The Selection of a minimum set of Key Grass Species for the Moist and Dry Phases of the KZN Highland Sourveld

J.O. Botha* and C. Adjorlolo
Department of Agriculture and Environmental Affairs, Private Bag X9059, Pietermaritzburg, 3200, South Africa
Cobus.Botha@kzndae.gov.za

INTRODUCTION

- Land owner based biodiversity conservation initiatives…
- Rangeland condition assessments - tool used for assessing vegetation health and for making conservation stocking rate recommendations.
- Renewed demand for simplified, yet accurate rangeland condition assessment techniques such as the key species method- this method can provide trends on vegetation dynamics.

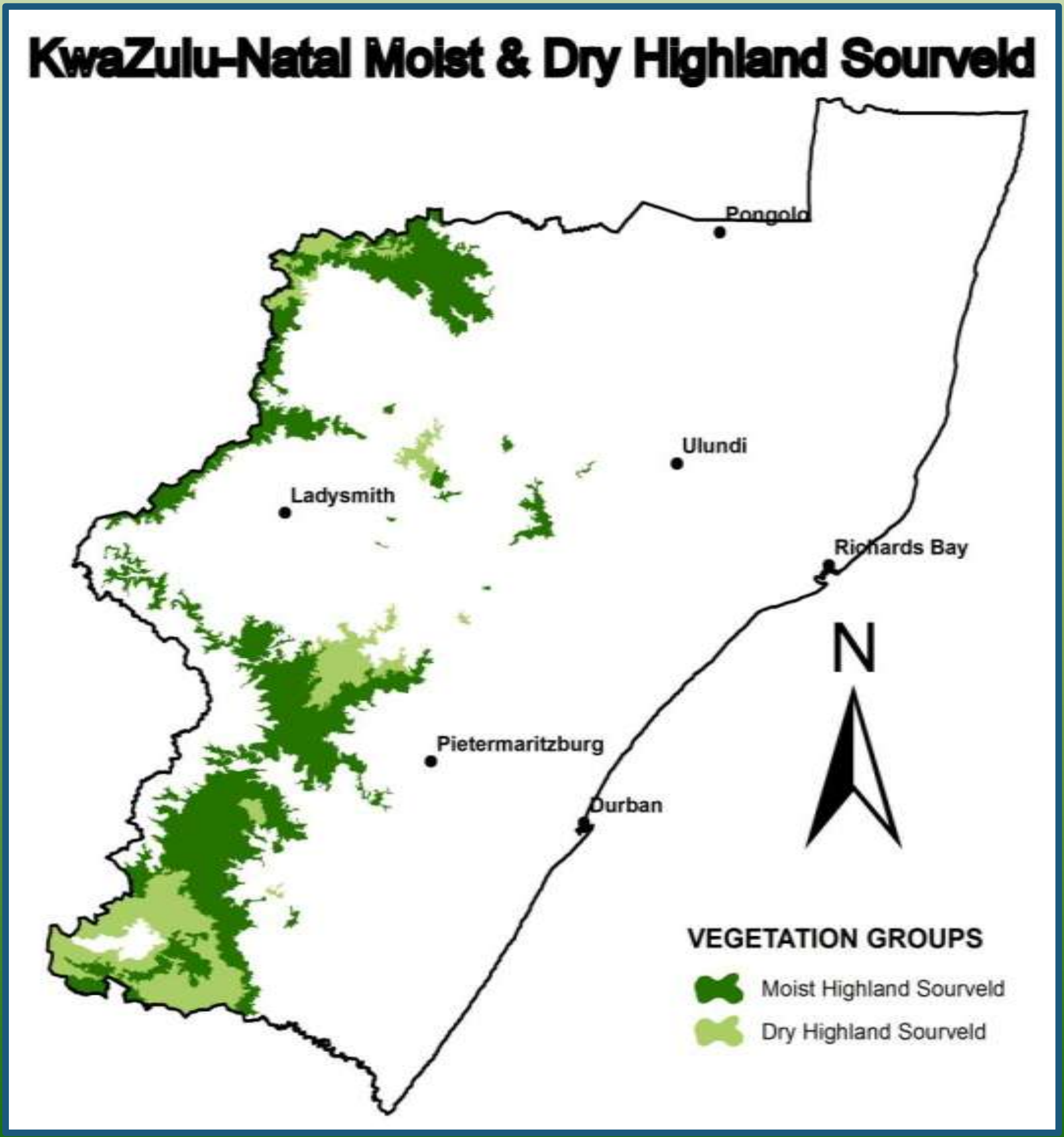
PURPOSE

To select a minimum set of key grass species for both the moist and dry phases of the KwaZulu-Natal Highland Sourveld.

