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Land Suitability Assessment Gambir Commodities (*Uncaria gambir* Roxb.*)* In Pakpak Bharat District

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ABSTRACT
Gambier (*Uncaria gambier* Roxb.) is a cultivated plant regeneration in Pakpak Bharat. Gambir extract benefits as well as the pharmaceutical industry and traditional is quite interesting so market opportunities gambier quite open for the domestic market and abroad. Land potential and development opportunities gambir high enough, it is in the use of a plantation area of 1,225 ha and optimization of a dry land area of 16.049,6 ha (Pakpak Bharat in Figures, 2022). Gambier development in Pakpak Bharat tends to increase, so it is necessary to study the suitability of the land to see the direction of the development of the appropriate location. This assessment was conducted by using ALES *(Automated Land Evaluation System)*. SDPLE *(Standard Procedure for Land Evaluation)* data was imported into the ALES program. Land evaluation result was shown in spatial form. This form is made by importing tabulation data to the GIS *(Geographical Information System)* form. Suitability land maps (scale 1: 250.000) are present based on each commodity by the ArcView program.
Keywords: *Land Suitability, Gambier, Pakpak Bharat, Ales*

ABSTRAK
Tanaman gambir (*Uncaria gambir* Roxb.*)* merupakan tanaman yang dibudidayakan secara regenerasi atau turun temurun di Kabupaten Pakpak Bharat. Manfaat ekstrak gambir sebagai bahan industri farmasi maupun tradisional cukup diminati sehingga peluang pasar gambir cukup terbuka baik pasar dalam negeri maupun luar negeri. Potensi lahan dan peluang pengembangan gambir cukup tinggi, hal ini dalam penggunaan lahan perkebunan seluas 1.225 ha dan optimalisasi lahan kering seluas 16.049,6 ha (BPS, 2021). Pengembangan komoditas gambir di Kabupaten Pakpak Bharat cenderung terus meningkat, sehingga perlu dilakukan pengkajian pewilayahan komoditas untuk kesesuaian lahan untuk melihat arah lokasi pengembangan yang sesuai. Pengkajian ini dilakukan dengan memanfaatkan program ALES *(Automated Land Evaluation System).* Pelaksanaan komputasi dilakukan dengan mengimport data SDPLE *(Standard Procedure for Land Evaluation)* atau data yang sudah tersedia dalam format Excell ke program ALES. Penyajian hasil evaluasi lahan dalam wujud spasial atau peta dilakukan dengan cara mengimport data tabulasi kedalam format GIS *(Geographical Information System).* Penyajian peta kesesuaian lahan (skala 1 : 50.000) dibuat berdasarkan jenis komoditas pertanian dengan menggunakan program ArcView.
Keyword: *Kesesuaian lahan, Gambir, Pakpak Bharat, Ales*

1. Introduction

Pakpak Bharat was a division of Dairi District in 2003 with a population in 2010 of 40,505 people consisting of 8,992 households. Pakpak Bharat Regency is located at 2015'00"-3032'00" N latitude and 96000'-98031' E longitude and the area is 1,218.30 km2 consisting of 8 sub-districts and 52 villages. In the plantation

subsector, in 2013 there were three mainstay commodities with the largest area and production, namely Gambir, Arabica Coffee and Palm Oil. In 2012 the gambier plantation area was 1,225 ha with a production of 1,452 t (BPS, 2021). When compared to West Sumatra Province, Pakpak Baharat has a much smaller planting area and production area, This is because the level of public knowledge about gambier cultivation is still low so people's interest in planting gambier is low even though the potential land for planting gambier is still large (Distan Pakpak Bharat, 2021) By the Regional Government's policy in the coming year, Pakpak Bharat will become the largest gambier producer through the one million gambier program. However, information regarding the availability of Gambir land for future development is still very limited. Therefore, in 2022, the Pakpak Bharat District Government, in collaboration with BPTP Sum. Utara conducted an assessment of land suitability for gambier plants in Pakpak Bharat Regency.

