Mapping Climate Classification of Oldeman in Agricultural Resources Management in South Tapanuli District

Imelda Sari Harahap*, Irwan Zulfikri Matondang, Suryanto, Erti Kumala Indah and Irmalia Fitri
Faculty of Agriculture, Universitas Muhammadiyah Tapanuli Selatan, Indonesia.

* imelda.sari@um-tapsel.ac.id

Abstract. The Oldeman classification system is very useful in the classification of agricultural land for food crops in Indonesia using the element of rainfall. The criteria are based on the calculation of wet months (BB) and dry months (BK), respectively, with the limits taking into account the chance of rain, effective rain and water requirements for plants. With the Oldeman climate classification, a cropping pattern system can be determined in an area. Based on the research results obtained 4 types of climate in the South Tapanuli region, namely: D1, D2, E1, and E2. The wettest climate type in the Sipirok region is climate type D1 with 4-5 wet months and <2 dry months. And those that are suitable for planting short-lived rice are 3 (three) harvests or short-lived rice is 2 (two) harvests and secondary crops 1 (sastu) harvests. The driest climate types in the East Angkola region are climate types E1 and E2 with the number of wet months <3 and the number of dry months 6-7. What is suitable for planting short-lived lowland rice is 1 (one) harvest and secondary crops 2 (two) times, the second special harvest falls in the dry season. The topographical condition of an area greatly influences the climatic conditions of the area. With a good climate classification and suitable for rice plants without irrigation assistance, the climate types are D1 and D2, namely in Sipirok District, West Angkola District and a Small Part of Saipar Dolok Hole and Batang Angkola Districts. Meanwhile, the East Angkola sub-district can be planted with rice with the help of irrigation, especially in the dry season.

1. Introduction
Climate is one of the characteristics of land that is very difficult to mitigate, so that climate is an important limiting factor in agricultural planning in Indonesia, while suggests that climate is a natural habit that is driven by several element[1] [2]. Climatic elements include: solar radiation, air temperature, air humidity, clouds and precipitation (rain), evaporation (evaporation), air pressure, and wind. Based on the climate description, it can be identified the type of vegetation that grows in that place, whereas to determine which plants can live in a certain climate, it requires more detailed growth requirements and weather information from several decades with average values and distribution patterns throughout the year, and To estimate plant diversity, daily weather information is needed[3].

Climatic classifications can be mapped by collecting data on climate elements for decades. Along with the occurrence of climate change due to global warming, the possibility of changing climate types is very large, while for decision making in the agricultural sector, information on the climate of an area is needed because from climate and rainfall data it can be determined which plants are suitable for agricultural areas. The suitable climate classification used in Indonesia for agricultural zoning is...
Oldeman's classification. This classification is widely used for climate suitability for agriculture because the classification is based on the number of wet and dry months in a row for a minimum of 10 years, this is related to the need for plants to get a lot of water from rain, because the water requirements for plants and their processing are different, different depending on the type [4].

The Indonesian government through the Agricultural Research and Development Agency has created a planting calendar that aims to facilitate farmers in selecting planting periods, types of fertilizers, and types of crops. The making of a planting calendar is obtained from data on rainfall, soil types, water sources, and the vulnerability of an area to disasters, which has been socialized by the government and widely applied by farmers. This condition is of course closely related to Oldeman's classification of agro-climatic zoning which has the same goal, namely the selection of the right type of plant and planting time for agriculture. So it is necessary to study the suitability of Oldeman's classification agro-climate zone theory with its implementation in the field to find out the presentation of the use of climate classification information for farmers.

South Tapanuli Regency is an area located in North Sumatra Province and has an agricultural sector that contributes to the region. The southern part of Tapanuli Regency (Tabagsel) consists of 14 Districts, where some of the livelihoods of the population are farmers (+ 80%) and are one food self-sufficient regency in the province of North Sumatra. However, the classification and mapping of climate information is still very low in the district, so that the farming community only uses old habits / traditions, so it is not uncommon for agricultural products to experience crop failure / fuso due to flooding and cropping patterns that are not suitable for climatic conditions in the region. The existence of climate classification mapping in South Tapanuli Regency can certainly help all parties in making policies related to climate, especially the management of agricultural resources.