ASSUMPTIONS

1. Selected species should account for least 95% of the variation in range condition;
2. All selected species should significantly affect range condition;
3. All 3 ecological status classes should be represented in the selected species;
4. Selection process is terminated as soon as all these criteria are met.

STUDY AREA



	Highland Sourveld	
	Dry	Moist
MAP	<800mm	>800mm
Altitude range	900 - 1400m	1400 - 1800m
MAT	14.3°C	14.1°C

Dry Highland Sourveld

Moist Highland Sourveld

MATERIALS & METHODS

- Range condition assessment data from 962 sites collected between 1981 and 2013;
- Moist Highland Sourveld (n=442)
  - Training dataset n=302
  - Test dataset n=140
- Dry Highland Sourveld (n=520)
  - Training dataset n=342
  - Test dataset n=178

MATERIALS AND METHODS

- Kolmogorov-Smirnov Test – dataset normality
- Forward stepwise multiple regression
- Grass species - independent variables & range condition score (RCS) - dependent variable.
- Minimum set significant species selected @ tolerance level of Root Mean Square Error (RMSE) < 5% of the observed mean.
- Model accuracy tested: Nash-Sutcliffe model efficiency coefficient (NSE)

RESULTS

Figure 1: Histogram of Moist Highland Sourveld Training Data

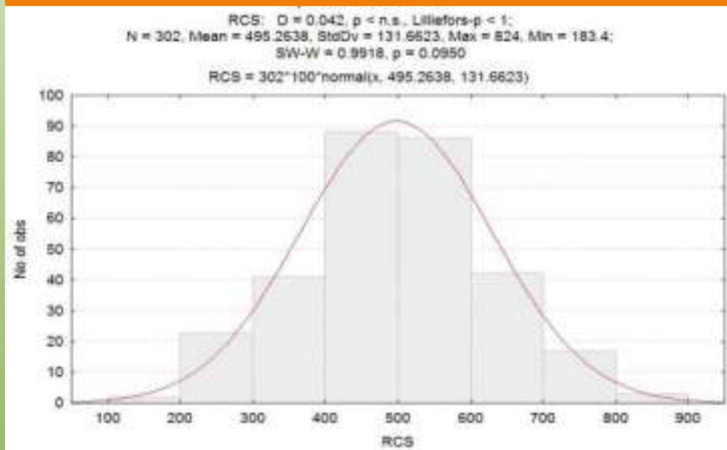


Figure 2: Histogram of Moist Highland Sourveld Test Data

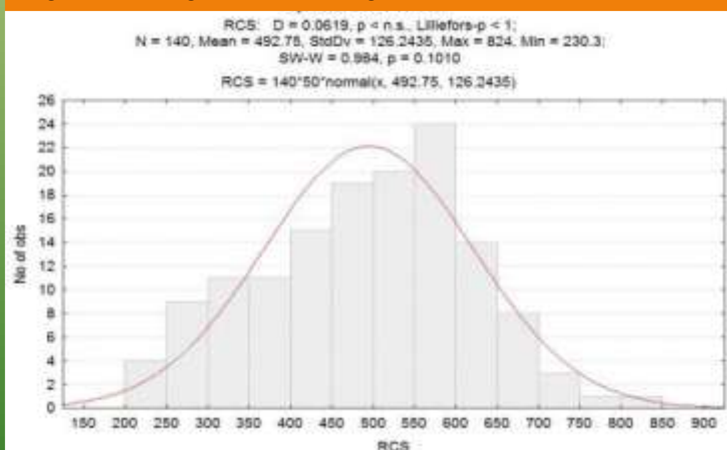


Table 1: Regression summary for key species selection in the Moist Highland Sourveld.