The topography of this area is mostly hilly to mountainous. The area is at an altitude of 300-1,500 m above sea level. The amount of rainfall during 2010 was 3161 mm with an average monthly rainfall of 263 mm/month and an average of 13 rainy days/month. Based on the topography, the land consists of flat land (km2), sloping (3,348 km2), sloping (28,016 km2) and steep (84,070 km2) with alluvial soil types, gley humus, Organosol (512 ha), brown/gray podzolic (91,136 ha), brown podzolic (3,552 ha), Latosol/Regosol (3,072 ha) (BPTP Sum. Utara, 2018). Land use in this area is dominated by dry land covering 114,444 ha, while wetland (rice fields) covers an area of 1,206 ha. Most dry land is allocated for forests. The main source of livelihood for the people in this area is dominated by the dry land agricultural system, namely plantation crops or mixed crops covering an area of 40,121 ha, while rice fields only cover an area of 1,622 ha. The dominant plantation crops are gambier, rubber, cocoa, palm oil, coffee and patchouli (Distan Pakpak Bharat, 2021). Gambir plants are found in all sub-districts and the most extensive are in Si Telu Tali Urang (STTU) Jehe Sub-district covering an area of 582 ha (55%), 117 ha (11%) in Kingdom and 114 ha (11%) in Tinada. Production of dried gambier sap produced from Pakpak Bharat in 2010 was 1,523 t. Gambir production centers are in the villages of Bandar Baru, Central Kaban, Mbinalum, Malum Perolihen (Kec.STTU Jehe), Aornakan, Simerpara (Kec.PGGS), Mahala (Kec.Tinada), Majanggut I, Majanggut II (Kec.Kerajaan) such as seen in Table 1.

Table 1. Extent and production of gambier in Pakpak Bharat District

Subdistrict	Area (ha)	Production (t)
Salak	92	51
Sitelu Tali Urang Jehe	589	832
Pagindar	33	13
Sitelu Tali Urang Julu	21	16
Pergeteng Geteng Sengkut	170	140
Kerajaan	115	154
Tinada	118	141
Siempat Rube	87	105
Total	1.225	1.452

Source : BPS, 2021

Maps of commodity direction and land suitability for gambier plants and other commodities in Pakpak Bharat Regency have been produced by BPTP North Sum. (Ibrahim *et al,* 2018). The land suitability map with a scale of 1: 50,000 is based on land evaluation data for various agricultural commodities, both in the form of tabular data and spatial data (land suitability map). Meanwhile, land evaluation is based on land characteristics sourced from land unit data/maps resulting from terrain analysis which have been equipped with soil and climate data, as well as socio-economic data.

The presentation of land evaluation results in spatial or map form is carried out by importing tabulated data from ALES results into GIS format. The presentation of land suitability maps is based on the types of agricultural commodities studied using the ArcView program. To prepare regional maps for agricultural commodities at a scale of 1: 50,000, land evaluation results for various agricultural commodities are required (Amien, 2000). Land evaluation is based on spatial data, namely land unit maps resulting from terrain analysis, and tabular data in the form of field and laboratory data using climate, terrain and soil parameters. Land evaluation is carried out by comparing (matching) land characteristics and land use requirements (Lukas, 2019) . From the results of the land evaluation, agricultural commodity zoning was carried out by considering closely related aspects, namely: land suitability class, types of regional superior commodities, competitiveness and economy, local social and cultural conditions, accessibility and availability of local labor (Amien and Karama, 2001). Gambir commodity land use requirements can be seen in Table 2.

Table 2. Gambir Land use requirements.

Landuse Requirements	Land Suitability Class			
	S1	S2	S3	N
Temperature (TC) :				
Average Temperature (°C)	18 – 22	15-18 22-25	25-17 -	<15 >27
Water Availability (wa)				
Rainfall (mm)	2.000 – 2.000	1.300-2.000 2.500-3.000	1.000-1.300 3.000-4.000	<1.000 >4.000
Oxygen Availability (oa)	well, kinda	rather	hampered	Very quickly
Drainage	good	hampered	rather fast	hampered
Rooting media (rc) :				
Texture	h,ah,s,ak	h,ah,s,ak	k	k
Rough material (%)	< 15	15-35	35-55	>55
Soil depth (cm)	>100	75-100	50-75	<50
Peat :				
Thickness (cm)	<60	60-140	140-200	>200
+ Inserting	<140	140-200	200-400	>400
Maturity	saprik +	saprik hemik+	hemik fibrik	fibrik
Nutrient retention (nr) :				
KTK clay (cmol)	>16	≤16		
Base saturation (%)	>50	35-50	<35	
pH H_20	5,0-7,0	4,0-5,0	<4,0	
C-organic (%)	>0,4	≤0,4		
Toxicity (xc)				
Salinitas (ds/m)	<5	5-8	810	>10

