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# Criticise of Van Zuidam Classification: A Purpose of Landform Unit

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***ABSTRAK***

*Klasifikasi bentang alam telah dikemukakan oleh banyak pakar di bidang geomorfologi. Salah satu klasifikasi yang lazim digunakan adalah klasifikasi Van Zuidam. Dengan berbagai interpretasi para pembaca maka penggunaan klasifikasi ini sering diperdebatkan. Tulisan ini berusaha memediasi berapa perbedaan pendapat ataupun keberagaman interpretasi dengan melakukan modifikasi dari klasifikasi bentang alam Van Zuidam (1983) maupun Van Zuidam & van Zuidam- Cancelado (1979). Beberapa kendala yang merupakan kekurangan serta kelebihan klasifikasi dikemukakan untuk memperjelas proses kritisasi ini. Proses penyatuan bentang alam juga diharapkan dapat lebih mudah dipahami serta menyesuaikan aturan bahasa Indonesia yang baku. Prosedur penamaan satuan bentang alam dapat dilakukan dengan berbagai parameter namun hendaknya dilakukan dengan prosedur yang terutama mempertimbangkan pola kontur dan kesamaan genetic bentang alam. Tulisan ini mengusulkan adanya 17 sub kelas sebagai rincian dari 7 kelas morfometri utama yang dibuat Van Zuidam& van Zuidam- Cancelado (1979.)*
*Kata kunci: bentang alam, klasifikasi, Van Zuidam*

**ABSTRACT**

The classification of landscapes has been put forward by many experts in geomorphology. One classification commonly used is the Van Zuidam classification. With various interpretations of the reader, the use of this classification is often debated. This paper wants to mediate the differences of opinion or diversity of interpretations by modifying the landscape classification of Van Zuidam (1983) and Van Zuidam - Cancelado (1979). Several constraints which constitute the shortcomings and advantages of classification were raised to clarify this critique process. The process of unifying the landscape is also expected to be more easily understood and adjust the standard Indonesian language rules. The procedure for determinating landscape units can be done with various parameters but it should be done with procedures that mainly consider the contour pattern and genetic similarity of the landscape. This paper proposes the existence of 17 sub-classes as details of 7 main morphometric classes made by Van Zuidam & van Zuidam-Cancelado (1979.)
Keyword : landform, classification, Van Zuidam

## 1. INTRODUCTION

The determination of the name of the landscape unit on the geomorphology map has often been a debate among academics of the Department of Geological Engineering. One familiar landscape classification used is the classification of Van Zuidam and van Zuidam-Cancelado (1979) [1] and Van Zuidam (1983) [2]. However, the use of these classifications in determinating geomorphological units is still often referred to differently. Departing from differences of opinion that often occur, this paper tries to mediate some differences of opinion and want to give a little revision in name determination of geomorphological units. Several issues related to difficulties in referring to the morphometry classification of Van Zuidam & van Zuidam-Cancelado (1979) [1] and Van Zuidam (1983) [2] are also discussed to obtain certainty in determining morphometric classes. This paper is the result of thoughts that seek to criticize the Van Zuidam classification in order to easily understand the advantages / disadvantages of the classification. In addition, this paper presents a modification of the classification of Van Zuidam and van Zuidam-Cancelado (1979) and Van Zuidam (1983) and packaging it in standard Indonesian so that the naming of geomorphological units can be more easily done.

## 2. METHOD

The method used in the critique of the classification of Van Zuidam and van Zuidam-Cancelado (1979) [1] and Van Zuidam (1983) [2] is to examine the advantages and disadvantages of classification and find out the constraints that occur when someone has difficulty applying the classification. Based on the experience that has occurred, many users often ignore the morphometric determination procedure, so there

need to be some important notes that are known so that the determination of geomorphological units can be done with more representation.

## 3. RESULT AND ANALYSIS

Main hierarchic classification levels of the ITC terrain classification based on the ITC-Geomorphological classification system states that geomorphological units are generally used in mapping at a scale of 1: 10,000 - 1,50,000. Detailed mapping on a scale of 1: 25,000 as required for ITNY Department of Geology Engineering students always leads to the naming of geomorphological units. Therefore, it is important to know the method of determining geomorphological units well and correctly.

