Precision Agroforestry Planning and Productivity Estimation Using DEMNAS Imagery Data Around Tahura Wan Abdul Rachman

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INTRODUCTION

Agroforestry

Combination of various types of trees, plantation and forage crops

Farmers additional income, welfare

hope

Sungai Langka and Talang Mulya villages

reality

Lower agroforestry income rather than nearby village

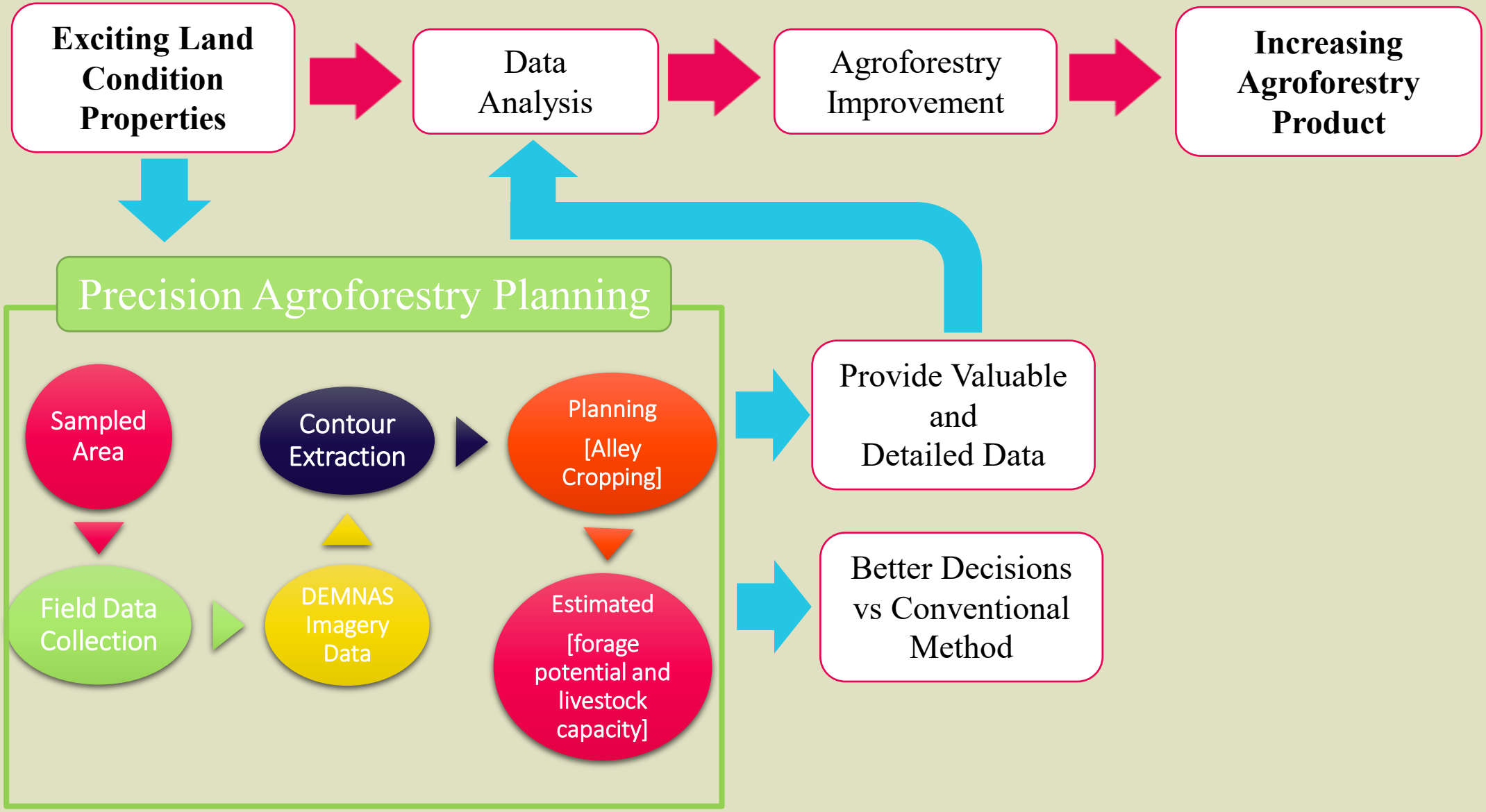
cause

- Farmers implement tree planting randomly with no consideration to land contours matching
- There is no plan for the types of crops nor spacing arrangements