Source: BPTP Sumatera Utara, 2018

2. Method.

This assessment activity was carried out in Pakpak Bharat Regency in April 2022. The materials used in this study were secondary data from related agencies, also used several software such as ALES (Automated Land Evaluation System) ALES is extremely flexible and fairly scale-independent and can be used for land evaluations at sub-national, landscape local, and community or project levels, Arc Info and Arc View as well as tools GPS (Global Positioning Systems).
Implementation Method

2.1. Preparation of Land Evaluation Model

The preparation of the land evaluation model (ALES) is carried out through the following stages:

2.1.1. Determine the land use type or LUT (Land Use Type). These are the types of land use described in detail regarding management, required inputs and specific expected outputs.
2.1.2. Determine plant growth requirements or LUR (Land Use Requirement) for each LUT.
2.1.3. Select the land characteristics or LC (Land Characteristic) of each LUR for each LUT. Is land properties that can be measured or estimated such as slope size, effective depth, drainage, texture, soil reaction, base saturation, and aluminum saturation.
2.1.4. Decision tree or DT (Decision Tree). Is a decision making method to determine land suitability classes in a "hierarchal multi way key" manner. Decision making to determine the land suitability class has a multilevel hierarchy and is determined by one or more

land characteristics that are closely related to each other.The procedure for preparing a detailed land evaluation model will refer to the Standard Procedure for Land Evaluation (Technical Report No. 18, Version 3.1. 2000).

2.2. Computing

Land evaluation is carried out using the ALES (Automated Land Evaluation System) program. Operation of the ALES program is by the ALES User Manual Version 4.65 (Rositer, 1997). The computation is carried out by importing SDPLE data or data that is already available in Excel format into the ALES program.

2.3. Data Preparation

Presenting land evaluation results in spatial or map form is carried out by importing tabulated data into GIS format. The presentation of land suitability maps is made based on the type of agricultural commodity using the ArcView program. The results of the land evaluation present land suitability classes for gambier commodities in Pakpak Bharat District (Sardyani dan Lukas, 2021). The land suitability of each commodity on each land unit is divided into 3 classes, namely: suitable (S), marginally suitable (CS), and not suitable (N). Soil map units in the form of associations or complexes can have 2 to 3 different land suitability classes so that to make their use easier, simplifications are made as shown in Table 3.

Table 3. Simplification Criteria for Gambir Commodity Land Suitability Classes, Kab. Pakpak Bharat

Class	Description
Suitable land (S)	
S	>75% suitable land
C/S	50-75% suitable land, 25-50% marginal land
Marginal suitable land (CS)	
CS	>75% marginal land
CS/N	50-75% marginal suitable land, 25-50% unsuitable
Unsuitable land (N)	
N	>75% unsuitable land
N/CS	50-75% unsuitable land, 25-50% marginal land

Source : Puslittanak. 2017.

2.4. Presentation of Results

The results of the preparation of land unit maps and land suitability maps for Gambir commodities are presented in the form of maps accompanied by a report text. The map format follows the Earth Map projection and coordinates system, namely the UTM (Universal Transvere Mercator) projection system. The map scale is presented on a scale of 1 : 250,000 (Wang *et al,* 2020*).* Map scale information is affixed to the map in the form of a numerical scale and a graphical scale (Environmental Systems Research Institute. Inc, 2015).

