Information System in The Analysis of The Spread of ALSINTAN in Kalawat District, Minahasa Utara Regency

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Abstract

This research aims to develop a geographic information system to support the use of agricultural tools and machines in Kalawat District, North Minahasa Regency. This research was carried out for 2 months, starting in January-February 2022, with two stages, namely data collection at the research location in Kalawat sub-district, North Minahasa district, and data processing are made and displayed in tables and information maps. Equipment used Laptop Acer Aspire 5 A515, GPS Garmin and GPS Essential, Digital Camera, Smartphone Poco F3 Software (Software), Operating System Windows 10, ArcGIS 10.8, Microsoft Office Word 2013, Microsoft office excel 2013, Google Earth Pro 7.3.2 (64-bit), Postgre Structured Query Language (PostgreSQL) 10, PostGeographic Information System (PostGIS) and Mozilla Firefox. Research Results The making of an information system map for identifying the spread of ALSINTAN in Kalawat sub-district, North Minahasa district, has been carried out and is running well. Geographic Information System (ArcMap) can provide information related to agricultural tools and machinery in Kalawat District, North Minahasa Regency. This information system is very helpful and makes it easy for anyone who needs data and information about the availability of agricultural tools and machinery in Kalawat District, presented in the form of an interactive information map. In addition, the Information System (ArcMa) is useful for policymakers as a supporting tool in making decisions regarding the distribution and implementation of agricultural tools and machinery to farmers in the study location.

Keywords: Information system, spread of agricultural machinery

INTRODUCTION

Alsintan or agricultural machinery is a term for all tools and machines used in agricultural businesses. The strategic role of agricultural mechanisms through alsintan is the process becomes faster. With mechanization, we can carry out land processing, harvesting, and post-harvest quickly. And there are several alsintan tools that must be examined, then Alsintan has also become an important need for farmers to increase production, using GIS to provide information on the location points where the Alsintan is located and whether or not the Alsintan is still functioning.

North Sulawesi has a fairly abundant food supply in several areas, and also in terms of the availability of agricultural development land. The agricultural land available for development is 164,593 ha. Around 133,135 ha (80.9%) is directed to annual crop commodities, 5,091 ha (3.1%) to seasonal crop commodities, and 26,367 ha (16.0%) to paddy fields (Agricultural Research and Development, 2017), especially in North Minahasa Regency. In order to achieve the target of food security as part of national food sovereignty, one of the things that will support it is agricultural tools and machinery spread across several points in Kalawat District, North Minahasa Regency. Administratively, the north is bordered by Talawaan and Dimembe Districts, the east by Airmadidi District, the west by Manado City, and the south by Mianahasa Regency. The area of Kalawat District is 3819.79 ha. (BPS, 2018).

Rice and corn are the most promising commodities for the application of agricultural tools and machinery (alsintan) to increase productivity, from pre-production to post-harvest. In the application of alsintan, proper planning is needed, including mapping and identification of priority areas for the

application of alsintan in a region. To facilitate this process, a Geographic Information System (GIS) can be used. GIS is a computer-based information system, designed to work using data that has spatial information (spatially referenced). GIS has greatly helped the analysis process in various fields such as the environment, health, disasters, social, and agriculture. In the field of agriculture, GIS is often used for crop planning, irrigation planning, to predicting pest attacks. Likewise, in this study, the tools contained in the GIS application will be used for the analysis process, starting from the analysis of regional potential and the potential for the application and distribution of agricultural tools and machinery (Dodi Setiawan 2018).

MATERIAL AND METHOD

Time and Place of Research

This research was conducted over 2 months, from January to February 2022, with two stages: data collection at the research location in Kalawat sub-district, North Minahasa Regency, and data processing, which involved creating and displaying tables and information maps.

