Spatiotemporal Variations in Remote Sensing-Based Pasture Management Tools

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Summary of Research Agenda

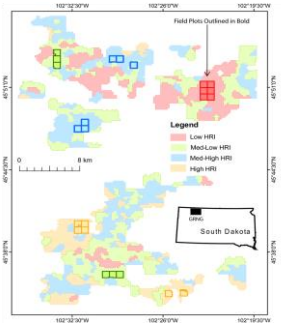
- Develop decision tools for sustainable range management by assessing forage quality and quantity with remote sensing-based data
- Model the capacity for forage to meet herd nutritional needs
- Estimate residual biomass needed for wildlife cover
- Evaluate multiple spectral data sources and platforms with respect to information needs for large landscapes
- Evaluate predictive strength of vegetation indices at multiple time points

Landsat

Trained imagery to select herbaceous vegetation in allotments- 36,000 ha

10 years of MODIS data unsupervised classification- 4 colors

Stratification and plot selection



Spectra	Landsat 5 and 7		Landsat 8	
	Wavelength (nm)	Description	Wavelength (nm)	Description
Band 1	450 - 520	Blue	430 - 450	Coastal Aerosol
Band 2	520 - 600	Green	450 - 510	Blue
Band 3	630 - 690	Red	530 - 590	Green
Band 4	760 - 900	Near InfraRed (NIR)	640 - 670	Red
Band 5	1550 - 1750	Short Wave InfraRed 1 (SWIR 1)	850 - 880	NIR
Band 6	10400 - 12500	Thermal InfraRed (TIR)	1570 - 1650	SWIR 1
Band 7	2080 - 2350	Short Wave InfraRed 2 (SWIR 2)	2110 - 2290	SWIR 2
Band 8			500 - 680	Panchromatic
Band 9			1360 - 1380	Cirrus
Band 10			10600 - 11190	TIR 1
Band 11			11500 - 12510	TIR 2

Index Acronym	Equation[1]
EVI Enhanced Vegetation Index	$2.5 \times \frac{(B4-B3)}{[B4+(6\times B3)-(7.5\times B1+1)]}$
Simple Ratio Band5/Band4	$\frac{B5}{B4}$
MTVI1, modified transformed 1	$1.2\times[1.2\times(B4-B2-2.5\times(B3-B2)]$
NDSVI, normalized senescent	$\frac{B5-B3}{B5+B3}$
NDVI Normalized Difference	$\frac{B4-B3}{B4+B3}$
SATVI Soil Adjusted VI	$1.5\times\left[\frac{B5-B3}{B5+B3+0.5}\right]-\left[\frac{B7}{2}\right]$
Simple Ratio Band 7/Band 1	$\frac{B7}{B1}$
SWIR-Simple Ratio Band 7/Band 5	$\frac{B7}{B5}$

METHODS

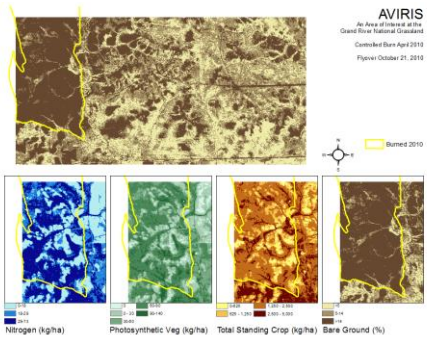
Field, DEM and Image Data Collection Pre and Post-Grazing 2010-2012

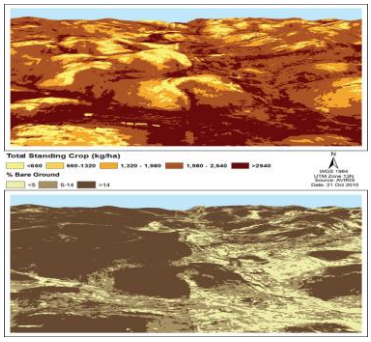
- Plant biomass (green and senescent)
- Plant nitrogen content
- Plant moisture
- Topographic position
- Spectral vegetation index
- Species
- Bare Ground

Used an iterative model selection procedure for building linear prediction models for Total Standing Crop (TSC) and nitrogen

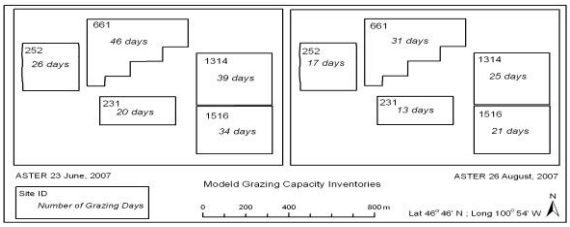
RESULTS

Image Date	Position	Predictive Equation
Jul 2010	All	$TSC\ (kg\ ha^{-1}) = 7415 + (EVI \times 2077) - (SWIR\text{-}SR \times 9776) - (\%water \times 34)$
Oct 2010	1	$TSC\ (kg\ ha^{-1}) = 6720 - (SWIR\text{-}SR \times 5153) - (\%water \times 25) - 548$
	2	$TSC\ (kg\ ha^{-1}) = 6720 - (SWIR\text{-}SR \times 5153) - (\%water \times 25)$
	3	$TSC\ (kg\ ha^{-1}) = 6720 - (SWIR\text{-}SR \times 5153) - (\%water \times 25)$
Jul 2011	1	$TSC\ (kg\ ha^{-1}) = 7987 + (SATVI \times 7.8) - 5624 - SATVI$
	2	$TSC\ (kg\ ha^{-1}) = 7987 + (SATVI \times 7.8)$
	3	$TSC\ (kg\ ha^{-1}) = 7987 + (SATVI \times 7.8)$
Jun 2012	1	$TSC\ (kg\ ha^{-1}) = 4434 - (EVI \times 27) - (\%water \times 34) + (EVI^2 \times 5.4) - 1706$
	2	$TSC\ (kg\ ha^{-1}) = 4434 - (EVI \times 27) - (\%water \times 34) + (EVI^2 \times 5.4) - 1078 + (160 \times EVI)$
	3	$TSC\ (kg\ ha^{-1}) = 4434 - (EVI \times 27) - (\%water \times 34) + (EVI^2 \times 5.4)$
Oct 2012	1	$TSC\ (kg\ ha^{-1}) = 5618 + (SATVI \times 1.8) - (SWIR\text{-}SR \times 1963) - 798$
	2	$TSC\ (kg\ ha^{-1}) = 5618 + (SATVI \times 1.8) - (SWIR\text{-}SR \times 1963)$
	3	$TSC\ (kg\ ha^{-1}) = 5618 + (SATVI \times 1.8) - (SWIR\text{-}SR \times 1963)$





Some Publications



Forage Inputs….Animal Nutritional Inputs…Scaling to Paddock…..Grazing Capacity