3. Result and Discussion.

From the land suitability class results, it was found that the total suitable land (S2) for gambier plants was 40,717 ha or 35% of the land suitability class area for gambier plants in Papak Bharat. The definition of an appropriate land class (S2) has limiting factors and limiting factors that influence productivity require additional inputs and these obstacles can usually be overcome by farmers (Tripathi *et.al,* 2016). The land suitability class according to the requirements (S3) for Gambir plants in Pakpak Bharat is 23,975 ha or 17.68% of the total land suitability classes for Gambir plants in Pakpak Bharat. Land suitability class according to conditional (S3) land has more severe limiting factors than S2 which affect productivity, requires more input than land classified as S2 and to overcome this requires high capital and requires government or private sector intervention (Djaenudin *et.al* , 2000). The unsuitable land suitability class (N) for Gambir plantations in Pakpak Bharat is 71,456 ha or 52.7% of the total land suitability classes for Gambir plantations in Pakpak Bharat. Land suitability class is not suitable (N), land that is not suitable because the limiting factors are very severe and difficult to overcome (Djaenudin *et.al,* 2000). The suitability class of Gambir crop land in Pakpak Bharat Regency can be seen in table 4.

Table 4. Land Suitability Class for Gambir Plants in Pakpak Bharat

Class		Limiting Factor	Land Area (ha)	Percentage (%)
Land is classified as suitable				
1	S1 (very suitable)	-	-	-
2	S2 (suitable)	eh	9.523	7,02
3	S2 (suitable)	eh, rc	480	0,35
4	S2 (suitable)	eh, nr	22.566	16,64
5	S2 (suitable)	nr	7.602	5,61
6	S3 (conditionally appropriate)	eh	14.257	10,51
7	S3 (conditionally appropriate)	oa	877	0,65
8	S3 (conditionally appropriate)	tc	4.836	3,57
9	S3 (conditionally appropriate)	tc, eh	4.005	2,95
The land is classified as unsuitable				
10	N (unsuitbale)	eh	37.205	27,44
11	N (unsuitbale)	eh, lp	31.742	23,41
12	N (unsuitbale)	lp	2.509	1,85
Total			135.602	100,00

Sourcer : BPTP Sumatera Utara, 2018

Explanation : eh-erosion hazard; nr-nutrient retention; rc-rooting conditions; oa-oxygen limitations; tc-altitude; lp-land preparatation

The presentation results from the table above can be seen in the map image below

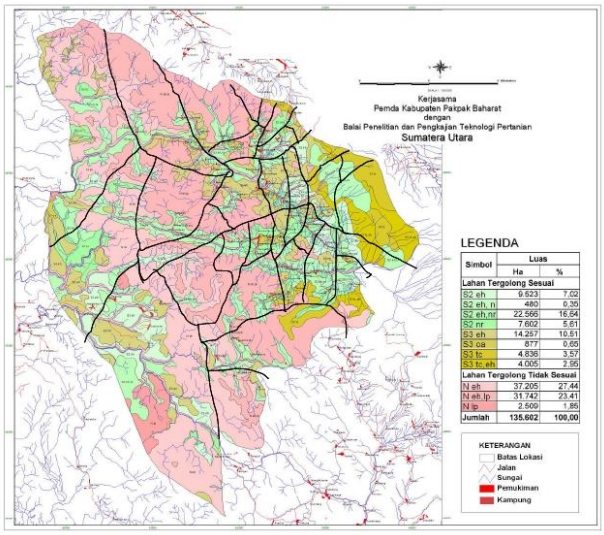

Figure1. Gambir Land Suitability Map

4. Conclusion

Based on the results of the discussion, it was found that the suitable land suitability class (S2) was 40,717 ha or 35%, conditionally suitable (S3) was 23,975 ha or 17.68% and not suitable (N) was 71,456 ha or 52.7% of the total suitability classes. Gambir plantation land in Pakpak Bharat. That the development of gambier plants in Papak Bharat Regency still has great potential. If we compare the existing land use area for Gambir with the suitable land area for Gambir, there is still potential for development land of 39,666 ha. Apart from that, there is also very large land available that can be planted with gambier with certain cultivation technology requirements. The main limiting factor, namely the danger of erosion covering an area of 37,205 ha or 27.44% of the area, can be prevented and inhibited by conserving land, making terracing, and reforestation. The second limiting factor in preparing 31,742 ha of land or 23.41% of the area can be done by improving the quality of soil fertility with organic fertilization as well as land conservation, terracing, and reforestation.

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