Land and Forest Fire Hazard Mapping ff Jeneberang Watershed

Uca[a)], Sukri Nyompa[b)], Muh Rais Abidin[c)], Amal[d)] and Erman Syarif[e)]

Department of Geography, Universitas Negeri Makassar,Makassar, Indonesia.

[a)]Corresponding author : Ucasideng@gmail.com
[b)]sukrinyompa@unm.ac.id
[c)]muhraisabidin@unm.ac.id
[d)]amal@unm.ac.id
[e)]ermansyarif@unm.ac.id

Abstract. Forest and land fire research aims to provide information and input to the community and local government regarding the level of fire hazard and to inform the distribution of locations that have a high level of fire hazard. The variables used in determining forest and land fire hazard are land use, slope, altitude, road distance and average air temperature. The method used in this study is to use Overlay analysis or overlapping of several variables used. From the results of the analysis of the data obtained shows that the level of vulnerability of forest and land fires in the Jeneberang watershed shows a percentage of more than 40% of the total area of the Jeneberang watershed 78883.90 Ha for the very high category. In this study land use variables are determinants and indicate that the extent of forest and land fire vulnerability is a result of rapid land use changes from year to year in the Jeneberang watershed.

INTRODUCTION

Historically, forest and land fires have been a recurring phenomenon in almost all forested areas in Indonesia. Data released by the World Bank Group in January 2016 shows that between June and October 2015 there were 2.6 million hectares of forest and land burned with losses estimated at USD 16.1 billion [1]. Sletnes [2] gives a broader picture that forests and land are important economic factors, and at the same time provide goods and services, complex, dynamic, and very valuable natural ecosystems that also facilitate and protect biodiversity [2].

Forest fires have a considerable impact on the hydrological system, land degradation, flooding and soil erosion [3], loss of biodiversity, and forest and land degradation [4]. Forests and land for people who live and depend on forest products become more effective, such as heavily damaged forest areas that require no simple handling, in addition, people who have lost their livelihoods need treatment that cannot be postponed [5]. The root causes of land and forest fires are becoming increasingly diverse, ranging from natural to man-made factors that propagate to social and economic behavior as well as cultural factors. Starting from this understanding, the concept of vulnerability becomes an equally important focus to look further into the various causes of disasters in an area.

The Jeneberang Watershed is one of the watersheds in South Sulawesi which has been included as a priority watershed. The condition of the land in the Jeneberang watershed has undergone changes in environmental physical conditions so that it can be a major factor causing fires. For example, the condition of land use, where more and more tree felling is carried out, causing fires to spread easily during the dry season. El Nino is recognized as the biggest contributor to the prolonged summer which also increases forest and land fires and the drought of agricultural crops between 8-10 times [6].

The use of Geographic Information Systems (GIS) in the context of fire hazard studies has been used for analysis and observation of forest fires since the 1990s. The function of this GIS can be used for monitoring fires and making plans for anticipating fires by making fire-prone maps through modeling techniques [7], Analyzing the risk [8] and Zoning area of forest fire [9]. The ability of GIS in predictive strategies makes it very reliable in mapping forest and

land fire [10] so that it can produce a product in the form of a map of areas prone to burning and can be used to calculate the burned area and adaptation strategies for handling it such as .

METHODS

The study area took a place in Jeneberang Watershed located in South Sulawesi which is 119^0 30’ 0” - 119^0 50’ 0” E and 5010’ 0”- 5030’ 0” S.