Data and Equipment
- **Data used**

Data needed to support research:
a. Land Map Data for Kalawat District, scale 1:25.0 00
b. Data on the number and location of agricultural machinery distribution in Kalawat District
c. Agricultural machinery specification data
d. d. Photo/documentation of the object

- **Equipment used**

Equipment needed to support research:

Hardware*:*
1. Acer Aspire 5 A515 Laptop
2. Garmin GPS and Essential GPS
3. Digital Camera
4. Poco F3 Smartphone

Software
a. *Windows 10 Operating System*
b. *ArcGIS 10.8*
c. *Microsoft Office Word 2013*
d. *Microsoft Office Excel 2013*
e. *Google Earth Pro 7.3.2 (64-bit)*
f. *Postgre Structured Query Language (PostgreSQL) 10*
g. *PostGeographic Information System (PostGIS)*
h. *Mozilla Firefox*

Observation Variables
1. Speed and accuracy of presentation of information on the distribution of agricultural machinery
   - The speed of information that will be delivered to users, especially farmers, can be seen from the aspect of completeness of data, location and condition of agricultural machinery in the field and has a reliable data source.
   - The level of accuracy of this research is very good because it uses field data that is processed into spatial data by producing output that can be seen by users in the form of maps.
2. Ease of analysis of distribution, needs, and planning of agricultural machinery
   - An analysis using a Geographic Information System application makes it easier for farmers who need agricultural machinery on agricultural land to make plans for their agricultural land needs.
   - This information system can make it easier for farmers to plan during the pre-harvest and post-harvest periods on agricultural land so that they can use time, energy, and costs more efficiently.

Research methods

The method used is the field survey method, then continued with map-making using GIS applications. Furthermore, a descriptive analysis is carried out, which explains the observation variables.

Research Procedures

Data collection

Data collection, both primary data containing the number and type of agricultural machinery, as well as supporting data in the form of physical conditions of agricultural machinery and the role of agricultural machinery. The data obtained are primary data from measurements and surveys in the field such as determining coordinate points in determining the location of agricultural machinery and measuring the area of agricultural land in each village in Kalawat District, North Minahasa Regency and secondary data through the Minahasa Utara Regency Agriculture Service, also the results of data searches on the Internet related to the Kalawat District Topographic Map data, North Minahasa Regency, as well as information on existing agricultural machinery specifications.

Data processing

a. Spatial / Graphical Data Entry

Entering secondary data in the form of an RBI map and digitizing it using *the ArcMap application* to determine the specific location points to be studied.

b. Non-spatial/Attribute Data Entry

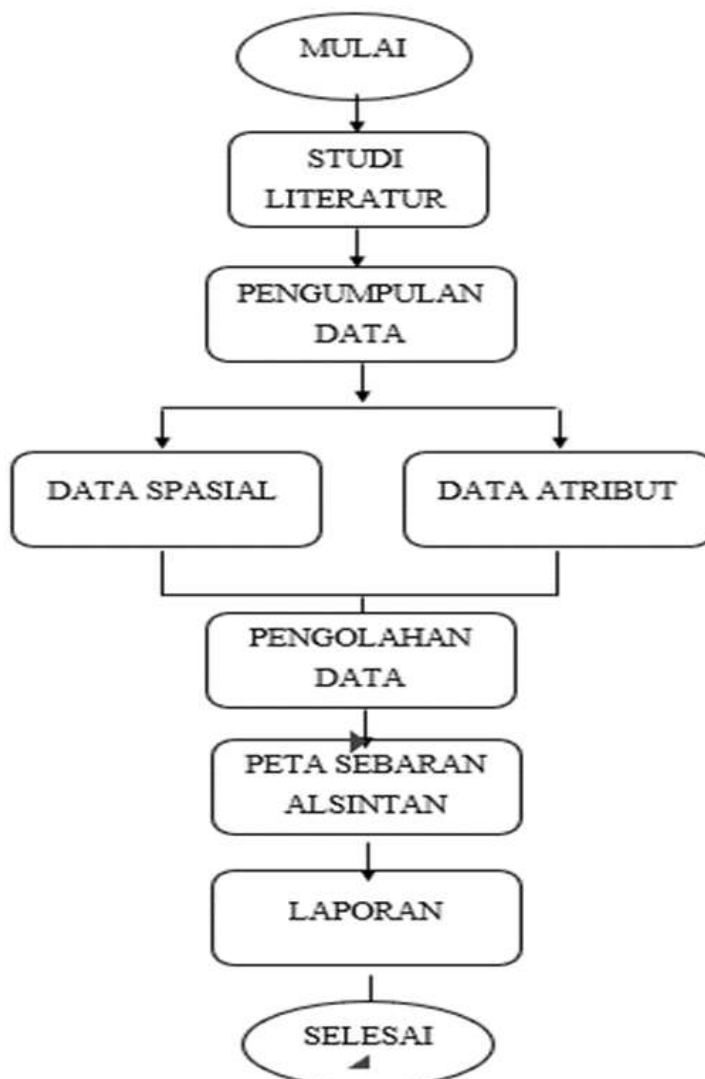The attribute data that will be entered includes various agricultural machinery data such as mentioned in Figure 1.