Urgently needed a good planning and technology updates in Sungai Langka and Talang Mulya agroforestry management

- Precision Agroforestry Planning
- Utilization of National Digital Elevation Model (DEMNAS)

Precision Agroforestry Planning Concept



METHODS

50 land units as a sample based on the Purposive Sampling method. 30 unit in Talang Mulya Village (Site A) and 20 unit in Sungai Langka Village (Site B)

Direct observation with on field data collection on the sampled area was carried out for primary data in the form of: geographic location, land boundaries, area, altitude. Land slope was calculated using QGIS 3.14 software

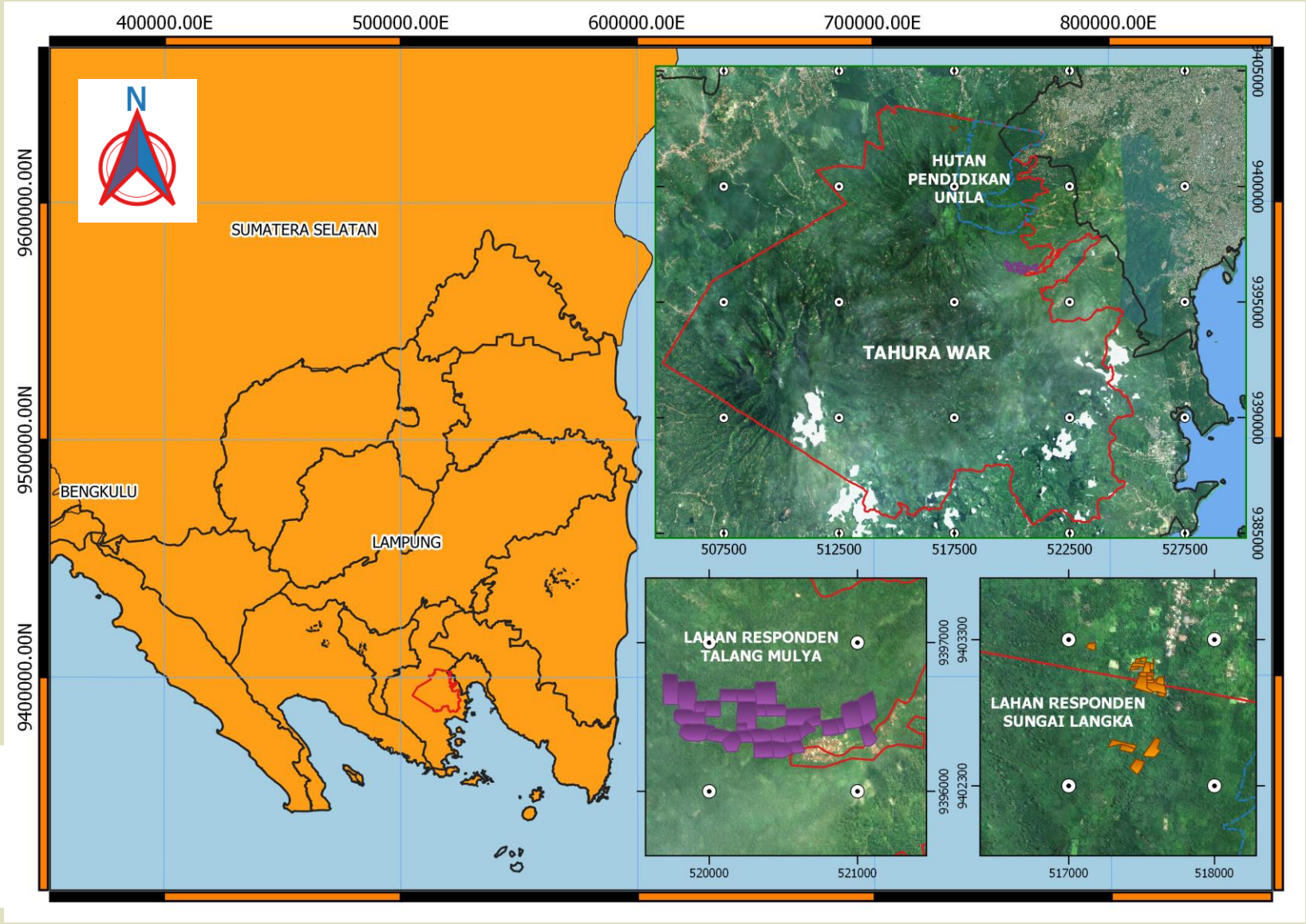
Alley Cropping pattern approach based on DEMNAS images to generated Contour line as Planting Rows using height interval of 1, 2, 3, and 4 meter.