So from the description above, the researcher is interested in conducting "Mapping of Oldeman's Climate Classification in Agricultural Resource Management in South Tapanuli Regency" so that agricultural productivity in South Tapanuli Regency can be increased and maintained so that the welfare of the farming community can be increased and the need for food self-sufficiency in the region can be fulfilled.

2. Methods
This research was conducted in the Southern part of Tapanuli (Tabagsel) by observing the rainfall data for the last 10 years covering Padangsidimpuan City, South Tapanuli Regency, Mandailing Natal Regency, North Padang Lawas Regency and Padang Lawas Regency.

The main materials used are rainfall data for the last 10 years which are scattered in the Tabagsel region, topographic maps of the area, books and journals relevant to this research. The tools used are Office Stationery, Computer (Hardware), MS Word and MS Excel.

The data used in this study are secondary data obtained from related agencies. The method of collecting rainfall data is purposive sampling, namely the selection of samples with a specific purpose. From a total of five regencies / cities in the Tabagsel region.

Data processing is divided into several stages, namely calculating the Oldeman classification climate type and processing spatial data. Spatial data processing includes: Interpolation to determine the distribution of climate classification Oldeman and overlay to determine the suitability of the agro-climate zone with the planting calendar.

Processing of spatial data in this study is divided into several stages, namely, the initial stage of collecting data on rainfall post coordinates and entered in the ArcGis software so that the coordinates of the location of the rainfall posts can be displayed on a map and processed in the form of a shapfile. The next stage is calculating the Oldeman climate classification value for each rainfall station, and entering it in the rainfall post attribute data. The analysis technique used is interpolation and overlay. Interpolation is filling in data gaps with certain methods from a data set to produce an area-shaped distribution. One of the advantages of GIS is the data manipulating function, which displays the distribution in the form of an area. Interpolation is used to determine the climate distribution of Oldeman's classification, while overlay is an overlap between maps with the same type of data, area,
and coordinate system so that information on two maps can be found in one map. Overlay is used to determine the suitability of Oldeman's classification of agro-climatic zones with the prevailing planting calendar.

3. Results and Discussion

From the results of processing rainfall data in South Tapanuli Regency for the last 10 years starting from 2008 to 2017 in the six rainfall stations scattered in the area, the results are in the following table.

| No | Rainfall station name | Number of BB (Consecutive wet months) | Number of BK (Consecutive dry months) | Climate Type |
|----|-----------------------|---------------------------------------|---------------------------------------|--------------|
| 1  | Saipar dolok hole     | 4                                     | 4                                     | D1,D2,E1     |
| 2  | Simagomago            | 4                                     | 2                                     | D1,D2,E1     |
| 3  | Padang Balangka       | 3                                     | 7                                     | E1,E2        |
| 4  | Huta holbung          | 3                                     | 5                                     | D2,E1        |
| 5  | Hutakojie             | 4                                     | 4                                     | D1,D2        |
| 6  | Arse                  | 3                                     | 6                                     | D2,E1        |

The results of data processing in the table above are interpolated on a map using the GIS (Geographic Information System) method as shown in the figure.

The existence of an Oldeman map can help the agricultural sector in knowing adaptation to climate. With the oldeman classification map information, it can be mapped the climate areas suitable for rice in particular. Rice plants (Oryza sativa) can live well in areas that are hot and contain lots of moisture. The average rainfall is 200 mm per month or more than the distribution for 4 months, the desired rainfall per year is around 1500-2000 mm[5].

Based on this information, suitable for rice plants without technical irrigation assistance are climate classification areas C1, D1, and D2. For the climate classification areas E1, E2, E3, rice can be planted with the assistance of irrigation, especially in the dry season[6]. The climate classification areas are D1 and D2 in the six rainfall stations, namely Saipar Dolok Hole District, Sipirok District, West...
Angkola District. And Batang Angkola has climate types D2, E1 and Arse has climate types D2, E1. The lowest rainfall is in East Angkola District with climate types E1, E2.