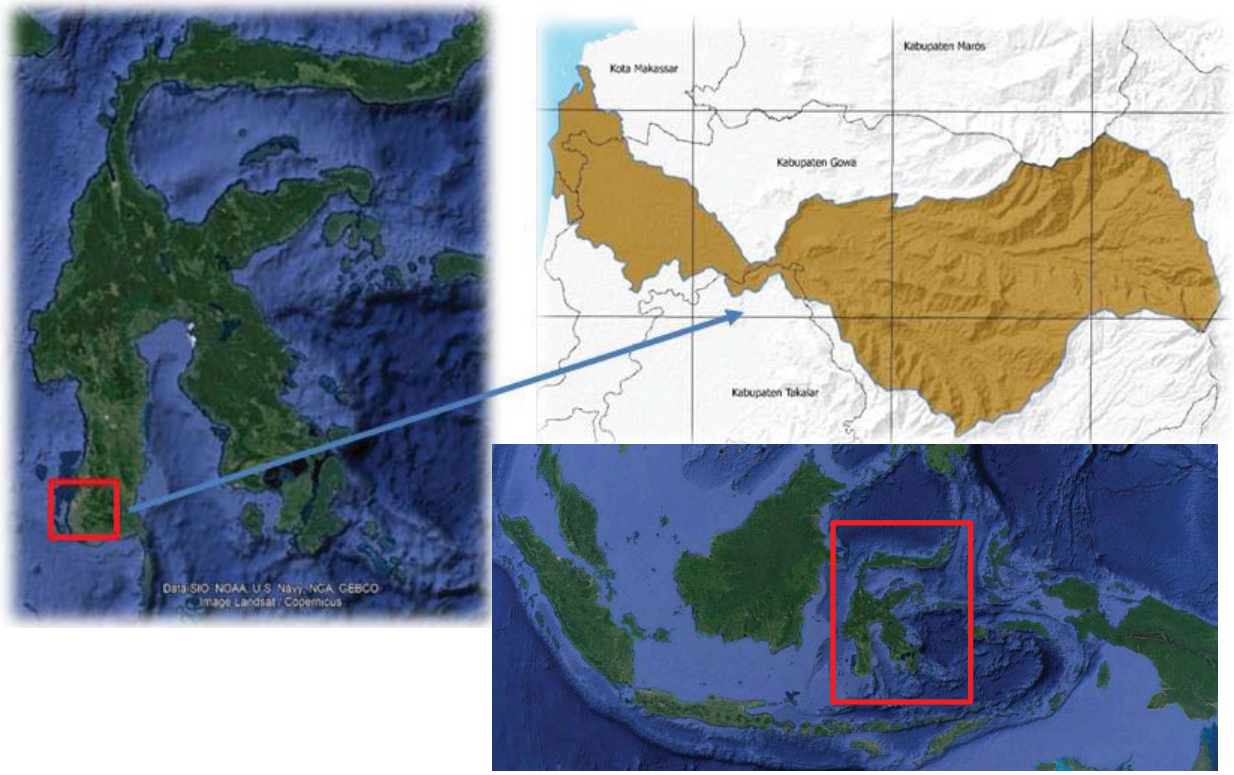

FIGURE 1. Study Area

The data processing and analysis technique is based on the Geographic Information System, namely ArcGIS 10.3 software. The analysis is divided into two stages of modeling, namely scoring and overlay models. The scoring model is the stage of scoring and weighting the variables, in which there is a mathematical operation process according to the parameters of each vulnerability. The overlay stage is combining two or more layers to create a new output feature class that contains information from both inputs. Data analysis in this case is the act of classifying or grouping certain criteria against this research data, the data that has been analyzed is grouped for the level of determining forest and land fire vulnerability.

The formula consisted of several parameters such as slope and topography obtained from DEM, while land use, road and temperature buffer zone from surveying. The analysis of fire vulnerability based on National Disaster Management Agency [11]. Fire vulnerability = Land Use*0.3854) + (Slope Slope*0.2531) + (Topography*0.0983) + (Buffer*0.0380) + (temperature*0.0627)

RESULT AND DISCUSSION

The results showed that changes in land use in the Jeneberang watershed have caused changes in area. Where the use of dry agricultural land mixed with shrubs is the largest land use of 37,739.52 hectares or 47.84% of the total area of the Jeneberang watershed which is 78883.90 Ha, while the least land use is plantation with an area of 173.93 hectares or 0, 22% of the Jeneberang watershed area. The following is the result of mapping the land use of the Jeneberang watershed.