Figure 1Flowchart Procedure Study

RESULTS AND DISCUSSION

Planning

Research Area Profile

Based on the Central Statistics Agency of Kalawat District 2021, the area included in the research area is located within the administration of Kalawat District with an astronomical location of 1.65882 ° N-1.80612 ° N and 124.96853 ° E-125.05751 ° E. Based on its geographical position, Kalawat District has boundaries: North - Dimembe and Talawan Districts; South - Minahasa Regency; West - Manado City; East - Airmadidi District.
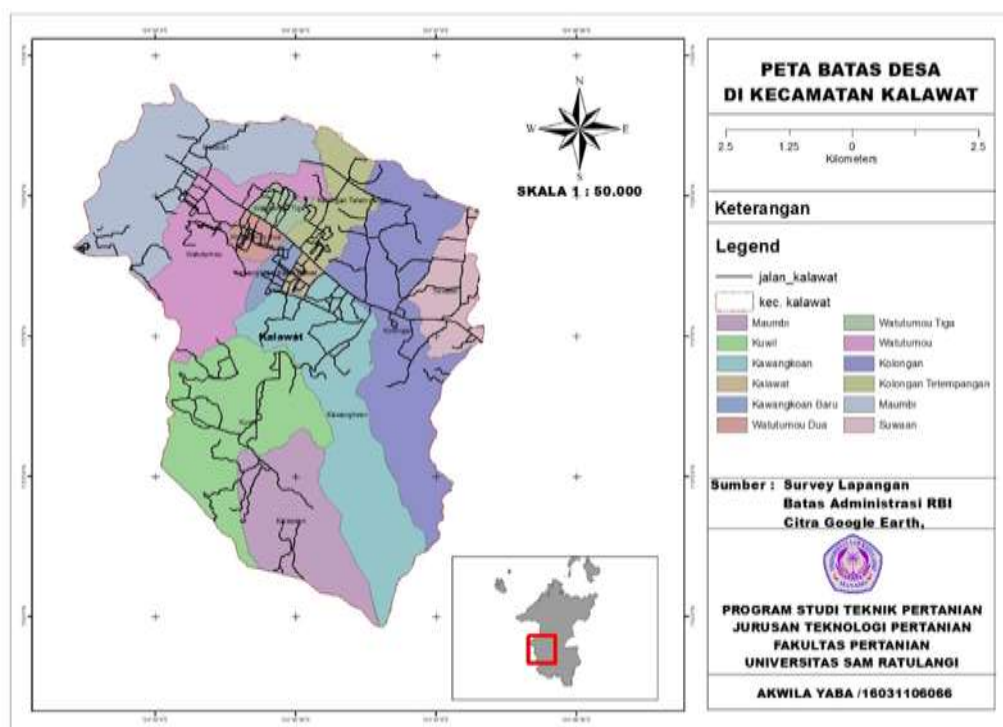

Figure 2Administrative Village Boundary Map

Scope of the problem
- Data collection on agricultural machinery in the field is only based on data from the North Minahasa Agriculture Service and conducting field surveys on each agricultural machinery in Kalawat District, North Minahasa Regency.
- The creation of an information map of the distribution of agricultural machinery only shows the coordinate points of the agricultural machinery in the Kalawat sub-district.

Data collection

Data on the distribution of agricultural machinery and village boundaries obtained from the Department of Agriculture, Livestock and Plantations covers the entire Minahasa Utara district and is sorted at the sub-district level and processed according to the sub-district used for the research, namely Kalawat sub-district.

Agricultural machinery data obtained from the North Minahasa Agriculture, Livestock and Plantation Service, namely, there are 26 agricultural machines, including 25 pre-harvest agricultural machines and 1 harvest agricultural machinery. Based on these data, the author took agricultural machinery points directly in the field.

The taking of agricultural machinery points is done using the *GPS Essentials application* on *a smartphone. Poco F3* in 11 villages in the Kalawat sub-district, namely

Suwaan, Kolongan, Kolongan Tetempangan, Kawangkoan, and Maumbi.

