

MAPPING STREAM BANK CONDITION FROM AIRBORNE LIDAR AND HIGH SPATIAL RESOLUTION IMAGE DATA IN A TEMPERATE RURAL-URBAN ENVIRONMENT, AUSTRALIA

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ABSTRACT:

Stream bank condition is an important indicator of physical form for streams that is related to the environmental condition of riparian corridors. The objective of this research was to develop and test an approach for mapping bank condition from high spatial resolution airborne UltracamD image and LiDAR data. Initially, bank condition, represented by scores, was assessed in the field based on both quantitative and qualitative measurements of biophysical parameters related to bank condition and derived within homogenous plots. Five bank condition scores from 0 - 4 were used in the field to indicate: (score = 0) very poor bank condition with distinct erosive features; (score = 1) poor bank condition; (score = 2) average bank condition; (score = 3) good bank condition; and (score = 4) excellent bank condition. The field observations were then related to UltracamD and LiDAR derived metrics including: valley confinement; bank height; bank width; plant projective cover; grass cover; bank slope; bank top crenulation; stream sinuosity; and channel width and height variability. Image based metrics showing covariation with the field observed measurements of bank condition were used as input for cumulative logistic regression modelling to estimate bank condition. This approach was suited for integrating discrete ordinal bank condition scores assessed in the field with image derived continuous data values. The highest correlation was achieved between field assessed bank condition scores and image derived grass cover ($R^2 = 0.43$, $n = 41$), channel width/height ratio ($R^2 = 0.41$, $n = 41$), average bank slope ($R^2 = 0.60$, $n = 41$) and valley confinement (producer's accuracy = 100%, $n = 9$). Predictive models were produced to calculate the probability of bank condition scores. The predictive models produced bank condition scores that corresponded to those assessed in the field in 34 out of 50 cases. Cross-validation was used to assess the average mis-classification error of the predictive models. An average mis-classification error of 0.95 was achieved, indicating an average accuracy better than one bank condition score. The predictive models and the image derived metrics were then used for object-based image analysis in eCognition Developer 8 to automate the mapping approach of bank condition. This approach was applied to areas classified as stream banks based on LiDAR derived elevation and terrain slope information. The developed approach show potential for automation and will be used in 2010 for the mapping of stream bank condition for 26,000 km of streams in Victoria, Australia, using batch-processing and the Definiens eCognition Suite.

TOPIC: Remote sensing applications

ALTERNATIVE TOPIC: Land cover classification