R^2 = 0.96; RMSE= 25.76

Species	Category	B	Effect %
Intercept		318.385	
Themeda triandra	D	6.881	81.227
Tristachya leucothrix	I	5.569	9.928
Heteropogon contortus	II	2.702	2.297
Diheteropogon fillifolius	III	-3.219	1.354
Aristida junciformis	III	-3.327	1.305
Forbs	II	-3.205	0.904
Sedges	II	-3.210	0.639
Rendlia altera	III	-3.916	0.465

RESULTS

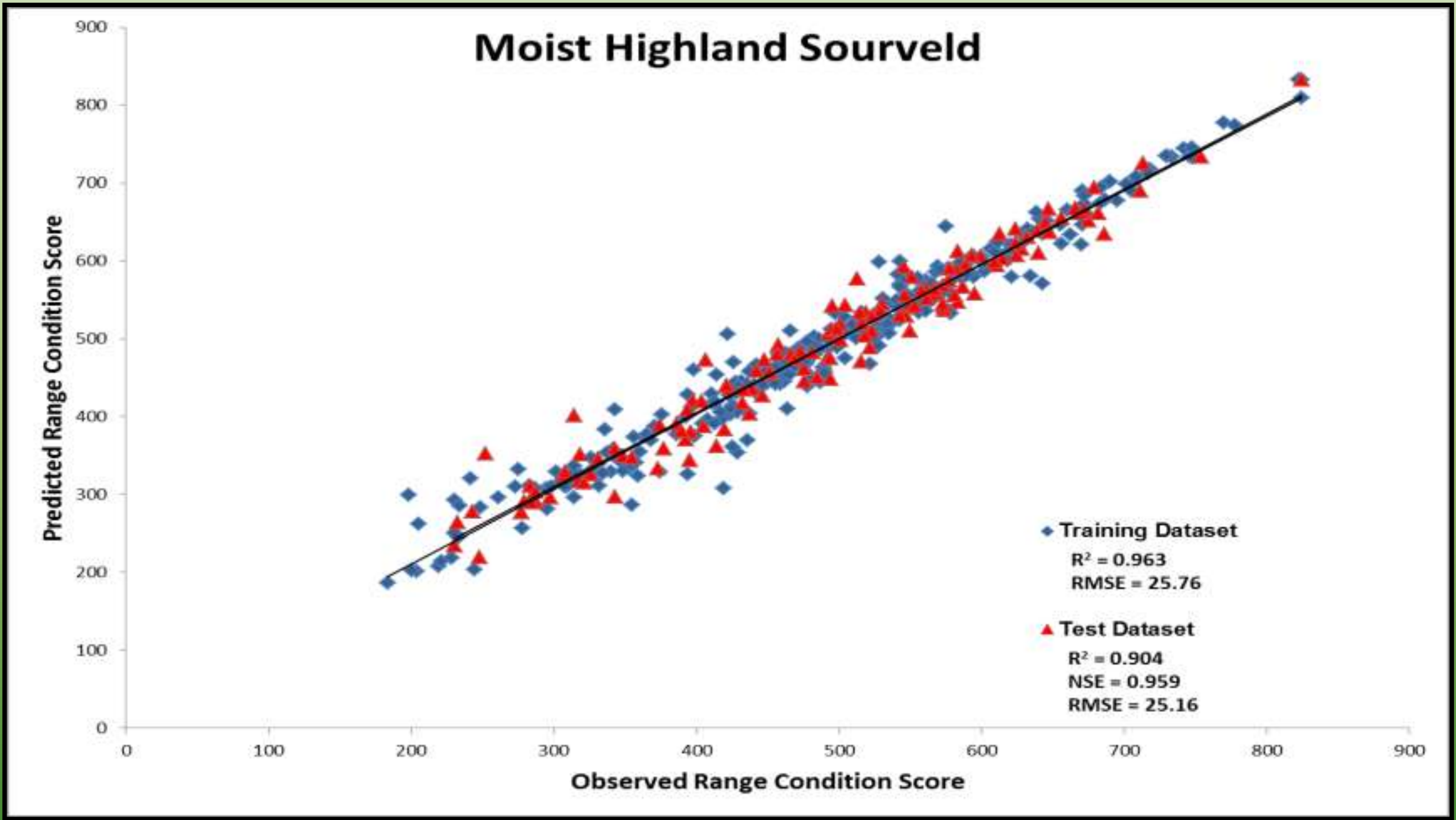


Figure 5: Plot of predicted vs. observed range condition scores for training and test datasets.