The following are the results of the agricultural machinery obtained.

Table 1 Kalawat District Equipment Data

Village	Agricultural machinery			Group name Farmer	Condition
	Type	Unit	Classification		
Suwaan	2-Wheel Tractor	1	Pre-Harvest	Agro-independent	Broken Repaired
	2-Wheel Tractor	1	Pre-Harvest	KTNA	Good
	Shelling Machine	1	Harvest		Good
	2-Wheel Tractor	1	Pre-Harvest	Women's Work	Good
	Hand Sprayer	2	Pre-Harvest		Good
Column	4 Wheel Tractor	1	Pre-Harvest	Independent Farmer	Good
	Water pump	1	Pre-Harvest	Watudane	Good
	Cultivator	1	Pre-Harvest	Matuary	Good
	Rice Transplanter	1	Pre-Harvest	Source of Blessings	Good
	2-Wheel Tractor	1	Pre-Harvest	Mega Cempaka	Good
	2-Wheel Tractor	1	Pre-Harvest	Malimbukan	Good
	2-Wheel Tractor	1	Pre-Harvest	Transparent	Good
	Water pump	1	Pre-Harvest	Top Reko	Good
	Hand Sprayer	1	Pre-Harvest	The Sun	Good
Column The Temptation	Hand Sprayer	1	Pre-Harvest	Independent Business	Good
	Hand Sprayer	1	Pre-Harvest	Joint Venture	Damaged
	Cultivator	1	Pre-Harvest	Deadly	Good
	Hand Sprayer	1	Pre-Harvest		Good
	Rice Transplanter	1	Pre-Harvest	Mapalus	Good
The Kawangkoan	Hand Sprayer	1	Pre-Harvest	Bethany	Good
	2-Wheel Tractor	1	Pre-Harvest	Alpha Omega	Good
	Manual corn planting tool	1	Pre-Harvest	Agape	Good
	Cultivator	1	Pre-Harvest	Gogoon	Good
Maumbi	2-Wheel Tractor	1	Pre-Harvest	The Rinambaan	Good
	Water pump	1	Pre-Harvest		Good

Data processing

The results of taking agricultural machinery points in the field in *KML format* are then copied to the *Acer Aspira 5 A515 laptop* and then converted using *the ArcToolBox menu* into a *layer format* so that it can be processed using *the ArcMap 10.8* application. This will produce a map of agricultural machinery distribution information.

Figure 3 is a map of the distribution of agricultural machinery. The results of data processing from the Village Boundary *Shapefile of Kalawat* District, North Minahasa Regency, which added the attribute of the coordinate points of

agricultural machinery. The points in the view show the coordinates of pre-harvest and harvest agricultural machinery located in Kalawat District, North Minahasa Regency, using various colored point symbols.

Figure 4, namely the village boundaries of Kalawat District, North Minahasa Regency. Processing Results from the *2022 Indonesian Administrative Map* selected according to the district used for research. The image in the data view shows the village boundaries of Kalawat District, North Minahasa Regency, using area symbols and lines. The district

