Using Remote Sensing to Determine Changes in Soil Erosion and Sediment Loads from Guam Badlands

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In southern Guam, dramatic erosion processes are visibly evident in large, bare plots of earth that occur throughout watersheds in the southern half of the island. These areas of land along the steeply sloping topography are called “badlands” and are continually eroding soil leaving patches of exposed earth. Previous studies have indicated that badlands can contribute an average of 157 tons/acre/year of soil erosion in a watershed, which is 30 times more than any other type of land coverage. The major problems with badlands are that they have tendency to move and expand within a watershed. To implement effective erosion control practices on badlands requires: 1) knowledge of the location and the extent of current badland areas, 2) identification of where the badlands have expanded in size over time, and 3) details on the underlying soil type and slope angle where the badland expansion has occurred. Traditional field inventories and surveys may accurately delineate the boundaries of each badland area, but it difficult to monitor changes in the badland areas over time by this method alone. Remote sensing applications provide a useful means of overcoming this disadvantage.

Currently, there are satellite images as well as aerial photos of Guam which were recorded on different years. By using remote sensing applications, changes in the total area of badlands can be identified, and mapped over time. The specific remote sensing software application that will be used in this study is called ERDAS Imagine®, created by Leica Geosystems. Satellite images of Guam are analyzed by the remote sensing software to detect changes in the area of badlands over time. The slope angle, soil type, and estimated soil erosion for each badlands will be determined by the GIS soil erosion base model that has been developed by WERI researchers. The model combines the Universal Soil Loss Equation (USLE), the Geographic Information Systems (GIS), and the Digital Elevation Model (DEM) for predicting potential soil erosion. The model is capable of identifying the areas of high erosion potential, evaluating the effectiveness of various soil erosion reduction practices, and estimating the sediment yield for an entire watershed. The objectives of this project are to: 1) identify, map, and monitor the changes in badland areas over time, 2) use the GIS erosion base model to identify the underlying soil types and slope angle of the terrain where badland expansion is occurring, and 3) provide recommendation on appropriate soil erosion control practices and re-vegetation methods for the areas where badland expansion is occurring..