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Rapid erosion assessment on disturbed site: Quantification of erosion rates using laser scanning and modelling on a mine waste rock dump

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Post-mining landforms are often constructed of a variety of materials with different erodibilities, initially devoid of vegetation and often have steep angles. Therefore they frequently have a high erosion risk. Further, these landforms can often contain materials such as acid-generating waste that require no exposure to oxygen or water or in the case of uranium mines low-level radionuclides that require long-term encapsulation. It is vital that these landforms be constructed so that they are geomorphically stable. Further, government regulators require that the mine demonstrate that their rehabilitation designs be erosionally stable. Quantifying erosion for different materials may take years as the material armours and vegetation develops and pedogenesis commences as initial high rates of erosion reduce to the long-term erosion rate.

On mine sites the field quantification of erosion on different materials is often problematic the mine may have a short life (several years) so erosion plots are not practical. Erosion plots are also costly to install and maintain. An alternative method for erosion quantification is to use remote sensing methods such as laser scanning to produce high resolution digital elevation models of landscape surfaces. Laser scanning has many advantages as a large number of points can be measured on a landform very rapidly with the data available in near real-time. Repeat measurements can be made easily. The data can be used for both an overall erosion assessment (denudation rates), quantification of rill and gully erosion as well as for the calibration of numerical erosion or landscape evolution models.

In this study, erosion on a waste rock dump in a semi-arid region in Northern Australia is quantified using laser scanning over several years. Overall hillslope morphology was captured by the laser scan data with the major rills being clearly defined. A denudation rate was able to be determined. Nevertheless, over the 3 year study period vegetation was an issue and areas affected were not included in any analysis. Overall the site demonstrated a range of erosion rates which are initially high and are likely to reduce. The data is used to calibrate an erosion and landscape evolution for longer term predictions. The method and modelling demonstrates a rapid and effective erosion assessment and prediction methodology.