boundaries are red, and the village boundaries use color codes and label styles.
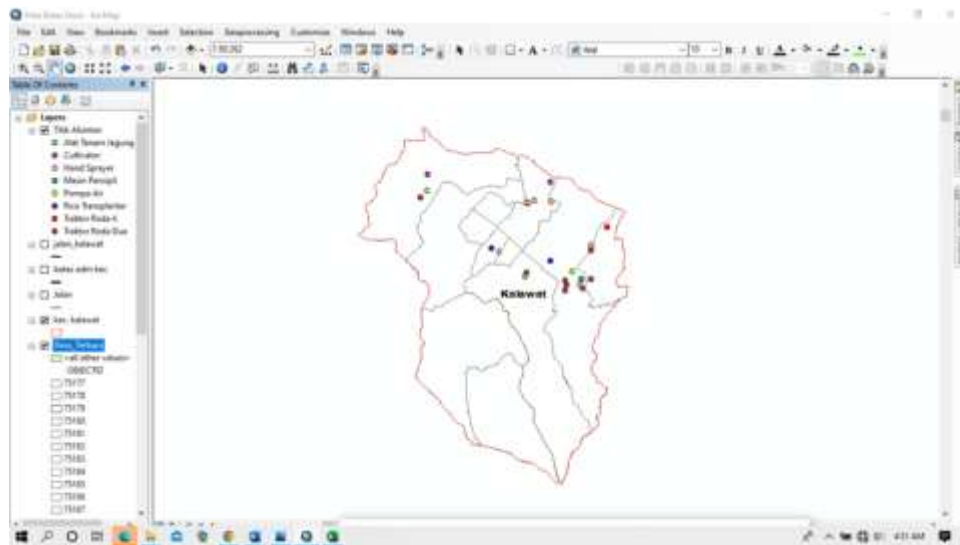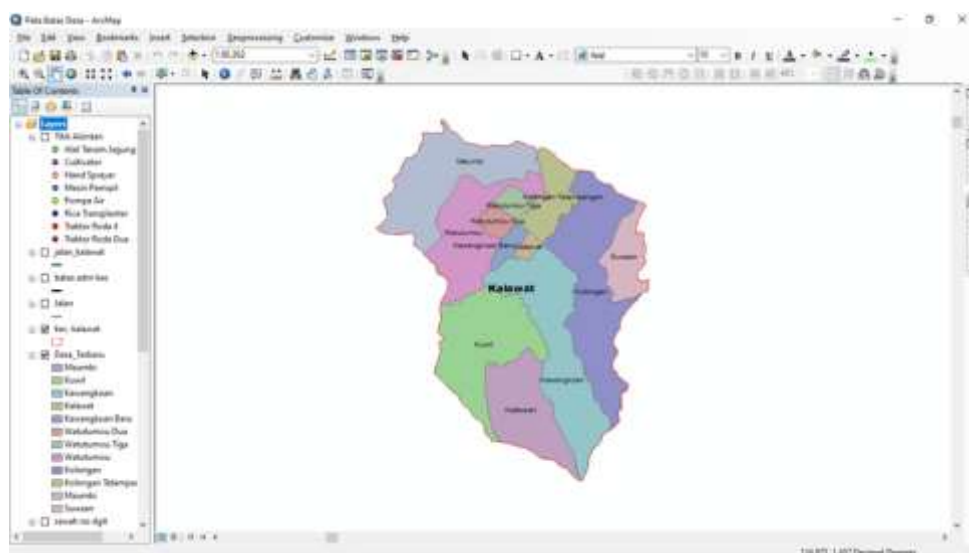

Figure 3Shapefile of Alsintan distribution

Figure 4*Shapefile of* village boundaries in Kalawat District, North Minahasa Regency

Figure 5 is a map of the distribution of pre-harvest agricultural machinery. Processing results from the Village Boundary *Shapefile* of Kalawat District, North Minahasa Regency, which has been added with the attribute of the coordinate points of pre-harvest agricultural machinery. The points in the view indicate the coordinates of the harvested agricultural machinery located in Kalawat District, North Minahasa Regency, using a red dot symbol.