Forage production estimated using:

- a spacing of 1.00 meters and 3.73 kg/year for *Gliricidia sepium* (Savitri et al., 2013).
- a spacing of 0.70 meters and 2.01 kg/year for *Pennisetum purpureum. cv. Mott* (Kusdiana et al., 2016).

Livestock Carrying Capacity:
Catlle Animal Unit (AU) = 9.1 kg dry forage with 21% dry matter content (Hartadi et al., 1980). 1 AU equal to 14 adult goats (0.16 AU) (Soekoharto, 1990).

Research Site



Result & Discussion

LAND CONDITIONS

Table 1. Farmer's Land Descriptions

No.	Descriptions	Unit	Site A	Site B
1	*Sample Area*			
	Minimum	*Land unit*	*0.25*	*0.08*
	Maximum	*Land unit*	*2*	*0.86*
	Average	*ha*	*1.24±0.57*	*0.34±0.26*
	Total	*ha*	*36.99*	*6.08*
	Status		*state-owned*	*Private*
2	*Height*			
	Minimum	*m asl*	*340*	*440*
	Maximum	*m asl*	*493*	*537*
	Average	*m asl*	*418.53 ± 0.92*	*477.76 ± 30.53*
3	*Slope*			
	Minimum	*%*	*9.87*	*6.95*
	Maximum	*%*	*30.26*	*49.23*
	Average	*%*	*22.01 ± 6.02*	*29.67 ± 13.64*

PRECISION AGROFORESTRY PLANNING

Table 2. The Calculations of Planting Row Number and Length.

No.	Descriptions	Unit	Interval			
			1 m	2 m	3 m	4 m
1	*Number of Planting Row*	*line*	*7*	*3*	*2*	*2*
	a. Minimum					
	b. Maximum	*line*	*87*	*36*	*30*	*23*
	c. Average	*line*	*35.9±22.22*	*14.62±7.47*	*9.69±6*	*8.98±5.22*
2	*Planting Row Length*	*m*	*224*	*109*	*78*	*58*
	a. Minimum					
	b. Maximum	*m*	*7839.708*	*3898.625*	*2596.62*	*1924.196*
	c. Average	*m*	*2290.51±2118.33*	*1140.81±1055.2*	*761.17±704.35*	*569.4±520.46*