RESULTS

Figure 3: Histogram of Dry Highland Sourveld Training Data

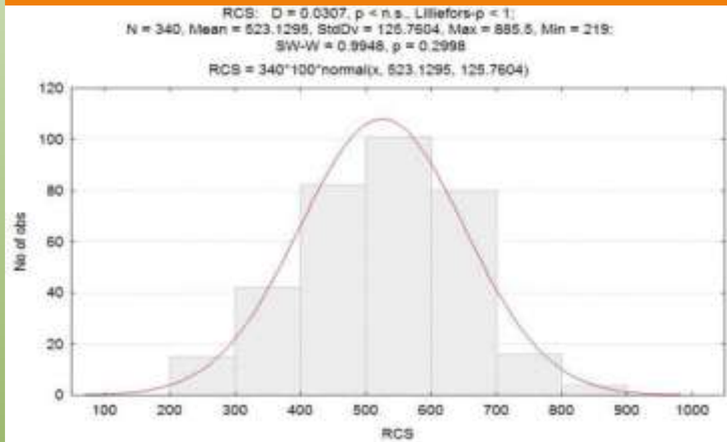


Figure 4: Histogram of Dry Highland Sourveld Test Data

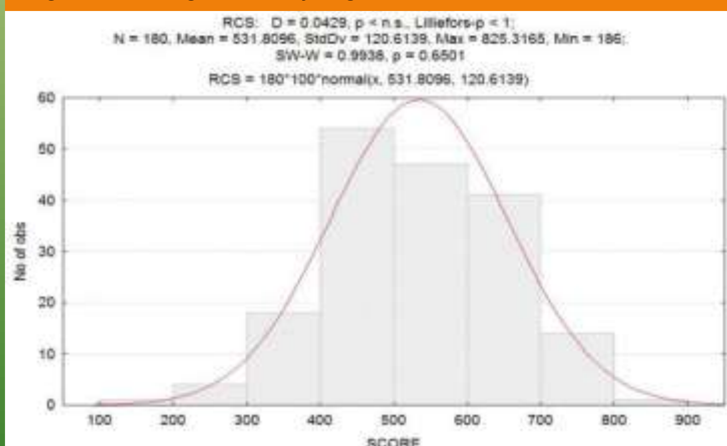


Table 2: Regression summary for key species selection in the Dry Highland Sourveld.

R^2 = 0.96; RMSE= 26.09

Species	Category	B	Effect %
Intercept		277.424	
Themeda triandra	D	7.137	78.262
Tristachya leucothrix	I	6.122	14.661
Heteropogon contortus	II	2.694	1.523
Eragrostis curvula	II	2.107	1.111
Andropogon appendiculatus	D	2.996	0.950
Forbs	II	-3.191	0.559
Diheteropogon fillifolius	II	-3.384	0.456
Elionurus muticus	II	-2.586	0.354