Figure 6 is a map of the distribution of harvested agricultural machinery. Processing results from the Village Boundary *Shapefile* of Kalawat District, North Minahasa Regency, which has been added with the coordinate point attribute of harvested agricultural machinery. The points in the view indicate the coordinates of harvested agricultural machinery located in Kalawat District, North Minahasa Regency, using a red dot symbol and the label style.
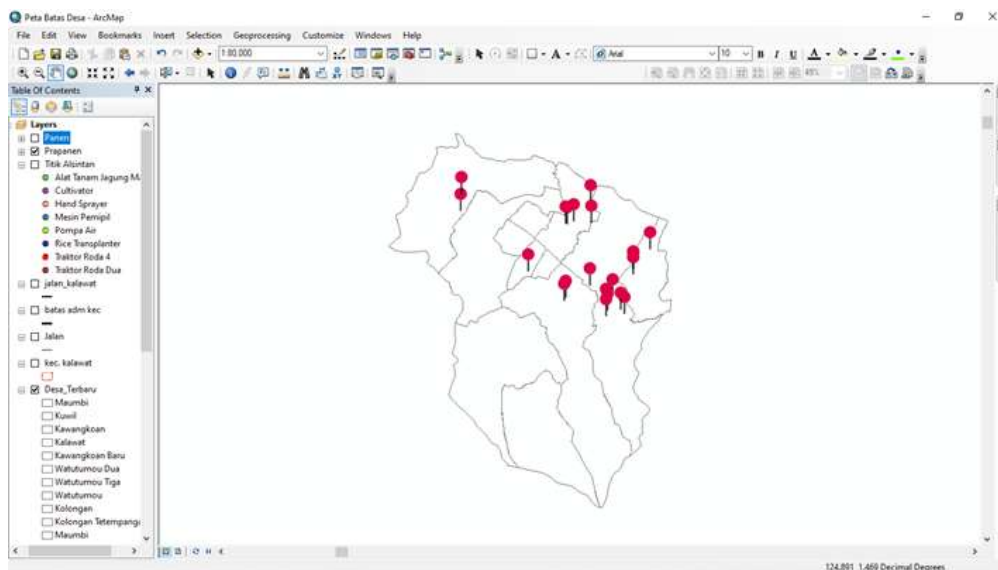
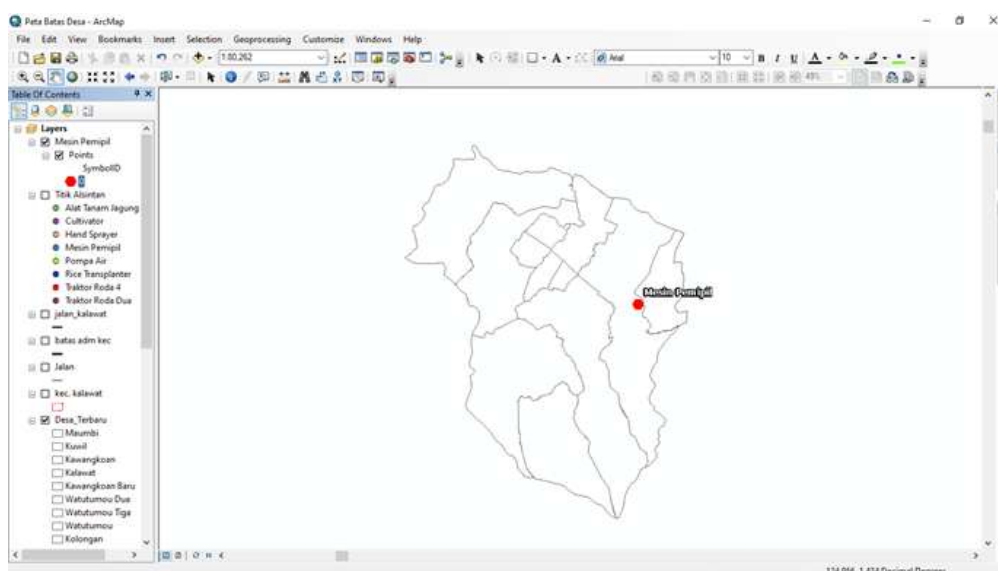Figure 5*Shapefile,* Kalawat District , North Mianahasa Regency.

Figure 6Shapefile of Agricultural Machinery Harvest in Kalawat District, North Minasaha Regency

Figure 7, namely Agricultural Land in Kalawat District, North Minahasa Regency. Processing Results from the Indonesian Administrative Map 2022, selected according to the sub-district used for research. The image in the data view shows the village boundaries of Kalawat District, North Mianahasa Regency, and Agricultural Land of Kalawat District, North Mianahasa Regency, using a green area symbol for agricultural land.