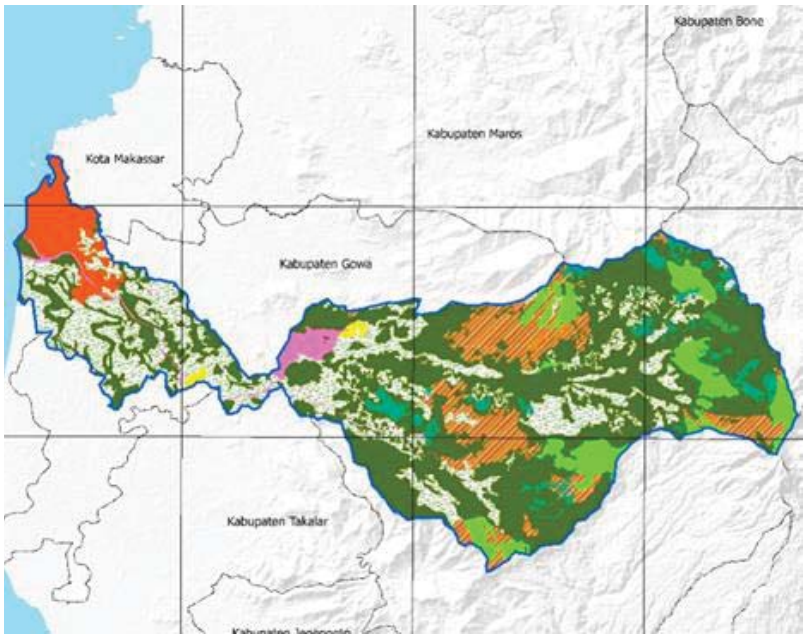

FIGURE 2. Land Use

While based on the results of the slope analysis, the Jeneberang watershed is dominated by a slope of 0-8% and 8-15%. While the slope above 45% is the slope with the smallest area of 218 hectares or 0.27% of the Jeneberang watershed area of 78883.90 hectares

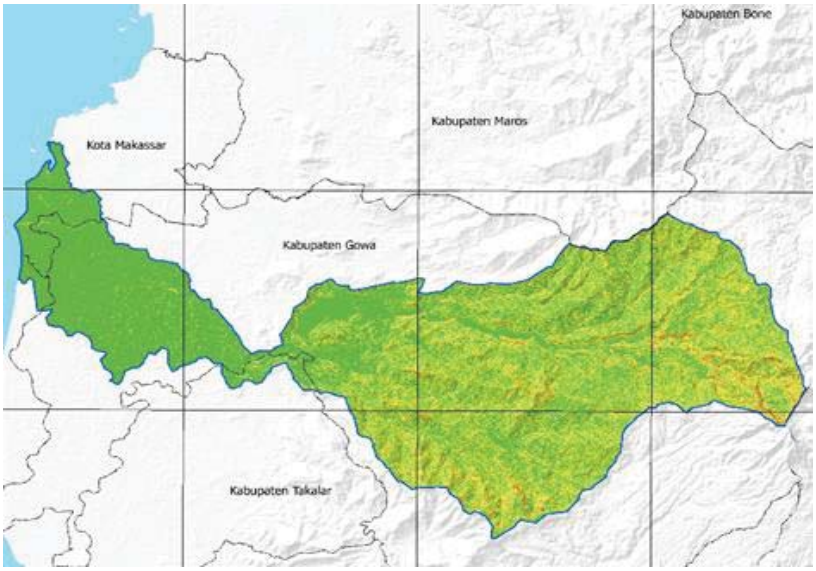

FIGURE 3. Slope

The Topography results of the analysis, Jeneberang watershed is dominated by an altitude of 0-200 meter and 400-600 meter. While 600-800 asml is an altitude with a smaller area of 10450.33 hectares or 13.25% of the Jeneberang watershed area of 78883.90 hectares.