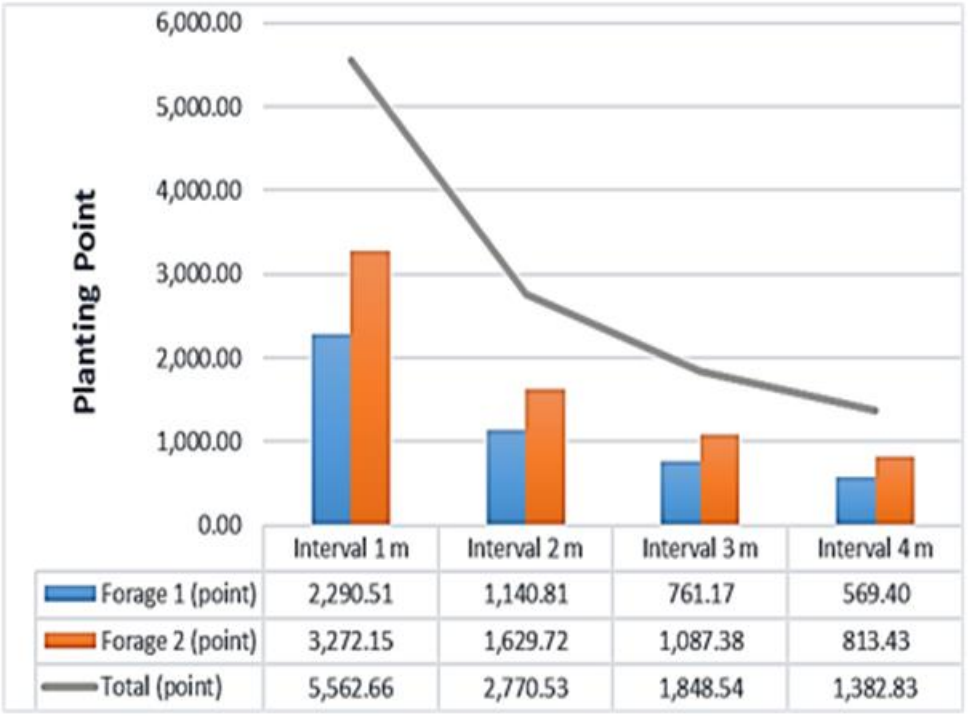
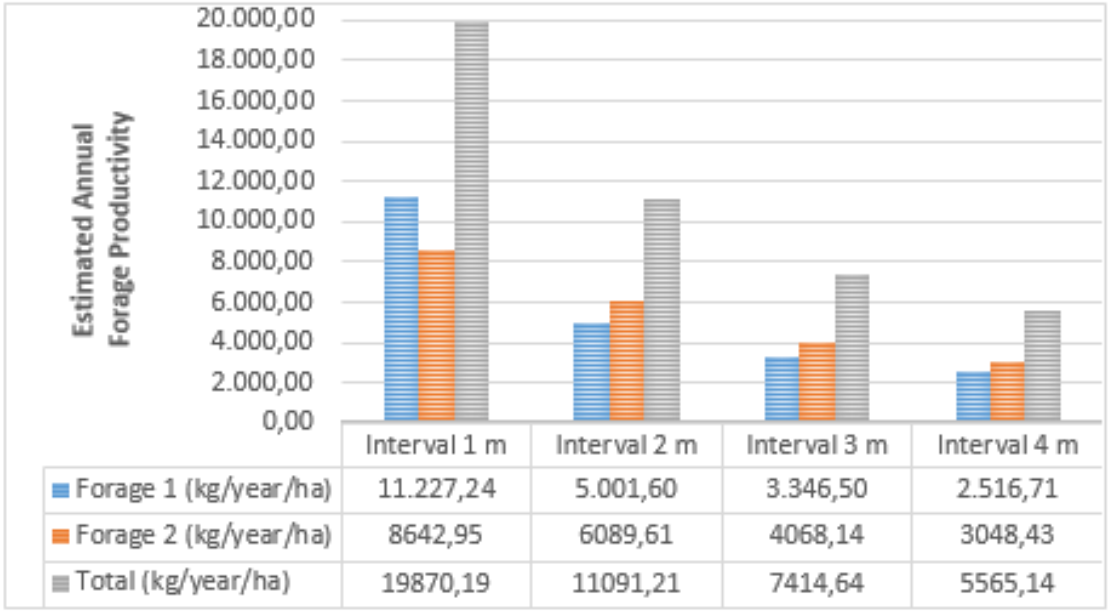