Figure 8, namely the distribution map of farmer groups. Processing Results from *Shapefile Essential GPS* in Kalawat District, North Minahasa Regency, which has added farmer group coordinate point attributes. The points in the view show the coordinates of farmer groups located in Kalawat District, North Minahasa Regency, using various colored point symbols.
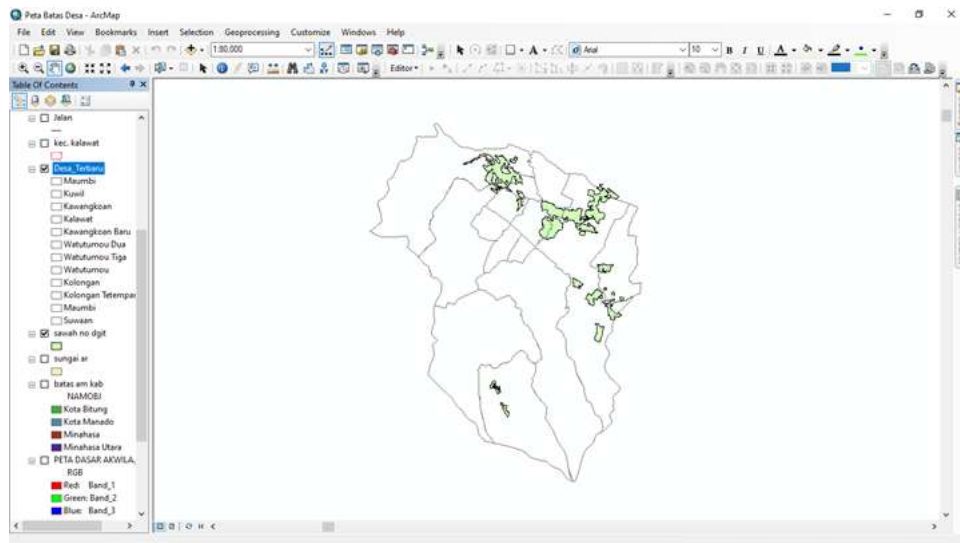
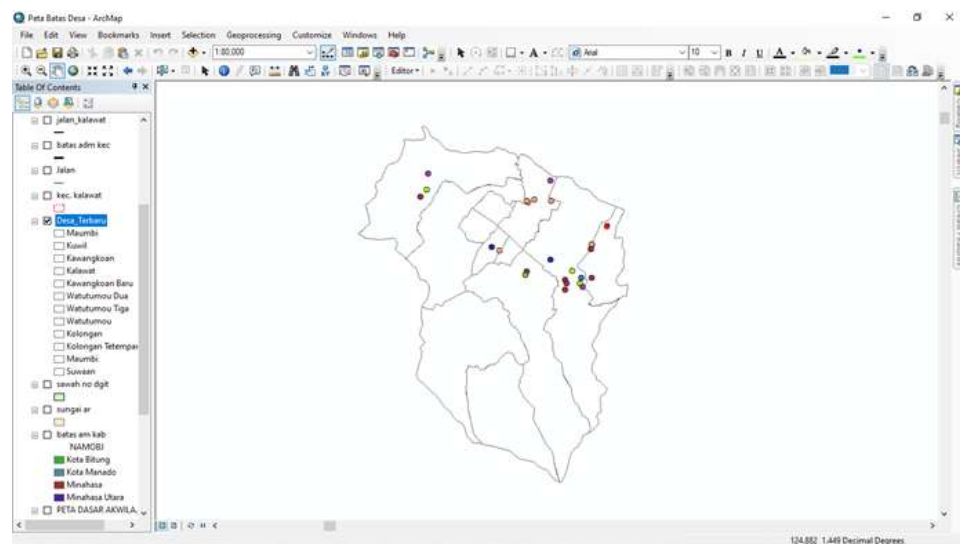Figure 7Shapefile of Agricultural Land in Kalawat District, North Minahasa Regency
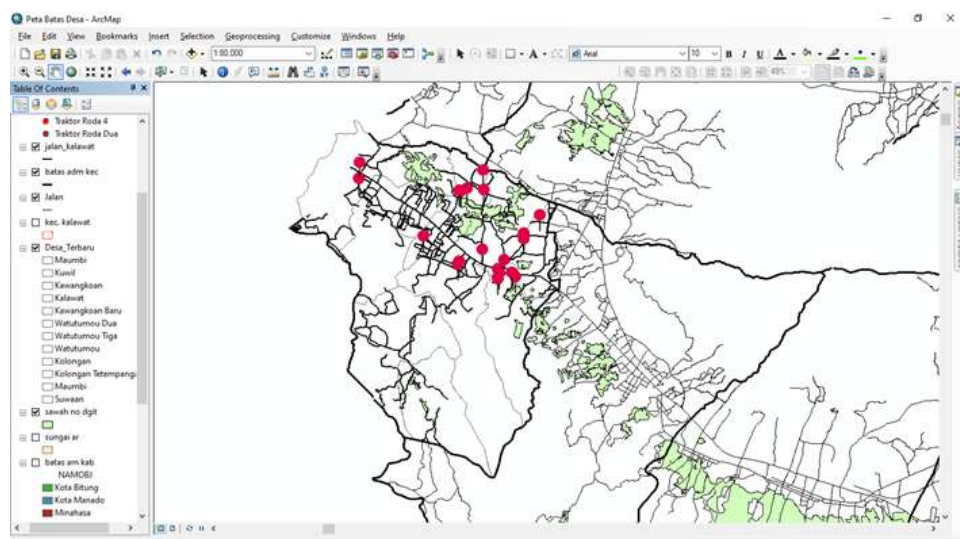