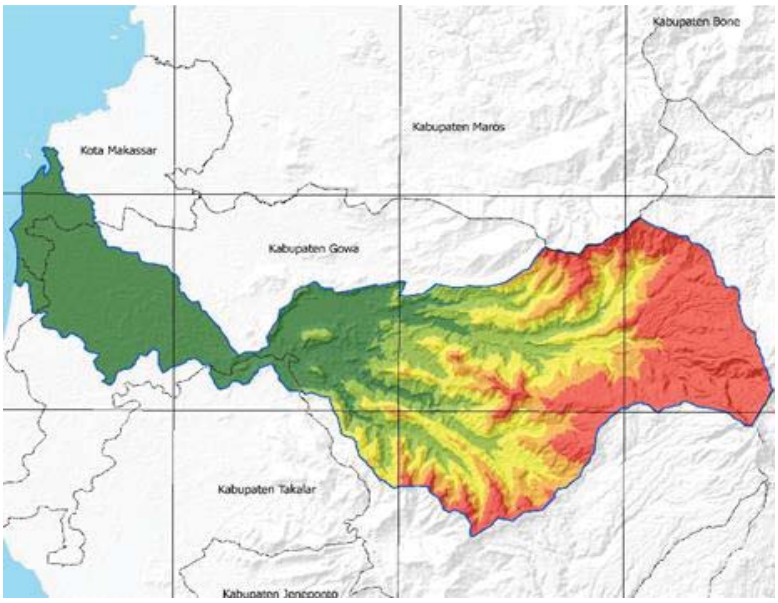

FIGURE 4. Topography

The topography data shows that Jeneberang watershed has variety of topography starting from the low land to high land.

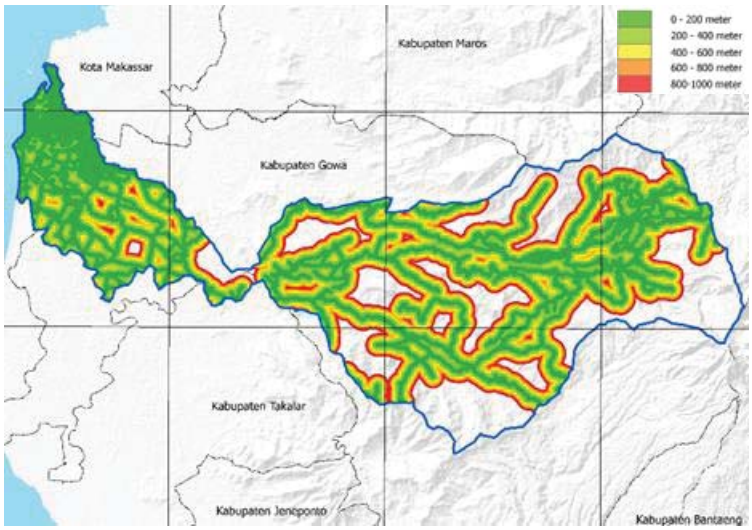

FIGURE 5. Buffer

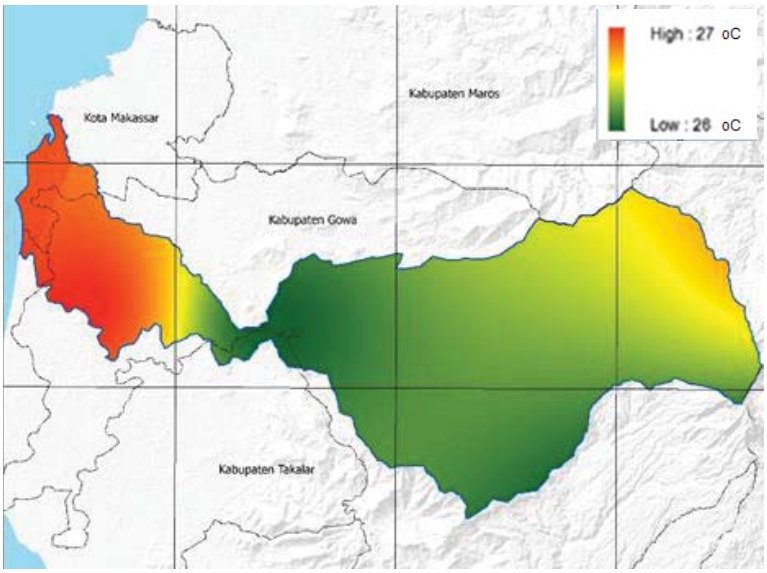

FIGURE 6. Temperature

The result show that mostly the high temperature in Jeneberang Watershed mostly concentrate in the low land while low temperature is in the high land. The average temperature is 26.1^{0}C which the highest is 30^{0}C and the lowest 21.8^{0}C.

Forest and land fire hazard maps are generated from the results of overlapping each variable, namely, land use, slope, altitude, buffer and temperature. Each of these variables is given a weight in accordance with predetermined indicators. The results of the forest and land fire hazard mapping show that most of the Jeneberang watershed area is in a high status which dominates the entire watershed area. For very low vulnerability, most of them are in the middle of the Jeneberang watershed, namely the border between Takalar Regency and Gowa Regency.