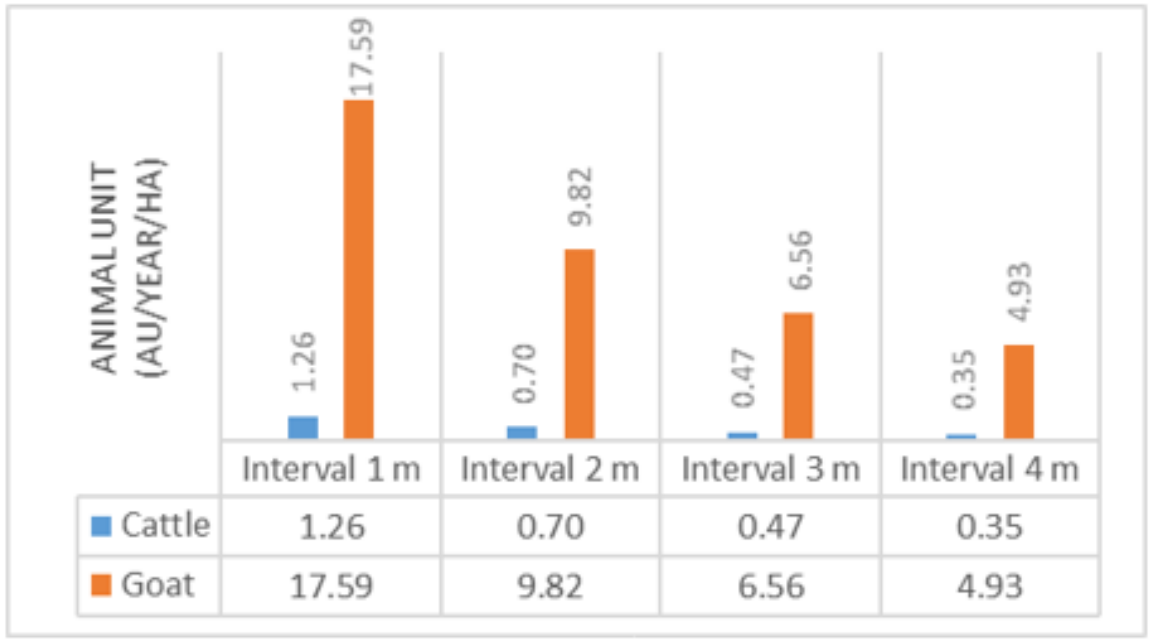
Figure 1. Number of Planting Point

ESTIMATION OF LAND PRODUCTIVITY



	Interval 1 m	Interval 2 m	Interval 3 m	Interval 4 m
Forage 1 (kg/year/ha)	11.227,24	5.001,60	3.346,50	2.516,71
Forage 2 (kg/year/ha)	8642,95	6089,61	4068,14	3048,43
Total (kg/year/ha)	19870,19	11091,21	7414,64	5565,14

Figure 2. Estimated Annual forage productivity



	Interval 1 m	Interval 2 m	Interval 3 m	Interval 4 m
Cattle	1.26	0.70	0.47	0.35
Goat	17.59	9.82	6.56	4.93

Figure 3. Livestock Carrying Capacity in Animal Unit

CONCLUSIONS

- Precision agroforestry planning and productivity estimation on sloping land can be done by spatial analysis using DEMNAS imagery extracted to land contours as planting rows following the Alley cropping pattern.

- The highest calculation results (planting row, planting row length, planting point, total annual forage productivity livestock carrying capacity) at both sites are generated for the most dense intervals, 1 meter height interval.

- Detailed planning is hoped to be able providing a clear picture of the potential and sustainably that will be obtained from land cultivation using topgraphic-specific agroforestry sistem.

Thank You

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