Figure 8Farmer Group Points

Figure 9. Overlay of each layer

Overlay or Overlay of each vector data in the process of making the map (Figure 9), the author *overlays* or overlaps spatial data by entering the data that has been obtained, namely spatial data in vector form, including: village boundary *polygon shapefile data, agricultural machinery service polygon shapefiles* in Kalawat District and *shapefile data* of agricultural equipment and machinery location points from pre-harvest to harvest, as well as *shapefile data of* farmer group points. The *overlay process is carried out* to obtain a combined map of all the spatial data that has been entered, along with its attributes, so as to produce more information related to agricultural equipment and machinery in each village in Kalawat District. After that, the author inputs *supporting* data in the form of the name of the agricultural machinery, the number of agricultural machineries, and other information related to the agricultural machinery at each location point, and also enters information on each *polygon*, so that it becomes an attribute table data. In attribute data. Attribute data can be seen in the attachment. After the map containing spatial data & attributes was created, the author then built a geographic information system map, or what is commonly called *ArcGIS*.

Speed and Accuracy of Data Presentation

The presentation of this research data is a spatial-based data presentation. In a geographic information system, almost all data has a high level of accuracy because most of the data is taken according to the conditions in the field. This information system is easily accessible and quickly understood by the general public as users, especially farmers.

Based on the data taken in the field, it can be seen that the output produced is a map that has a high level of accuracy because it takes points or coordinates in the field using GPS assistance. The points taken are the distribution of agricultural machinery in the Kalawat sub-district,

North Minahasa Regency (Figure 3) there is also the area of agricultural land in the sub-district (Figure 7).

This study helps farmers find out what agricultural machinery is close to their location, thus helping farmers in making plans for their farmland and using time, energy, and costs more efficiently. In this study, farmers can quickly access the location of existing agricultural machinery using a geographic information system. In Figure 9, it can be seen that agricultural machinery is spread across several points and is still in one sub-district; in other words, farmers can know the overall location of the agricultural machinery itself, so that farmers can make plans easier than before.

Analysis of Distribution, Needs, and Planning of Agricultural Equipment

The distribution of agricultural machinery in K alawat District (Figure 3) shows that agricultural machinery is widely distributed in several locations close to farmers' rice fields.

This information system is expected to meet the needs of farmers' agricultural machinery in the area, so as to help farmers in planning during the harvest and harvest period. Planning during the pre-harvest and harvest periods greatly affects the harvest itself. Therefore, a precise and accurate information system is needed related to the pre-harvest and post-harvest processes; in this case, agricultural machinery is very influential in increasing the harvest.

While the program has achieved substantial progress in addressing data inconsistencies and fostering collaboration, several challenges remain, including issues related to data ownership, jurisdictional disputes, and limited stakeholder engagement. The findings highlight that effective policy reform, increased stakeholder involvement (Barai *et al*. 2025), and capacity-building initiatives are critical to overcoming these challenges.

In planning, an accurate information system is needed, so the results of this study are very helpful for farmers to use agricultural machinery in the area. The need for agricultural machinery for farmers greatly influences the level of success of their harvest. Through the outputs produced in this research, farmers are expected to be able to increase their harvest results by utilizing existing information systems.

CONCLUSION

Based on the results of the research that has been carried out, it can be concluded that: 1) The creation of an information system map for identifying the distribution of agricultural machinery in Kalawat sub-district, North Minahasa district has been implemented and is running well. 2) Geographic Information System (ArcMap*)* can provide information related to agricultural tools and machines in Kalawat District, North Minahasa Regency. This Information System is very helpful and makes it easier for anyone who needs data and information about the availability of agricultural tools and machines in Kalawat District in the form of an information map. In addition, the Information System *(ArcMap)* is useful for policymakers as a supporting tool in decision-making for the distribution and implementation of monitoring of agricultural tools and machines for farmers at the study location.

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