RESULTS

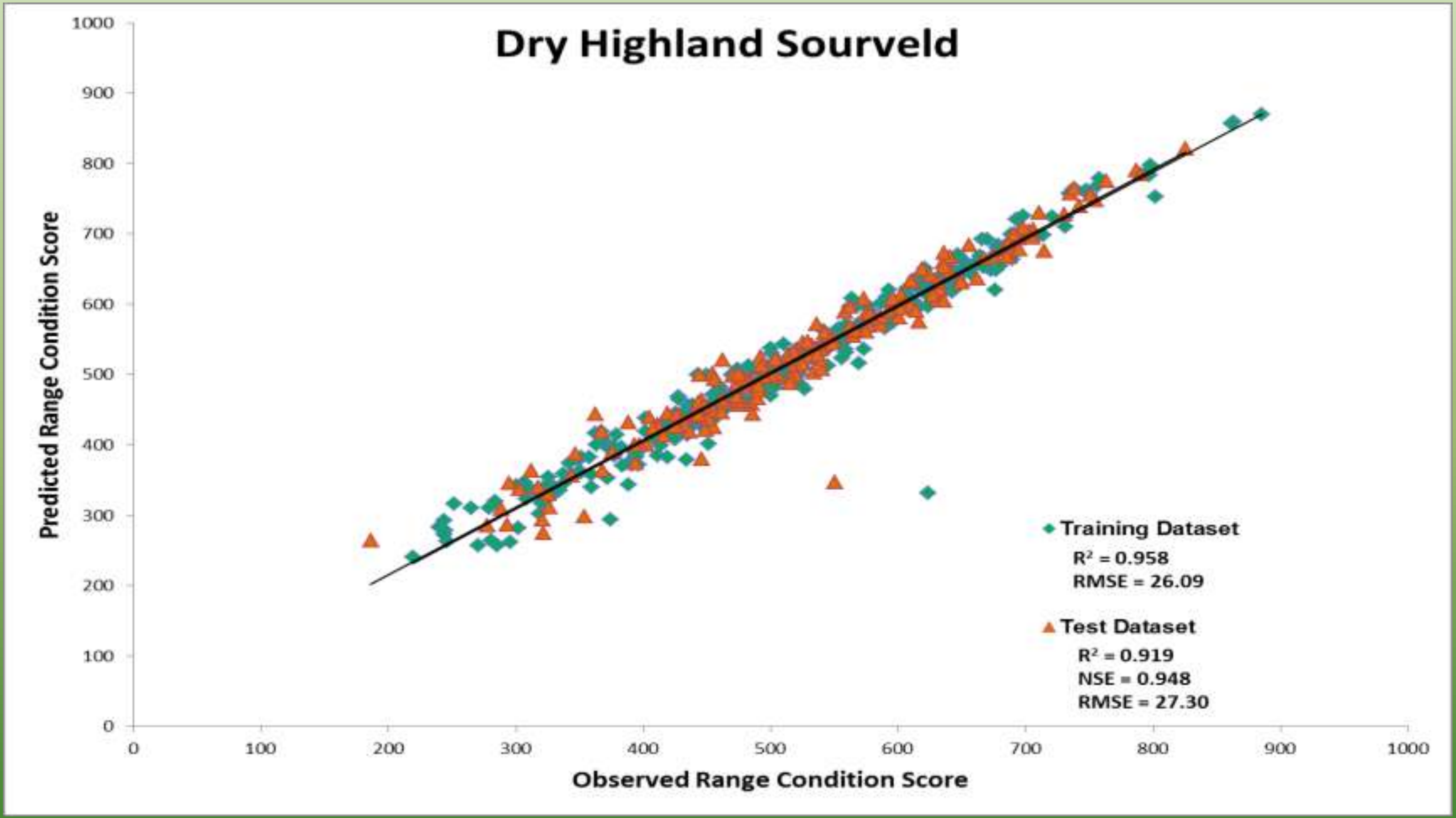


Figure 6: Plot of predicted vs. observed range condition scores for training and test datasets.

Analysis of the Results

- **Normal distribution** - attributed to dataset size, spatial and temporal distribution (Figures 1-4);
- **FSR**: a minimum set of **8 key species** for both MHS and DHS;
- Selected species showed a **63% overlap** between MHS and DHS but coefficients of determination differed.
- *T. triandra*, *T. leucothrix* and *H. contortus* accounted for >93% of the variation in RCS – Hurt & Hardy (1991) – *H. hirta*

Analysis of the Results

- Model accuracy tested against independent dataset yielded RMSEP = 5.3% of mean RCS of 492.8 for MHS and 5.1% of a mean RCS of 531.8 for DHS.

- Nash-Sutcliffe model efficiency coefficients of 0.96 for MHS and 0.95 for DHS indicate that key species models are effective predictors of variation observed in-field.

CONCLUSIONS

- Minimum set of key grass species for use by practitioners can be selected for Moist and Dry Highland Sourveld;

- Selection criteria should be well defined not to compromise the accuracy and the objectives of the technique.

- The selection of a single set of species that represent all of the Highland Sourveld should further be investigated.