CALCULATION OF THE NUMBER OF PEAKS IN THE THOUSAND HILLS AREA OF SOUTHERN JAVA USING NATIONAL DEM, FOCAL MAXIMA FUNCTION AND TOPOGRAPHY SLOPE CLASSIFICATION METHOD

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Abstract: Thousand Hills (Gunung Sewu) is a karst area in the southern Java island. The area stretches 85 km east to west covering around 1.300 km^2. The region consists of thousands of conical hills, so unique that it was inaugurated as a UNESCO Global Geopark in 2015. From environmental protection point of view, it is necessary to have detailed information of the environment. One of them is on the number of peaks or hills of Gunung Sewu which is currently not available. In the past, the availability of high resolution satellite imagery, aerial photos, and high resolution Digital Elevation Model (DEM) for the whole area hindering a detailed investigation. This research aims to calculate the number of hills in the Gunung Sewu area using spatial analysis methods, namely focal maximum function and slope position classification. The information obtained will be beneficial for environmental protection and management of this important karst area.

The main data for the calculation was the recently relesead Indonesian national DEM (DEMNAS) from the Indonesian Geospatial Information Agency (BIG). Its spatial resolution is set at 0,27-arcsecond/8,25 m. The processing used the DEM in its original spatial resolution, and the resampled version at a spatial resolution of 10 m and 16,5 m. The processing consists of detection of peaks, selection of local peaks and top of hilss, and evaluation. Focal maximum function was used to detect the presence of local peaks, pixels with higher elevation compared to its surrounding. Twenty four combination of type of window, size of the window, and spatial resolution of DEMNAS were evaluated. The result of this step showed that higher eleveation did not always means top of hills but other feature that misidentified as peaks. These errors were eliminated using the result of slope position classification. All ridges were vectorised to obtain their polygons. Morphologically, peaks should be located on the ridge. Thefore, all peaks outside the polygons of ridges were deleted, leaved only peaks that represents top of the hills or regional peaks. The accuracy of the calculation was assessed using seven test areas with 1,163 hills digitized manually. The digitization was conducted on UAV images, high-resolution satellite imagery, Esri images, and complemented with field survey.

Of the different combination tested, the best function to detect the hills is a circle type window with a radius of three pixels. The most optimum spatial resolution of the DEM is 8,25 m spatial resolution. There are three types of hills are can be identified from the slope position

classification: residual-cone karst, labyrinth-cone karst, and polygonal-cone karst. This findings were rightly verified using satellite and UAV imageries. On the dimensional elements of hills, the shorthest distance that can be detected is 8.25 m which is equal to the size of the pixel. The average length and width of the hills are 160.7 and 89.0 m, respectively. The calculation found that there are 26.878 regional peaks, or hills, in the Thousand Hills area. The results were tested using a confusion matrix with overall accuracy is 86.4%.