Quantifying Topographic Characteristics of Wetland Landscapes - Wetlands
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Appendix 4 - Landform Classification Calculation

The slope metric was calculated using the D8-algorithm and was classified into three classes to designate flat regions (zero degree slopes), low slope regions (greater than zero and less than three degrees slopes), and high slope regions (greater than three degrees slopes) (Table 4.1). Classification ranges were selected based on the understanding that a three-degree slope threshold value corresponds with a change in hydrologic activity (Macmillan et al. 2000).

Profile curvature was calculated based on Zeverbergen and Thorne's (1987) algorithm, which produces profile curvature signs opposite to alternative algorithms (Pennock et al. 1987, MacMillan et al. 2000) and requires care to ensure congruence with literature-derived landform classification criteria. Threshold values for each profile curvature class varies from 0.1 Deg/100 m (Pennock et al. 1987, Reuter et al. 2006) to 10 Deg/100 m (MacMillan et al. 2000). Iterative geovisualization of threshold values at 0.01, 0.05, 0.1, 1, and 10 resulted in the selection of a +/- 0.05 Deg/100 m profile curvature threshold value based on its ability to best visually represent the elevation contours in this study area. The profile curvature was reclassified to define convex (water shedding), linear, and concave (water ponding) regions (Table 4.1).

Plan curvature was also calculated based on Zeverbergen and Thorne's (1987) algorithm but produced plan curvature signs in agreement with existing landform literature (Pennock et al. 1987, MacMillan et al. 2000). Following an iterative process similar to the profile curvature process, a threshold value of +/- 0.05 was selected for plan curvature. Negative values (< -0.05) designate horizontally concave surfaces that would experience converging flow while positive values (> 0.05) designate horizontally convex surfaces that would experience diverging flow. Zero values (- 0.05 - + 0.05) designate horizontally linear surfaces (Table 4.1).

A deviation from mean elevation (DEV) metric was calculated that quantified each cell's deviation from a landscape's mean elevation to quantify high and low elevation regions in each landscape. The DEV metric calculation followed a similar methodology to the DEV metric outlined in the roughness analysis section but with small modifications to ensure the metric output was suitable for landform classification. This study's use of the DEV metric differs from existing DEV calculations (e.g. Lindsay et al. 2015, De Reu et al. 2013) by using the mean elevation of each 1 km sq landscape, whereas existing studies calculate the mean elevation surrounding each cell using a moving window. The mean elevation of the entire landscape was used to ensure that the metric output highlighted the high and low elevation regions of each landscape, rather than localized elevation extremes in a moving window. Each cell's elevation value was subtracted from the mean elevation of the landscape and then divided by the standard deviation of each landscape's elevation. Dividing the elevation deviation by the standard deviation improves the interpretation of the DEV metric and allowed most of the metric values to fall between -1 and 1 (De Reu et al. 2013). The DEV metric was then reclassified to create three distinct classes of low elevation position (< -0.5), middle elevation position (-0.5 – 0.5), and high elevation position (> 0.5) (Table 4.1).

Table 4.1 Value ranges used to reclassify input terrain metrics for landform element classification (Pennock et al. 1987, MacMillan et al. 2000, Reuter et al. 2006).

Metric	Class Range	Class Value	Description
Deviation from mean elevation (DEV)	< -0.5	1000	Low Elevation Regions
	-0.5 – 0.5	2000	Mid Elevation Regions
	>0.5	3000	High Elevation Regions
Slope	0	100	No Slope

(Degrees)	0 – 3	200	Low Slope
	>3	300	High Slope
Profile Curvature	< - 0.05	10	Convex (Shedding)
(1/100 m)	-0.05 – 0.05	20	Linear
	>0.05	30	Concave (Ponding)
Plan Curvature	< - 0.05	1	Concave (Converging)
(1/100 m)	-0.05 – 0.05	2	Linear
	>0.05	3	Convex (Diverging)

The reclassified terrain metrics (Table 4.1) were summed together to generate distinct topographic features with unique class codes that describe the range of each input terrain metric. For example, topographic feature 1231 would refer to a feature in the low elevation position with a low slope (0 – 3 Degrees), concave profile curvature (> 0.05 1/100 m), and concave plan curvature (< - 0.05 1/100 m). The class creation process generated 57 unique topographic features from which landform elements were defined by grouping features (In text Table 3) based on established landform classification criteria (MacMillan et al. 2000, Reuter et al. 2006).

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