### 3.1. Strengths and Weaknesses of Van Zuidam's Landscape Classification

Morphometrical landscape classification has been initiated by Van Zuidam & van Zuidam-Cancelado (1979) by classifying the relief unit [1], where this classification has several advantages and disadvantages that we need to evaluate. The following are some notes on the advantages and disadvantages of the Van Zuidam landscape classification that we can examine.

a. Strength

Landscape classification is often used because it has positive aspects, including:

- This classification is quite familiar among students and researchers especially those who have researched this field several decades ago.
- The Van Zuidam classification is quite systematic so that it can accommodate a variety of landscapes in various parts of the world.
- This classification accommodates special formations in landscape units.
- Geomorphological unit classifications are good for semi-detailed mapping (large-medium scale semi-detailed maps; 1: 25,000 - 1: 250,000) [2] in a large enough area.

b. Weakness

Some of the weaknesses of Van Zuidam's classification often become a pro-cons discussion that prolonged. These deficiencies can be explained as follows.

- The division of morphometric classes is less clear, meaning that the classification still offers a range so that there is not always a certainty of value in a class.
- Many morphometric criteria of a landscape have overlapping values, which is often confusing.
- Sometimes this classification cannot be applied to detailed scale maps (large - medium scale detailed maps), for example: it is difficult to find morphology in the status of mountains or mountains.

### 3.2. Proposed Classification

By evaluating some of the deficiencies in the Van Zuidam and van Zuidam-Cancelado classifications (1979) [1], the authors try to propose additional relief unit sub-classes as a modification to the classification (Table 1). This modification was made so as not to eliminate the seven main relief unit classes, but only to break down into 17 sub-classes. This additional classification is a modification that is expected to be a solution that answers the confusion of students or researchers in making units in geomorphological maps.

Table 1. Proposed division of relief unit classes of landform.

| No. | Relief unit (topography) | Sub unit (topography) | In *Bahasa* | α (%) | Δh (m) |
|---|---|---|---|---|---|
| 1. | Flat or almost flat | Flat or almost flat | *Dataran / morfologi hampir datar* | 0 – 2 | < 5 |
| 2. | Undulating | a. Gently undulating | *Morfologi sangat bergelombang lemah* | 3 – 7 | 5 – 50 |
| | | b. Undulating | *Morfologi bergelombang lemah* | 3 – 7 | 5 – 75 |
| | | c. Sloping undulating | *Morfologi bergelombang lemah terjal* | 8 - 13 | 5 – 25 |
| 3. | Undulating - rolling | a. Undulating - rolling | *Morfologi bergelombang lemah - kuat* | 8 – 13 | 25 – 75 |
| | | b. Rolling | *Morfologi bergelombang kuat* | 8 – 13 | 75 – 200 |
| | | c. Moderately steep rolling | *Morfologi bergelombang kuat terjal* | 14 – 20 | 25 – 50 |

Table 1. (continued)

| No. | Relief unit | Sub unit (topography) | In *Bahasa* | α (%) | Δh (m) |
|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| | (topography) | | | | | |
| 4. | Rolling - hilly | a. | Rolling - hilly | *Morfologi bergelombang kuat - perbukitan* | 14 - 20 | 50 – 200 |
| | | b. | Hilly | *Perbukitan* | 14 – 20 | 200 – 500 |
| | | c. | Steep hilly | *Perbukitan terjal* | 21 - 55 | 50 - 200 |
| 5. | Hilly – steeply dissected | a. | Hilly – steeply dissected | *Perbukitan – morfologi terbiku kuat* | 21 - 55 | 200 – 500 |
| | | b. | Steeply dissected | *Morfologi terbiku kuat* | 21 - 55 | 500 – 1000 |
| | | c. | Very steeply dissected | *Morfologi terbiku sangat kuat* | 56 - 140 | 200 - 500 |
| 6. | Steeply dissected - mountainous | a. | Steeply dissected - mountainous | *Morfologi terbiku kuat - pegunungan* | 56 - 140 | 500 – 1000 |
| | | b. | Moderately steep mountainous | *Pegunungan agak terjal* | 56 – 140 | > 1000 |
| 7. | Mountainous | a. | Mountainous | *Pegunungan* | > 140 | 500 – 1000 |
| | | b. | Extremely steep mountainous | *Pegunungan sangat terjal* | > 140 | > 1000 |

### 3.3. Some Important Notes

Often things happen that are wrong or not quite right when someone is doing a morphometric or morphogenesis study of an area. Based on experience in guiding students and research, this paper provides several important notes as an evaluation of map making and geomorphological analysis.

