegal drainage of wetlands, usually for agricultural or housing purposes. In this instance the wetland is set to be rehabilitated.

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 19: An example of old cultivated fields, most likely ploughed during the 1960s under inappropriate agricultural policy and subsidy schemes.

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 20: An example of old cultivated fields in savanna systems. Depending on the resolution of the satellite imagery these areas may appear as natural vegetation on satellite images.

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 21: Commercial timber plantations illustrating the fragmentation effects created on the original grasslands.

Photo: John Craigie, Ezemvelo KZN Wildlife

Figure 22: Extensive commercial sugar cane production.

References

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

2. Aldwaik SZ, Pontius RG. Intensity analysis to unify measurements of size and stationarity of land changes by interval, category, and transition. Landscape Urban Plan. 2012;106(1):103–114.