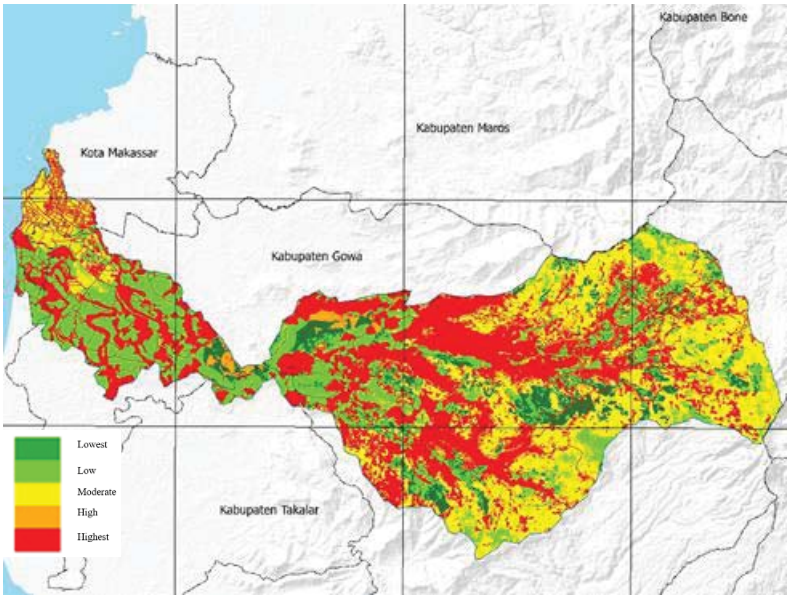

FIGURE 7. Fire Hazard

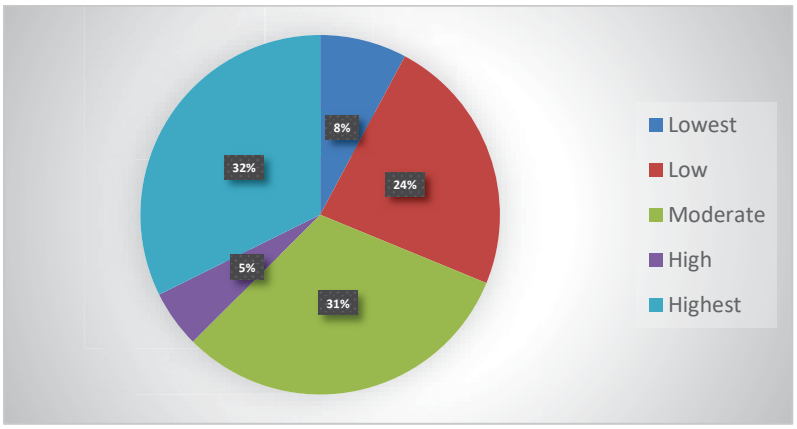

FIGURE 8. Diagram of Fire Hazard

Vulnerability to forest and land fires is an existing condition of the status of a forest area that has changed into a core component of how land and forest areas are used which at the same time shows the behavior of the status of the area. Changes in the status of forest areas that are part of land conversion are a guarantee of fire vulnerability. Most of the high vulnerability area consisted of dry land agriculture while a finding [12] which took the same area showed that the highest potency for land fire is coming from dry land agriculture, secondary dry land forest, and scrub. Furthermore, peat lands [13] correlated to high prone area which is worsen by high temperature [14] and Drought [15].

CONCLUSION

The forest and land fire susceptibility in the Jeneberang watershed is divided into five hazard classes, where each class has a different area, the very low fire susceptibility class is 7,167.15 hectares or 9.08%. Low land fire susceptibility covers an area of 16,576.85 hectares or 21%. The medium vulnerability class covers an area of 18,132.85 hectares or 23%. For high class vulnerability it covers an area of 35,376.74 hectares or 44.84% and for forest fire vulnerability and very high category it covers an area of 1,630.31 hectares or about 2.06% of the total area of the Jeneberang watershed 78,883.90 hectares

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