Some mistakes are often made starting from the selection of the slope incision sample to the determination of the relief unit. For this reason, there are several things that must be considered in the geomorphological analysis, especially in the aspects of morphometry and morphogenesis.

#### 3.3.1. Morphometry

Determination of geomorphological units usually begins by measuring the morphometry of a landscape in a predetermined area. The most common way to find out this morphometry is to determine the slope. The method used in calculating the slope can be random or based on gridding. However, to avoid some errors or inaccuracies in the calculation and classifying, there are some notes that can be considered as described below.

1. The slope section sampling must be representative, inter alia by the following method.
    a. The section is made perpendicular to the contour line (Fig. 1).
    b. The section through ridge morphology, not in valleys of gully/river (Fig. 1).
    c. The start/finish of the section is at (Fig. 1):
        - Break of slope
        - Valley bottom
        - Peak of hill
    d. The section must not cross a river or hilltop (summit/crest) (Fig. 1).
    e. Determination of the slope value takes into account the homogeneity of the slope (Fig. 2).
    f. The number of section slopes should be proportional to the unit area measured.
    g. The selection of the section sample should represent the dominant, ignoring minor anomalies.
2. Slope calculation results should not skip class (especially main class).

Simple morphometric analysis can be done with only two parameters, namely the magnitude of the slope angle and the height difference. The other parameters that can be used for geomorphological analysis include elevation, valley floor-height ratio, valley cross section, river gradient index and drainage density. This geomorphological analysis can be applied for example to see water resources in an area [4], even in quantitative geomorphological analysis, geomorphological analysis can also be carried out to determine its effect on the presence of springs in a groundwater basin [5].

#### 3.3.2. Morphogenesis

One of the main aspects of geomorphological mapping is morphogenesis [2]. These aspects include the origin and development of the landforms and the processes forming and acting on them. For this morphogenesis analysis, Van Zuidam has proposed several relief units. Geomorphological units can be discriminated in the geomorphic classification of large areas into eight units of origin [2], such as:

1. Denudational (D)
2. Structural denudational (S)
3. Volcanic (D)

4. Fluvial (F)
5. Marine (M)
6. Karst (K)
7. Glacial and peri-glacial (G)
8. Aeolian (A)

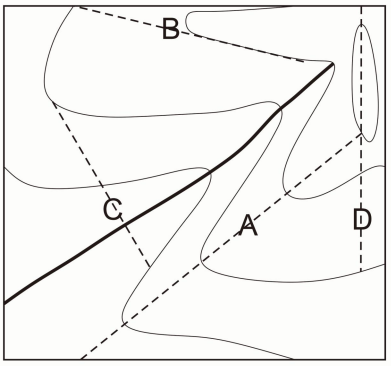


Figure 1.
A. The right example of slope section should be perpendicular to the contour line.
B. The section is inclined of contour (wrong).
C. The section is across gully (wrong).
D. The section is across peak of hill (wrong).

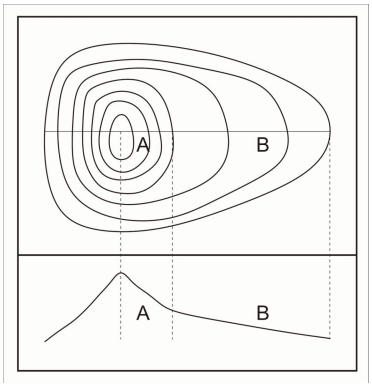


Figure 2. Make sure that slope A is different from slope B. The two samples is not homogen ones.

With reference to the geomorphic classification, some mistakes can be avoided based on the following notes / suggestions.

1. There are no structural landscape units in the classification.
   Note that there are no forms / mapping units that are a purely structural origin, but this unit always joins with denudational one. This is in accordance with the basic concept of geomorphology "Little of the earth's topography is older than Tertiary and most of it is no older than Pleistocene" [3].
2. One morphometric unit can consist of two morphogenesis units or vice versa.