Table 2. Agro-climatic Zones in South Tapanuli Regency, 2008 to 2017

| No | Territory          | Climate Type | Activity description                                                                 |
|----|--------------------|--------------|---------------------------------------------------------------------------------------|
| 1  | Saipar dolok hole  | D1,D2,E1     | Rice has one short life span, high production, very secondary crops, Too dry, maybe only one crop, depending on water availability and irrigation |
| 2  | Simagomago         | D1,D2,E1     | One time short-lived rice, high production, secondary crops, Maybe only one rice or one crop, Too dry, maybe only one crop, depending on water availability and irrigation |
| 3  | Padang Balangka   | E1,E2        | Too dry, maybe only one crop high production, secondary crops, maybe only once rice or once crops, too dry, maybe only once crops, depending on water availability and irrigation |
| 4  | Huta holbung       | D2,E1        | One time short-lived rice, high production, secondary crops, maybe only once rice or once crops, too dry, maybe only once crops, depending on water availability and irrigation |
| 5  | Hutakoje           | D1,D2        | Maybe only once rice or once crops, Too dry, maybe only once crops, depending on water availability and irrigation |
| 6  | Arse               | D2,E1,E2     |                                                                                       |

4. Conclusions
Based on the results of processing and analysis of monthly rainfall data from 6 rain posts in the South Tapanuli Regency, it can be concluded that based on the Oldeman climate classification, there are 4 types of climate in the South Tapanuli region, namely: D1, D2, E1, and E2. The wettest climate type in the Sipirok region is climate type D1 with 4-5 wet months and <2 dry months. And those that are suitable for planting short-lived rice are 3 (three) harvests or short-lived rice is 2 (two) harvests and secondary crops 1 (sastu) harvests. The driest climate types in the East Angkola region are climate types E1 and E2 with the number of wet months <3 and the number of dry months 6-7. What is suitable for planting short-lived lowland rice is 1 (one) harvest and secondary crops 2 (two) times, the second special harvest falls in the dry season. The topographical condition of an area greatly influences the climatic conditions of the area. With a good climate classification and suitable for rice plants without irrigation assistance, the climate types are D1 and D2, namely in Sipirok District, West Angkola District and a Small Part of Saipar Dolok Hole and Batang Angkola Districts. Meanwhile, the East Angkola sub-district can be planted with rice with the help of irrigation, especially in the dry season.

References
[1] As-Syakur, A.R., Iwayan, S., Iwayan, R., dan Inyoman, D. Pemetaan Kesesuaian Iklim Tanaman Pakan Serta Kerentananya Terhadap Perubahan Iklim Dengan Sistem Informasi Geografi (Sig) Di Provinsi Bali. Jurnal Pastura, Volume 1 No. 1, Agustus 2011, halaman 15-25, 2011.
[2] Kartasapoetra, A.G. Klimatologi: Pengaruh Iklim Terhadap Tanaman dan Tanaman. PT. Bumi Aksara. Jakarta, 2004.
[3] Irianto, dkk. Keragaman Iklim Sebagai Peluang Diversifikasi. Pusat Penelitian Tanah dan Agroklimat. Bogor, 2004.
[4] Rafi’I, Suryatna. Meterologi dan Klimatologi: Penerbit Angkasa. Bandung, 1995.
[5] Arronoff, Stanley. Geographic Information System: A Management Perspective. Ottawa : WDL. Publication, 1989.

[6] Sudraji, A. Pemetaan Klasifikasi Iklim Oldeman Dan Schmist Fergusson Sebagai Upaya Pemanfaatan Sumber Daya Iklim Dalam Pengelolaan Sumberdaya Alam Di Sumatera Utara, 2009.

Acknowledgments
The author expressed his gratitude to the Universitas Muhammadiyah Tapanuli Selatan on basic research through an internal APB grant of research and community service in 2019-2020.