The morphogenesis aspect is also important to analyze in relation to the morphometry of a region. Geomorphological processes can be known as quantitative geomorphological approaches. Geomorphological characteristics of an area can be evaluated based on the geomorphological index value, also by comparing it with the variable response of geomorphology of the river [6]. Thus, geomorphological mapping has quite broad aspects, both scientifically and applied.

### 3.4. Steps of Determination of Landscape Units

In the end part of making a geomorphological map, a researcher makes the unification of a landscape from two or more aspects of geomorphology. Simply put, the unification of this landscape can be done based on the dominant aspects of morphometry and morphogenesis. To get the right results, the following procedures are given in the stages of determining the geomorphological unit:

a. Delineation of regions based on the similarity of contour patterns, including:
   i. The shape of the contour (tongue, circular, elongated, etc.).
   ii. Contour density (tight, spaced, medium).
b. Calculation of morphometry (relief unit), by minimal parameters:
   i. Slope (α)
   ii. Height difference (Δh)
c. Determination of morphogenesis, with any consideration of:
   i. Origin (denudational, fluvial etc)
   ii. Source (name of a mountain, river of drainage area).
d. Determination of name of geomorphological units by:
   i. Combine of morphometry dan morphogenesis, such as:
      - Fluvial flat topography unit
      - Karst undulating morphology unit
   ii. Add the sources forming the morphological unit.

If the same morphometry and morphogenesis are found on one sheet of the map, then the distinction of unit names can be done by considering the source aspects of morphogenesis, for example:

- A-volcanic rolling morphology unit and B-volcanic rolling morphology unit (Fig. 3).
- A-fluvial plain unit and B-fluvial plain unit (Fig. 4).

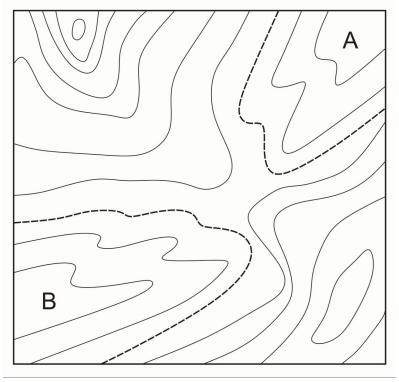


Figure 3. Because of different source then A volcanic unit should be distinguished from B volcanic unit.

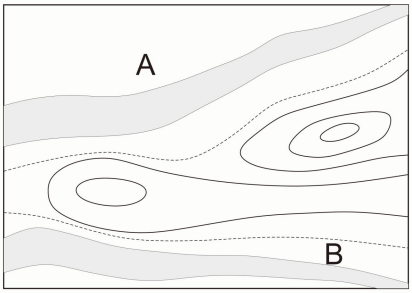


Figure 4. Fluvial unit of A is different from the fluvial unit of B when they have different drainage area.

e. The name of units should follow the rules of the Indonesian language that are good and right (*EYD*).
   i. The name of units starts with a noun (N) instead of adjective (Adj) (Table 2).

Table 2. Translation example of the name of the geomorphological unit.

| Morfologi | Unit | In *Bahasa* |
|---|---|---|
| Flat | Flat topography unit | *Satuan dataran* (N) |
| Undulating | Undulating topography unit | *Satuan **morfologi** bergelombang lemah* (N) not *satuan bergelombang lemah* (Adj) |
| Hilly | Hilly topography unit | *Satuan perbukitan* (N) |

   ii. Distinguish singular and plural words (see Table 3).

Table 3. Examples of singular and plural word distinctions.

| Morphologi | Singular | | Plural | |
|---|---|---|---|---|
| | English | *Bahasa* | English | *Bahasa* |
| Moderately steep topography | Hill | *Bukit* | Hilly topography | *Perbukitan* |
| Extremely steep topography | Mountain | *Gunung* | Mountainous topography | *Pegunungan* |

## 4. CONCLUSION

The landscape unit classifications of Van Zuidam and van Zuidam-Cancelado (1979) and Van Zuidam (1983) can be easily used but have some drawbacks that sometimes make confuse users. To avoid overlapping criteria, the authors propose modifications to 17 sub-classes in the aspect of morphometry (relief unit). This modification is done without eliminating the main relief classes (eight classes). Determination of name of landscape units should be based on the similarity of morphometric and genetic characteristics. In addition, several important notes are explained in this paper to minimize the mistakes made so far by several students / researchers.

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